

**FACTORS INFLUENCING THE LONG -TERM
COMPETITIVENESS OF SELECTED
COMMERCIAL MILK PRODUCERS IN EAST
GRIQUALAND, SOUTH AFRICA**

BY

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ABSTRACT

This study presents two *separate* competitiveness analyses to assess changes in, and factors influencing, the long-term competitiveness of a panel of commercial milk producers in East Griqualand (EG), South Africa. The Unit Cost Ratio (UCR) method was used to measure competitiveness of EG milk producers. It is defined as the ratio of dairy enterprise accounting costs plus an opportunity cost of management at 5% of milk revenue, to total dairy enterprise revenue. The initial UCR analysis was used to partly investigate the impact of dairy market deregulation on the relative competitiveness of EG milk producers over the period 1983 to 2006. The results of this UCR analysis found that the sample of EG milk producers were not competitive based on the net local price, P_L , received for milk but were competitive when dairy cattle trading income was included. This suggests that dairy cattle trading income played an important role in enhancing the competitiveness of EG dairy enterprises in the study period. Further UCR analysis revealed that differences in the inherent ability of members of the EG group to manage market deregulation impacted on the relative competitiveness of EG milk producers. The top one-third of the sample of EG milk producers remained relatively competitive from 1983 to 2006 due to higher real milk prices and lower real unit costs than producers in the bottom one-third category. Differences in relative competitiveness between the top and bottom one-third categories of producers were statistically significant.

Based on the findings of the UCR analysis, a Ridge regression analysis was then used to investigate other factors influencing the long-term competitiveness of selected milk producers from EG using unbalanced panel data for the period 1990 – 2006. Results of the regression analysis showed that dairy herd size, the level of farm debt, annual production per cow, technology and policy changes over time, and the ratio of trading income to total milk income influence the long-term competitiveness of these milk producers. To enhance their competitiveness in a deregulated dairy market, relatively small and profitable EG milk producers should consider increasing herd sizes as the importance of herd size in explaining competitiveness suggests that size economies exist. All EG milk producers should consider utilising more pasture and other forages to lower feed costs and select dairy cattle of superior genetic merit to improve milk yields.

DECLARATION

I, Justin Philip du Toit, declare that

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2. This dissertation has not been submitted for any degree or examination at any other university.
3. This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
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Signed:

Justin Philip du Toit

Date

Professor Gerald Ortmann
(Supervisor)

Date

TABLE OF CONTENTS

ABSTRACT	ii
DECLARATION	iii
LIST OF TABLES	ix
LIST OF TABLES	ix
ACKNOWLEDGEMENTS	x
INTRODUCTION	1
CHAPTER 1	7
SOUTH AFRICAN DAIRY INDUSTRY POLICY ENVIRONMENT: 1920 TO PRESENT DAY	7
1.1 Introduction.....	7
1.2 Regulation in the SA dairy industry	7
1.3 Milk production features.....	10
1.4 Milk market features.....	12
1.5 Adverse effects of regulation on SA agriculture	14
1.6 Adverse effects of regulation in the SA dairy industry	14
1.6.1 Higher consumer prices and surplus milk production.....	14
1.6.2 Protection and support of inefficient producers.....	15
1.7 Market deregulation of SA agriculture.....	17
1.7.1 Macroeconomic policy reforms.....	17
1.7.2 Market deregulation of the SA dairy industry	17
1.8 Effects of dairy market deregulation on the primary sector of the SA dairy industry: evidence from previous research.....	19
1.8.1 Price formation and the marketing arrangements for fresh milk in the dairy industry.....	20

1.8.2 Reduced real producer milk prices.....	21
1.8.3 Loss of market share for fresh milk and other dairy products.....	23
1.8.4 Expansion and consolidation of SA dairy farms	24
1.8.5 Efficiency gains as a result of deregulation.....	28
1.8.6 Changes in geographic distribution of milk production.....	29
1.9 Current types of government support for milk producers in selected international markets.....	31
CHAPTER 2.....	33
COMPETITIVENESS DEFINED AND STUDY RESEARCH METHODOLOGY.....	33
2.1 Introduction.....	33
2.2 Competitiveness defined.....	33
2.3 Levels and measures of competitiveness analysis.....	35
2.4 Previous research on the competitiveness of agricultural commodities in South Africa ..	37
2.5 Measure of competitiveness used in this study: Unit Cost Ratio (UCR) method.....	39
2.6 Description of the study area and data collection	40
2.7 Background to marketing arrangements for milk in EG	41
CHAPTER 3.....	43
THE IMPACT OF MARKET DEREGULATION ON THE COMPETITIVENESS OF SELECTED COMMERCIAL MILK PRODUCERS IN EAST GRIQUALAND: A UNIT COST RATIO ANALYSIS: 1983-2006.....	43
3.1 Introduction.....	43
3.2 Data.....	43
3.3 Method of analysis	44
3.4 Results of the UCR analysis.....	45
3.4.1 Unit Cost Ratio based on P_L (UCR_L)	45

3.4.2 Unit Cost Ratio based on P_T (UCR_T)	46
3.4.3 Unit Cost Ratio based on P_N (UCR_N).....	47
3.5 Categorisation of EG milk producers based on UCR_T	47
3.6 Discussion	49
CHAPTER 4	51
FACTORS INFLUENCING THE LONG-TERM COMPETITIVENESS OF SELECTED COMMERCIAL MILK PRODUCERS IN EAST GRIQUALAND: 1990 - 2006.....	51
4.1 Introduction.....	51
4.2 Factors affecting long-term performance of a dairy enterprise.....	51
4.2.1 Production factors	51
4.2.2 Financial, management and risk factors.....	53
4.3 Key physical and financial characteristics of the panel of EG milk producers	54
4.4 Panel data regression analysis	56
4.4.1 Theoretical model	56
4.4.2 Selection of variables used in the panel data regression model.....	57
4.5 Ridge regression.....	62
4.6 Multiple imputation.....	62
4.7 Results of the Ridge regression analysis.....	63
4.8 Differences between milk producers	67
4.9 Discussion	67
CONCLUSIONS AND POLICY IMPLICATIONS	69
SUMMARY	74
REFERENCES:.....	78
APPENDIX A	91

APPENDIX B	92
APPENDIX C	93
APPENDIX D	94

LIST OF FIGURES

Figure 1.1 Real producer milk price trends, South Africa, 1983/84-2006/07 (2000=100)	22
Figure 1.2 Imports of milk and other dairy products, South Africa, 1983 – 2005	24
Figure 1.3 Number of commercial milk producers and annual milk production per producer, South Africa, 1983 - 2004	26

LIST OF TABLES

Table 1.1 Farm and retail level price elasticity of demand and supply estimates for fresh milk	12
Table 1.2: Summary of deregulatory measures implemented in the SA dairy industry, 1971 - 1998	18
Table 1.3: Changes in the geographic distribution of milk production, South Africa, 1997 – 2007	30
Table 1.4: Direct government support to milk producers in selected countries, 1971 - 2006	31
Table 2.1: Analyses of competitiveness according to level of product aggregation and spatial extension	36
Table 3.1: Changes in milk production and contribution to total milk production, EG milk producers, 1985 - 2005	44
Table 3.2: Results of UCR analysis for the sample EG milk producers, 1983 – 2006.	46
Table 3.3: Mean UCR_T indicator results for two categories of the sample EG milk producers, 1983 – 2006.....	48
Table 4.1: Mean physical and financial characteristics of panel of EG milk producers, 1990 - 2006	54
Table 4.2: Definition of variables used in fixed effects regression models	58
Table 4.3: Results of a fixed effects Ridge regression model for a panel of EG milk producers, including imputed observations, 1990 – 2006 (n=187).....	64

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INTRODUCTION

Institutions play a crucial role in either enhancing or constraining the competitiveness of firms, sectors and industries within a nation's economy (Porter, 2005:43). Dairy industries in many countries have traditionally been heavily regulated and protected by the state (Brunstad *et al.*, 2001; Edwards, 2003), thus restricting competition within the industry, raising product prices to consumers and promoting an inefficient primary sector (Pasour, 1990:18-19). Globally, due to increasing demand for milk and new dairy products, however, emphasis has shifted from government support policies to flexibility and innovation to improve the competitiveness of dairy industries (Suzuki and Kaiser, 2005; Blayney *et al.*, 2006). Gopinath *et al.* (1996) argue that policies that promote productivity growth, such as public agricultural research and development, should be used in preference to policies that restrict competition to enhance the competitiveness of primary agriculture.

According to Groenewald (2000), statutory intervention in South African (SA) agriculture, under the Marketing Act of 1937 (Act 27 of 1937), transferred wealth, through higher food prices, from consumers to agricultural producers. Evidence of these transfers in the SA dairy industry can be found in a study by McKenzie and Nieuwoudt (1985b) who estimated transfers in cost from consumers to milk producers over the period 1979/80 to 1982/83 to be 12.7 to 17.1% of the value of fresh milk production, given an estimated own-price elasticity of demand for fresh milk of -0.51. Over the past 20 years the dairy industry in South Africa has undergone major structural change as the country has followed the global trend of liberalising the marketing of its agricultural products. Structural change in agriculture is characterised by changes in product characteristics, production and consumption patterns, size of operation and geographic distribution of producers (Boehlje, 1999). The SA dairy industry, previously regulated under the Marketing Acts of 1937 (Act 27 of 1937) and 1968 (Act 59 of 1968), was gradually deregulated; a process that was completed following the promulgation of the Marketing of Agricultural Products Act of 1996 (Act 47 of 1996) (Vink and Kirsten, 2000).

One such structural change in the SA dairy industry is the consolidation effect experienced in the industry's primary sector where declining milk producer numbers have been accompanied by an increase in dairy farm sizes. Commercial milk producer numbers have

declined from 28 885 in 1983 (Collins, 1994:61) to 3 655 in 2008, while the average number of cows-in-milk per producer has risen from 88 in 1998 to 151 in 2008 (Coetzee and Maree, 2008). With dairy farm expansion and producer exits, however, has come some evidence of an improvement in the technical efficiency¹ of South Africa's primary dairy sector. Mkhabela *et al.* (2008) found evidence of this improvement in the KwaZulu-Natal (KZN) dairy industry where they showed that from 1999 to 2007, KZN dairy farms operated with greater levels of technical efficiency, with large farms showing greater gains in efficiency than small and medium farms. According to Kalaitzandonakes (1994), gains in technical efficiency are assumed to be brought about by improvements in the productivity of existing rather than new resources through improved management. Examples of improved management in milk production that increase technical efficiency include better husbandry, more meticulous record-keeping and closer supervision of hired labour. Some authors argue that dairy farm consolidation and reduced production costs are driven by other forces as well as institutional change, e.g. the benefits of size economies (Comrie, 1974:5; Doll and Orazem, 1984:217; El-Osta and Morehart, 2000) and technological advancement (Weersink and Tauer, 1991; Manchester and Blayney, 1997).

Another structural change in the SA dairy industry is a change in the geographic distribution of milk production with a shift from inland to coastal areas (Coetzee and Maree, 2008). Blignaut (1999) contends that the impetus for this shift has been the popularisation of pasture-based milk production systems, which are more suited to coastal areas, and that lower collection costs per square-kilometre, due to less dispersion of milk producers, makes coastal areas more attractive to milk buyers². Coastal areas (KZN, Western Cape and Eastern Cape) accounted for 52.4% and 68.2% of total milk production in South Africa in 1997 and 2007 respectively (Coetzee and Maree, 2008).

Market liberalisation implies a redistribution of welfare between producers, consumers and taxpayers (Bouamra – Mechemache *et al.*, 2002). Previous local research attributes structural changes in the number, size and distribution of SA milk producers to dairy market deregulation (Collins, 1994:58-60; National Agricultural Marketing Council

¹ Technical efficiency is defined as the ratio of actual output to the maximum possible potential output from a given set of inputs and technology (Kalirajan and Shand, 1997).

² Milk buyers can be classified as producer-distributors and/or large milk processors (Coetzee and Maree, 2008).

(NAMC), 2001:31). More specifically, the deregulation process in the SA dairy industry was found to have contributed to increased cost pressure, reduced real producer milk prices (Collins, 1994:58-60), increased milk producer exit rates and loss of market share for milk producers (NAMC, 2001:31). Moreover, previous research suggests that the low profitability of milk production poses a significant barrier to entry for developing South Africa's emerging milk producers (NAMC, 2001:9). The effects of institutional change at the firm or producer level may vary, however. El-Osta and Johnson (1998) suggest that milk producers with low production efficiency³ and those that are highly leveraged are particularly vulnerable to institutional change.

Many authors note that the pace with which deregulation takes place, the stringency of regulatory policies being deregulated and the firm's structural inertia are important when considering the firm-level effects of deregulation (Mahon and Murray, 1981; Cook *et al.*, 1983; Reger *et al.*, 1992). Although deregulation of the SA dairy industry was completed following the abolition of the Marketing Act of 1968 (59 of 1968) in 1996, the deregulatory process, initiated in 1971, was characterised by gradual and incremental changes to legislation (Vink and Kirsten, 2000). This enabled milk producers and structures in supporting and related industries to adapt and respond to changes brought about by deregulation. International studies have found that market deregulation encourages innovation (Cantwell, 2005:544), entrepreneurship (Stiroh and Strahan, 2003), and increases in agricultural productivity (Doucouliagos and Hone, 2000; Blayney *et al.*, 2006). Sartorius von Bach and Van Zyl (1991) and Winston (1998) also suggest that deregulated firms are more flexible and, therefore, respond more rapidly to changes in their external environments.

In a changing policy environment requiring adjustment to forces of supply and demand, milk producers can improve the financial position of their farm businesses by understanding the factors that influence profitability (Short, 2000). The perception amongst many SA milk producers is that changes brought about by dairy market deregulation have left them with comparatively less bargaining power in the marketplace and vulnerable to the threat of "cheap" imports (Phillips, 2007b; Bischoff, 2008; Broom, 2008). As

³ Production efficiency is defined as the ratio of actual milk output to potential maximum milk output given a set of input factors (Lawson *et al.*, 2004).

competitors in the global dairy market, SA milk producers need to re-position themselves and become more innovative and responsive to future changes to improve their competitiveness. It is critical, therefore, that factors which may enhance or restrict competitiveness of milk producers in the long-term are identified.

An understanding of the concept of competitiveness is essential, not only to better understand the foundations upon which agricultural trade is based (Mosoma, 2004), but because competitiveness is a concept that, despite the widespread acceptance of its importance, is not well understood (Porter, 2005:43). Numerous authors recognise that the precise definition of competitiveness is ambiguous due to its multi-dimensional applications and interpretations. Some definitions focus on the underlying sources of competitiveness whilst others place more emphasis on the indicators of competitiveness (Ortmann, 2005; Esterhuizen, 2006:101; Siggel, 2006). There is, however, consensus in the literature regarding the following features: competitiveness is a *relative* concept and relates to the *profitable* maintenance and/or gain of domestic and/or international *market share* by a firm, sector or industry (Kennedy *et al.*, 1997; Ortmann, 2000; Esterhuizen, 2006:90; Siggel, 2006).

Using two *separate* competitiveness analyses, the objectives of this study are, firstly, to investigate the impact of dairy market deregulation on the competitiveness of commercial milk producers who comprise the East Griqualand (EG) study group in KwaZulu-Natal and the Eastern Cape Province of South Africa for the period 1983 to 2006. Secondly, based on the findings of the previous analysis, the study aims to use regression analysis to investigate the impact of other factors, such as production and financial factors, influencing the *long-term* competitiveness of a panel of EG milk producers for the period 1990 to 2006.

Study results are aimed, firstly, at addressing whether or not the perception by many SA milk producers that dairy market deregulation or market liberalisation impacted negatively on the profitability of their dairy enterprises has validity. Secondly, based on the study results, meaningful recommendations on how EG milk producers can improve the competitiveness of their dairy enterprises can also be provided. Study results and recommendations could be used by agricultural consultants advising milk producers, organisations such as the Milk Producers' Organisation (MPO), the National Agricultural

Marketing Council (NAMC) and the Department of Agriculture (DOA) to better understand the changes brought about by, and producer responses to, market deregulation and other institutional changes. It is also essential that policymakers are familiar with the determinants of long-term profitability and competitiveness at producer level so that appropriate support policies can, if needed, be developed to aid South Africa's emerging milk producers.

To achieve the study's objectives it is imperative that an appropriate and unambiguous definition of competitiveness be adopted as this definition will guide the study's research methodology. Based on a definition by Esterhuizen (2006:89), competitiveness in this study is defined as the ability of a milk producer to achieve sustainable *business* growth while earning at least the opportunity cost of management. A producer is, therefore, *competitive* if positive land rents (returns to land) are earned. To measure competitiveness at the producer level, this study uses a microeconomic indicator, the Unit Cost Ratio (UCR) developed by Siggel and Cockburn (1995). Since the UCR is a ratio of total enterprise costs to total enterprise revenue, it can also be considered as a measure of enterprise profitability. A microeconomic measure of competitiveness is used in preference to macroeconomic indicators because at the microeconomic level the concept of competitiveness focuses on the particular characteristics of each individual producer or firm competing directly for market share (Porter, 2005:43; Siggel, 2006).

Previous studies have varied in their approaches to measuring the competitiveness or profitability for agricultural commodities at the producer level. Some studies have focused on production cost measures of competitiveness (Vink *et al.*, 1998; Blignaut, 1999; Tauer, 2001) whilst others have used profitability measures such as gross margin per litre (Hopps and Maher, 2007), Return on Assets (ROA) (Gloy *et al.*, 2002) and Net Farm Income (NFI) (El-Osta and Johnson, 1998; Short, 2000). Previous research found a strong link between farm size (total numbers of cows), milking rate (production per cow) and dairy farm profitability (El-Osta and Johnson, 1998; Short, 2000; Gloy *et al.*, 2002). Other factors that significantly affected profitability were forage and feed costs per cow (El-Osta and Johnson, 1998), milkings per day and debt-to-asset ratio (DA) (Gloy *et al.*, 2002; Short, 2000), and specialization in dairy farming (El-Osta and Morehart, 2000; Short, 2000).

Shortcomings of previous local research into the impact of deregulation on SA milk producers include, firstly, that the investigations were too broad and were analytical rather than empirical, and, secondly, many local and international investigations did not consider the effect of deregulation *over time* on the responses by milk producers. Previous research into the factors affecting competitiveness of milk producers have also not recognised the contribution of trading income to the profitability of the dairy enterprise. These issues will also be addressed in this study.

This dissertation is structured as follows: Chapter 1 presents the main literature review of this study and discusses changes in the SA dairy industry policy environment since the 1920s. Structural changes, related to dairy market deregulation, with particular reference to consolidation of dairy farms and efficiency gains in the SA dairy industry are also discussed. The study's research methodology is presented in Chapter 2 and, in particular, this chapter addresses the need for an appropriate definition and measure of competitiveness. The first of two competitiveness analyses, the Unit Cost Ratio analysis of EG milk producers, is presented in Chapter 3. Based on the findings of the Unit Cost Ratio analysis, the second analysis is undertaken in Chapter 4, which considers other factors influencing the competitiveness of a panel of EG milk producers. This dissertation ends with conclusions, policy implications and suggested areas for further research. A summary of the study's main findings follows the conclusions.

CHAPTER 1

SOUTH AFRICAN DAIRY INDUSTRY POLICY ENVIRONMENT: 1920 TO PRESENT DAY

1.1 Introduction

South African (SA) agriculture has, for most of its recent history, been purposefully influenced by the country's prevailing statutory powers (Vink and Kirsten, 2000; Van Zyl *et al.*, 2000). Statutory intervention in agriculture was implemented via various agricultural policy instruments and structures including measures promoting agricultural production, financing and marketing by the state (Brand, 1985). Gradually, South Africa has followed the global trend of liberalising the marketing of its agricultural commodities (NAMC, 2001:12). This has had important implications for the competitiveness of agricultural producers who, post-deregulation, find themselves in a more competitive environment. The aim of this chapter is to contextualise policy and structural changes in the SA dairy industry by providing a rationale for statutory intervention in the industry, critically assessing previous legislation and discussing reasons for the structural changes in the SA dairy industry.

1.2 Regulation in the SA dairy industry

Vink and Kirsten (2000) note that prior to 1937, government involvement in SA agriculture was piecemeal and that the primary objective of government was to provide support, when required, to the agricultural sector. Similarly, in the United States (US), government programmes in agriculture were initially relatively small and seldom affected the individual producer over the period 1862 to 1933. The role of the United States Department of Agriculture (USDA) over this period was primarily to increase agricultural productivity, provide extension and statistical services, and to maintain competitive agricultural markets (Pasour and Rucker, 2003:11).

Extensive statutory intervention in the SA dairy industry began amid turbulent global economic conditions during the early 20th century (de Swardt, 1983; Vink and Kirsten, 2000). Intense competition between dairy processing firms led to accusations of

malpractice and inefficiency during a period of economic depression in the early 1920's (de Swardt, 1983). In 1927 the SA government commissioned the Board of Trade and Industries (BTT) to conduct an investigation into these allegations. The BTT found that the conversion costs (milk to processed dairy products) were high, product quality was inconsistent and that competition was ruthless. De Swardt (1983) contends that free competition among market participants during this period adversely affected the country's agricultural producers and that the trade of agricultural products was under the control of monopolised or cartelised traders. The bargaining power of agricultural producers under such conditions, he argued, was also weak.

The findings and recommendations of the BTT had important implications for the SA dairy industry and SA agriculture as a whole, and ultimately led to the establishment of the Dairy Industry Control Board in 1930. The primary roles of the Board, as cited by Bonsma *et al.* (1972), de Swardt (1983), McKenzie (1984:8) and the NAMC (2001:23) were:

- i) The fixing of milk prices (industrial and fresh milk).
- ii) The establishment and implementation of an efficient and fair grading system with regular inspection.
- iii) The registration of all manufacturers.
- iv) To administer a small levy on butter and cheese, payable by every registered processor to fund the activities of the advisory board established to monitor the industry's role-players.
- v) To co-ordinate the production, manufacture and marketing of all dairy products.
- vi) To promote the industry at all times.

De Swardt (1983) noted that with the establishment of the Dairy Industry Control Board in 1930, common ground was found between individuals with previously conflicting interests who, through collective action, could focus on improving industry efficiency, reducing costs, increasing producer incomes and competing favourably in export markets. The promulgation of the Marketing Act of 1937, subsequent to the Dairy Industry Control Act in 1930, advocated more direct and extensive statutory intervention in SA agriculture and the dairy industry (Kassier *et al.*, 1992; Scrimgeour and Sheppard, 1998; Groenewald, 2000).

Some of the powers of the Marketing Act of 1937, amended in 1968, included:

- i) Single channel marketing in which only the Board or its agents were legally entitled to buy, sell or store product.
- ii) The fixing of prices.
- iii) The introduction of pools and the transfer among pools.
- iv) Registration of traders and producers (this included the right to exclude or withdraw registration).
- v) The prohibition of the erection of mass storage facilities.
- vi) The fixation of transport tariffs.
- vii) The enforcement of marketing quotas.
- viii) Price discrimination.

Brunstad *et al.* (2001) suggest that, although regulatory policies in dairy industries vary in scope between countries, two interventions are commonly used to raise producer incomes and to regulate the flow of milk. Firstly, most dairy industries utilise market price supports in conjunction with quota and surplus removal schemes. Secondly, price discrimination, in which the markets for fresh and industrial milk are separated, is used in conjunction with pooling arrangements to ensure an equitable distribution of wealth amongst the industry's milk producers. The Marketing Acts of 1937 and 1968 aimed to stabilise the income of South Africa's milk producers by regulating the flow of milk and by restricting perceived *harmful* competition between market participants (Groenewald, 2000). Richards (1936) accurately predicted that the passing of the Marketing Act of 1937 would distort agricultural production and have the following implications for agricultural markets in South Africa: (1) the proliferation of an agricultural monopoly; (2) increased production of unwanted agricultural products; (3) increased consumer prices; (4) a rise in producer living and production costs; and (5) heavy losses to the state. Indeed, previous research has found that statutory intervention in agriculture does distort agricultural production and often more intervention is needed to mitigate the adverse effects of previous government policies (Sandrey and Scobie, 1994).

According to Pasour (1990:18-19), there are two competing hypotheses that explain the rationale for government intervention in agricultural markets. Firstly, agricultural markets

are often compared against the unattainable norm of a perfectly competitive⁴ market. Arguments citing the existence of monopolies, market instability, asymmetric information and negative externalities are, therefore, pervasive. Intervention in agricultural markets by the state is, therefore, justified on grounds of *perceived* market failure. Secondly, he argues that the impetus for intervention and control in agriculture by the state is best explained not on market stabilisation grounds but by the redistribution of wealth to rent-seeking groups who possess substantial political power. Pasour (1990:28-29) contends, however, that government programmes also compare unfavourably with perfectly competitive markets due to the creation of information problems (“because of the separation of power and knowledge”) and incentive problems (“due to the separation of power and responsibility”), restriction of competition, and rent-seeking activity. The relevant comparison, therefore, is between the functioning of real-world agricultural markets and the political process.

Proponents of control continue to argue that several features, unique to milk production in conjunction with the structure of the milk market, necessitate statutory intervention in order to stabilise the industry and ensure orderly marketing (de Swardt, 1983; McKenzie and Nieuwoudt, 1985b; Brunstad *et al.*, 2001). These unique features can be partitioned into milk production features and milk market features.

1.3 Milk production features

Seasonality of milk production: Generally, during South Africa’s mild spring and summer months the abundance of both natural and cultivated pasture in summer rainfall regions encourages milk producers to expand production whilst in winter, when pasture growth is constrained, milk production contracts. Thus, more use is made of purchased feeds (concentrates) and stored fodder during winter months in these regions (Buckle, 1969:10). In winter rainfall regions such as the Western Cape milk is predominantly produced using Total Mixed Ration (TMR) production systems and, therefore, the seasonal effects on milk production are less pronounced (Bischoff, 2008). Associated with seasonality in milk production is the concept of biological lags exhibited by livestock in

⁴ To be defined as perfectly competitive, a market must satisfy four conditions: 1) there are many buyers and sellers, 2) the product is homogenous, 3) all resources are completely mobile, and 4) all buyers and sellers possess perfect information of price determining forces (Tomek and Robinson, 2003:86-87).

their breeding cycles and also by crop production cycles which affect feed supply (Tomek and Robinson, 2003:175). Milk producers make use of purchased and own-produced feeds, depending on relative prices and availability. The two sources are treated as substitutes in the short-run and complements in the long-run (Beyers and Hassan, 2000).

The seasonal nature of milk production can lead to the generation of larger than anticipated supplies (“surpluses”) and lower than anticipated supplies (“shortages”) of fresh milk and other dairy products, resulting in a fluctuating producer price due to the price-inelastic nature of supply and demand for milk (de Swardt, 1983; NAMC, 2001:24; Tomek and Robinson, 2003:175; Suzuki and Kaiser, 2005). Therefore, to prevent substantial price fluctuations, proponents of control argue that statutory intervention is needed to regulate the flow of milk.

Short-run fixity of resources: Commercial milk production is highly capital intensive and requires use of specialised production inputs (Comrie, 1974:5; Bragg and Dalton, 2004). Milk is also harvested daily and is highly perishable, locking the producer into a choice of selling, processing or dumping the milk. This makes adjustment to changes in milk and input prices difficult as in the short-run, resources used in the production of milk (e.g., number of cows, type of feed, milking equipment) are fixed (Suzuki and Kaiser, 2005). This increases the risk borne by the milk producer in producing milk and, therefore, producers may feel government support is necessary as an aid to managing price risk in the short-run.

Rent-seeking behaviour by producer groups: Pasour and Rucker (2003:49) suggest that statutory intervention in agriculture is better explained by rent-seeking behaviour on the part of agricultural producers rather than market failure or inefficiency. Kassier *et al.* (1992) note that the political power and collective action of SA commercial agricultural producers ensured the passing of the controversial Marketing Act of 1937; an Act rejected by parliament the previous year. Therefore, through collective action, milk producers can increase their bargaining power relative to other market participants and may successfully lobby for greater state support.

1.4 Milk market features

Price-inelastic demand for fresh milk: Fresh milk is traditionally considered a basic necessity implying a price-inelastic demand (McKenzie and Nieuwoudt, 1985b). Evidence of this is provided in Table 1.1 which presents the findings of previous research on the price elasticity of demand for and supply of milk. Dahlgran (1980) estimated price elasticities of demand and supply for 16 US states and found that while the price elasticity of demand was highly inelastic, the supply elasticity was elastic over the period 1968 to 1977. Dahlgran's (1980) relatively high estimate of supply elasticity could be due to the use of monthly rather than annual time series data and/or bias resulting from the use of only positive supply elasticity estimates in calculating the aggregate supply elasticity. Huang (1996) estimated the price elasticity of demand for milk at the retail level in the US as highly inelastic with an estimate of 0.04.

Table 1.1 Farm and retail level price elasticity of demand and supply estimates for fresh milk

Region	Author	Time Period	Demand elasticity	Supply elasticity
USA	Ippolito and Masson (1978)	-	-0.12 to -0.34	0.40 to 0.90
	Dahlgran (1980)	1968-77	-0.01 to -0.50 ^a	1.74 ^a
	Huang (1996)	1989-93	0.04 ^b	-
Canada	Zuhair and Sahi (1976)	1958-72	0.04 ^b	-
RSA	McKenzie and Nieuwoudt (1985b)	1950/51-80/81	-0.51 to -0.65	0.55 ^c

a. This is an aggregate of 16 US states.

b. Retail level

c. Industrial milk only.

In South Africa, McKenzie and Nieuwoudt (1985b) estimated the own-price elasticity of demand for fresh milk as -0.78 at the retail level and -0.51 to -0.65 at the farm level over the period 1950/51 to 1980/81. Although they could not obtain an estimate of the price elasticity of supply for fresh milk, they estimated the price elasticity of supply for industrial milk as 0.55. They expect fresh milk supply to be more price-inelastic, relative to that of industrial milk, due mainly to asset fixity and health regulation reasons.

Due to the price-inelastic nature of demand for fresh milk, proponents of control argue that price fluctuations (volatility) in an unregulated dairy market would be large and the resulting risk would cause a backward shift in the supply function, reducing both consumer and producer surplus (Dahlgran, 1980; de Swardt, 1983; McKenzie and Nieuwoudt, 1985a). Christ (1980) argues further that since dairy farming involves substantial investment in facilities and equipment (sunk capital), adjustments to supply (due to price changes) are achieved by forgoing some sunk capital to the detriment of the milk producer.

Oligopsonistic market structure: Due to the perishable nature of milk, its frequency of harvest and the distance from market, milk producers were, in the past, left with few alternative buyers for their milk (Suzuki and Kaiser, 2005). This oligopsonistic (few large buyers, many small sellers) market structure meant milk producers had reduced bargaining power in the market and could often not negotiate more favourable prices. In the SA market, the power of producer co-operatives exacerbated the problem of oligopsony in agricultural commodity markets (Groenewald, 2000).

Protectionist policies: Differences in international competitiveness between countries for dairy products, due to differences in the levels of statutory intervention, necessitate the implementation of import quotas and/or tariffs to protect against dumping and “cheap” imports (Suzuki and Kaiser, 2005). The protection of domestic milk production is often justified by proponents of control on the basis of ensuring national food security and self-sufficiency in food production (de Swardt, 1983; Brand, 1985).

Brunstad *et al.* (2001) note that the regulation of dairy industries may have been applicable in the context of relatively poor economic conditions globally during the early 20th century, but due to structural and technological changes over time, the justifications for retaining these sanctions in dairy industries are tenuous. Substantiating this statement, they contend that the bargaining power of milk producers has increased over time (relative to other market participants) through advancements in distribution networks and milk conservation methods. Furthermore, price stabilization can no longer be justified as farm-level production has become more predictable. The effects of regulation on SA agriculture and in the SA dairy industry are discussed in the following section.

1.5 Adverse effects of regulation on SA agriculture

According to de Swardt (1983), statutory intervention in the SA agricultural sector was primarily aimed at improving the efficiency of production and the industry's market supply, stabilizing domestic production and consumption and protecting domestic producers from foreign competitors. Brand (1985) notes, however, that various policy aims can often come into conflict with, rather than complement, one another. For example, he suggests that increasing a country's food production to achieve self-sufficiency may not necessarily ensure acceptable net farm incomes if higher producer incomes are offset by higher production costs through higher derived demand for inputs. Furthermore, it is difficult for policymakers to identify, implement and manage valid policy aims and assign acceptable weights to those aims as these factors depend crucially upon the point of view of consideration.

As to whether the Marketing Act of 1937 achieved its intended aims in SA agriculture, Groenewald (1992; cited by Kassier *et al.*, 1992) suggests that the Act achieved few, if any, of its initial objectives. Firstly, the goal of efficient production, measured by productivity indexes, showed that only a small increase over a period of 30 years had been achieved. Secondly, the goal of stabilising producer prices was achieved to an extent but income stabilisation was not. Thirdly, the goal of providing fair and equal access to as many producers as possible was not achieved due to discriminatory legislation as well as a bias towards large-scale agriculture. Lastly, the goal of promoting demand and consumption was not as successful as originally anticipated.

1.6 Adverse effects of regulation in the SA dairy industry

1.6.1 Higher consumer prices and surplus milk production

Mahon and Murray (1981) and Pasour (1990:147) suggest that regulations implemented to limit excessive competition among firms directly impact on the competitive dynamics of the industry as individual producers and consumers no longer have the right to engage in mutually beneficial exchange. In the case of the SA dairy industry, competition among market participants was restricted by the state and SA milk producers were obliged to market their product either through the Milk Board or its agents under a single channel

marketing arrangement. In 1977 two dairy firms controlled approximately 70% of the total industry turnover (Groenewald, 2000) and the SA dairy industry, therefore, was characterised by an oligopsonistic (few, large milk buyers and many, small producers) market structure. Groenewald (2000) argues that under such a marketing arrangement (statutory monopoly), little or no competitive pressures to enforce improved performance and efficiency exist. He concluded that the economic concentration in the SA dairy and other industries caused by the Marketing Act of 1937 contributed substantially to high marketing margins of food in South Africa.

In the SA dairy industry price discrimination was, according to proponents of control, primarily aimed at stabilizing milk production and regulating the flow of milk (de Swardt, 1983). Pasour and Rucker (2003:126) contend, however, that the rationale for implementing price discrimination in the US dairy sector was also to raise the incomes of milk producers. McKenzie and Nieuwoudt (1985b) found that price discrimination, under the Fresh Milk Scheme, increased prices paid by SA consumers for fresh milk over the period 1979/80 to 1982/83. This resulted in a decline in consumption by 8.0 to 10.7%. Increased producer prices resulted in an increase in supply of milk by 2.3 to 4.5%, resulting in surplus production. They also estimate that income transfers from consumers to producers and the then Dairy Board are large, ranging from 12.7% to 17.1% of the value of fresh milk consumption. Less than half of these transfers (48%) were received by producers. McKenzie and Nieuwoudt (1985b) also estimated that in a perfectly competitive market, social costs would have been substantially lower. They estimated that consumer prices for fresh milk would have been 14.3 to 19.4% lower, producer milk prices would have been 5.2 to 10.8% lower, fresh milk production would have been 2.3 to 4.5% lower and fresh milk consumption would have been 8.0 to 10.3% higher.

1.6.2 Protection and support of inefficient producers

Studies by Kalaitzandonakes (1994), Ahmad and Bravo-Ureta (1995) and Richards and Jeffery (1997) suggest that government regulation in agriculture (such as price supports) directly affects an agricultural sector's growth in technical efficiency. Ahmad and Bravo-

Ureta (1995) found that productivity growth⁵ in the US dairy industry was hindered by protection policies and that productivity growth was primarily fuelled by *technological progress* rather than technical efficiency. In South Africa price discrimination policies under the Marketing Act of 1968 led to large inefficiencies in the production of milk and other agricultural commodities (Groenewald, 2000).

The problem of inefficiency (producing at a relatively high cost) was particularly prevalent in producers of industrial milk (Bonsma *et al.*, 1972). South African milk producers were classified as either industrial or fresh milk producers depending on the particular market they supplied⁶. Milk producers supplying fresh milk received the industrial milk price if they produced in excess of their quota allowance or during periods of higher than anticipated production if the producer operated under a pooling arrangement. The price of fresh milk commanded a price premium relative to industrial milk up to as much as 140c per 100 pounds of milk in 1972. This meant that the production of industrial milk was often *not competitive* relative to other agricultural enterprises such as crops and, hence, received less of the industrial milk producer's management time (Bonsma *et al.*, 1972). Industrial milk producers were also paid an average price for their milk (regardless of its quality) and, therefore, had little economic incentive to invest in improvements to milking equipment and facilities. A low capital outlay, low expenditures and the seasonal availability of feed, however, meant that many small, industrial milk producers were able to remain in the industry despite producing milk of questionable quality (Bonsma *et al.*, 1972).

McKenzie and Nieuwoudt (1985b) note that quotas for milk, applied predominantly in Natal (now KwaZulu-Natal), protected the higher marginal cost producer from declining pool prices, therefore proliferating inefficiency of the primary sector in the dairy industry. Furthermore, Richards and Jeffrey (1997) suggest that quotas for milk may cause producers to retain animals that would, in an undistorted market, be replaced by higher producing animals. This reduces the rate of technical change or genetic progress of the herd causing lower rates of productivity growth. This problem is particularly prevalent in

⁵ Productivity growth consists of growth in technical change and technical efficiency (Ahmad and Bravo-Ureta, 1995).

⁶ Proximity to a major centre was a major determinant of whether a producer marketed product as fresh or industrial milk (Bonsma *et al.*, 1972).

the Alberta dairy industry in Canada, they argued, and marketing schemes led to a loss in competitiveness to countries whose dairy industries operate without regulation (Richards and Jeffery, 1997).

1.7 Market deregulation of SA agriculture

1.7.1 Macroeconomic policy reforms

Vink and Kirsten (2000) note that the argument for a free market system rests on the basis that agricultural producers should be rewarded in proportion to their contribution to the national economy without interference with the forces of supply and demand by the state. According to Sandrey and Vink (2006), the deregulation of South Africa's agricultural markets began outside the agricultural sector during the late 1970's with extensive liberalisation of the country's financial sector. Policy reforms during this period resulted in fluctuations in the country's currency value and interest rates.

During the 1980's the Rand continued to devalue and farm input prices (which consist of a large import component) rose faster than output prices. Part of the reforms to the financial sector was an amendment to the reserve requirements of the banking sector which made it impossible for the Land Bank to continue subsidising lending rates to agricultural producers. The net effect was that, during the 1980s, interest payments rapidly became the largest cost component in agricultural production (Vink and Kirsten, 2000). During this period of policy reform, however, agricultural producers faced difficult and unpredictable climatic conditions forcing many agricultural producers to leave the sector (Sandrey and Vink, 2006).

1.7.2 Market deregulation of the SA dairy industry

Deregulatory changes in the SA dairy industry are summarised in Table 1.2. According to the NAMC (2001:19), deregulation of the dairy industry began in 1971 with the amendment of legislation allowing the colouring of margarine from white to yellow with the result that margarine became a closer substitute for butter. The amendment led to a 70% drop in butter sales from 1971-1979. From 1979 the deregulation process began to gather momentum until its completion with the abolition of the Marketing Act of 1968 (59

of 1968) and the promulgation of the Marketing of Agricultural Products Act of 1996 (Act 47 of 1996). Many of the policy reforms during the deregulatory process in the SA dairy industry were made to pricing institutions; for example, the abolition of retail price controls for fresh milk, cheese and butter in 1983 and 1985 respectively.

Table 1.2: Summary of deregulatory measures implemented in the SA dairy industry, 1971 - 1998

Year	Deregulatory measure
1971	Margarine allowed to be coloured yellow.
1983	Control over fresh milk prices at retail level abolished Registration of fresh milk distributors abolished
1985	Retail price control over cheese and butter abolished.
1987	Uniform hygiene standards set. Applied to fresh and industrial milk producers. Dairy Industry Control Act repealed.
1988	Floor price scheme for fresh milk implemented.
1993	Dairy Board closed and surplus removal scheme abolished.
1994	Quantitative import controls replaced by import tariffs.
1996	Marketing of Agricultural Products Act of 1996 (No 47 of 1996) is promulgated.
1998	Milk Board is closed. Producer marketing boards, including Milk Board, phased out over 12 months.

Source: NAMC (2001:23)

Restrictive registration for the right to distribute fresh milk was abolished in 1983, leading to a ten-fold increase in the number of fresh milk distributors between 1983 and 1994 (Collins, 1994:86). The objectives of the Marketing of Agricultural Products Act of 1996 (Act 47 of 1996) were aimed at enhancing the international competitiveness of SA agriculture via trade reform from an import substitution to an export orientated policy (Vink and Kirsten, 2000). The new Act aimed to: 1) increase market access for all market participants, 2) promote efficiency of the marketing of agricultural products, 3) optimise export earnings from agricultural products, and 4) enhance the viability of the agricultural sector (van Zyl *et al.*, 2000) Other stipulations in the Act were the phasing out of producer dominated Control Boards by 1 January 1997, bringing to an end significant producer support policies in the SA agricultural sector. The following section discusses the findings of previous research into the effects of SA dairy market deregulation on the industry's primary sector.

1.8 Effects of dairy market deregulation on the primary sector of the SA dairy industry: evidence from previous research

According to Winston (1998), market deregulation takes time to be effectively implemented due primarily to the time taken by policymakers to dismantle regulatory structures and the time taken by market participants to adjust to their new competitive environment. After conducting an investigation into the effects of market deregulation on the SA dairy industry, the NAMC (2001:3-4) found that the deregulatory process proceeded too rapidly, was too extensive and benefited the economies of developed countries, whose dairy industries were heavily subsidised, through increased dairy exports to South Africa.

Vink and Kirsten (2000) contend that the deregulation process in SA agriculture was characterised by gradual and incremental reforms to policy. When the deregulation process progresses gradually, firms have time to respond to impending changes and are, therefore, better off than if the deregulatory changes were abrupt (Reger *et al.*, 1992). Furthermore, Vink and Kirsten (2000) suggest that the incremental policy reforms over time afforded entrepreneurs in supporting and related markets to adapt and develop institutions to aid producers in managing risk. Over time, therefore, as dairy market deregulation proceeded, milk producers remaining in the industry would be able to adjust more rapidly to price changes.

A shortcoming of previous investigations into the impact of dairy market deregulation on the SA dairy industry is that these investigations were not sufficiently detailed and applied to the entire dairy value chain (producers through to consumers). Previous investigations were also not empirical and, therefore, the effects of dairy market deregulation on a particular sector of the SA dairy industry has not been adequately addressed. Previous investigations also omit the effect of market deregulation over the long-term and responses to market deregulation by the primary sector. The following section discusses several key findings from previous local studies on the impact of dairy market deregulation on SA milk producers.

1.8.1 Price formation and the marketing arrangements for fresh milk in the dairy industry

Subsequent to the abolition of the Marketing Act of 1968, SA farmers were no longer obliged to market their product through a single channel, i.e. Marketing Boards or their agents. Agricultural co-operatives, reliant on the guarantee of sales via Marketing Boards, found the competitive environment they operated in severely altered following trade policy reform in 1994; these co-operatives now faced competition from producers and multinational companies entering the SA market (D'Haese and Bostyn, 2001). Many SA agricultural co-operatives (including a major dairy co-operative) responded to these challenges by converting their organisations to private companies.

Milk producers are now paid on the basis of the compositional and hygienic quality of milk, volume of milk produced and proximity to the milk buyer's depot in a comparative base-pricing purchasing system administered by milk buyers. Price premiums are also administered on the basis of volume and/or seasonal adjustment criteria (NAMC, 2001:36). In South Africa's deregulated dairy market it is now the responsibility of individual milk buyers rather than statutory Control Boards to balance milk supply during times of lower or higher than anticipated supplies. The NAMC (2001:37) notes that whereas large milk buyers have the capital reserves and facilities to process and store surplus product in times of overproduction, small and medium milk buyers do not. The NAMC (2001:37) concludes that this has a destabilising effect on producer and, hence, consumer prices during periods of higher than anticipated supplies as small and medium milk buyers tend to sell their product at reduced prices to downstream market participants (such as wholesalers and retailers).

Price determination in the dairy industry is contentious due to differences in milk quality, proximity of milk producers to markets and production capacity which impact on the product price received by the producer. An example of the price calculation for a typical milk producer supplying a large milk buyer is provided in Appendix A. Subsequent to dairy market deregulation, the SA dairy industry's oligopsonistic market structure has persisted. Major milk buyers still had 75% of the market share in 1994 (Collins, 1994:86) and 8.5% of milk buyers purchased and controlled 91% of total production in 1997 (AGROCON, 1997:M13). The perception amongst SA milk producers is, therefore, that low bargaining power relative to milk buyers has impacted negatively on the profitability

of their dairy enterprises in a deregulated dairy market due to them having less control over product prices they receive (Phillips, 2007b).

One way in which a firm can gain more control over its product prices is to integrate forward into the supply chain to gain better access to end users and better market visibility (Thompson *et al.*, 2007:173). An example of this can be found in the KZN dairy industry where 34 milk producers collectively market milk under the Midlands Milk brand. In 2008, Midlands Milk processed approximately 230 000 litres per day and supplied numerous, larger milk buyers with unprocessed milk. Producers supplying Midlands Milk are paid on a milk quality and quantity basis but the cost structure of producers is also taken into account (Joubert, 2008). This payment arrangement, which also considers the producer's production cost structure, may, however, promote inefficient (high cost per litre) milk production as milk producers may not have a sufficient economic incentive to produce at a lower cost per litre.

1.8.2 Reduced real producer milk prices

International studies on the US banking and trucking sectors have found strong evidence that deregulation or market liberalisation caused lower real (operator, in the case of the trucking sector) prices due to the rents from statutory support no longer being realised (Winston, 1998; Nickerson and Silverman, 2003; Stiroh and Strahan, 2003). The implementation of uniform and minimum milk pricing legislation in 1988 enabled SA producers to negotiate with milk buyers on the price for milk (Collins, 1994:58). However, due to the oligopsonistic (few large buyers, many small sellers) structure of the dairy market created by previous regulation of the industry, individual producers had low bargaining power relative to milk buyers and were, therefore, often unable to negotiate for more favourable prices. Geographic constraints, limiting the milk buyer alternatives available to producers, further reduced producer bargaining power. Minimum pricing legislation also acted as a stimulus to production and the removal of surplus product was funded indirectly by milk producers through higher levies paid to milk buyers (Collins, 1994:58-60). The impact on national producer milk price can be seen in Figure 1.1 overleaf where the real national producer milk price (2000=100) declined from R2.00/litre in 1983/84 to a low of R1.22/litre in 1999/00. The real average national producer milk price was R1.44/litre in 2006/07.

Although minimum pricing legislation gave milk producers relative security against price fluctuations it also hindered a competitive pricing strategy for fresh milk. Milk producers were unable to price aggressively at levels below the minimum price set by the Dairy Board or its agents and, therefore, could not compete effectively against substitute products (Collins, 1994:59). Substitute products for fresh milk and other dairy products, such as non-dairy blends, whiteners and yellow margarine have been more price flexible and have eroded per capita consumption of fresh milk and dairy products over time. This has ultimately eroded milk producer revenue (McKenzie and Nieuwoudt, 1985a).

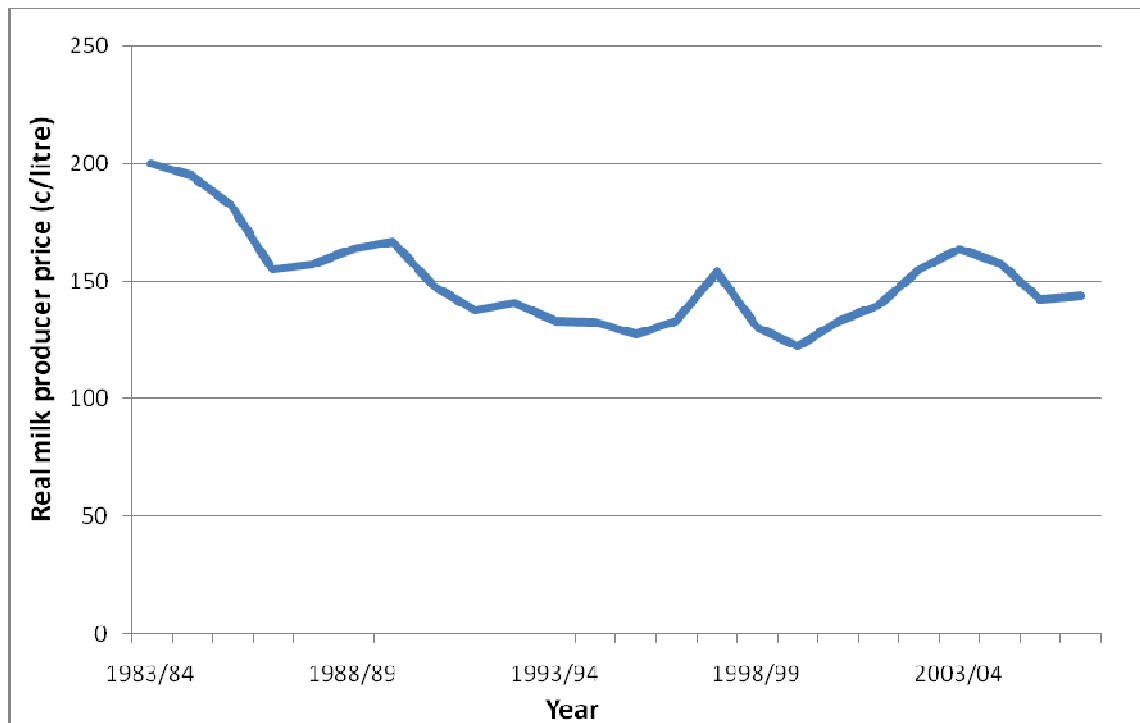


Figure 1.1 Real producer milk price trends, South Africa, 1983/84-2006/07 (2000=100)

Source: National Department of Agriculture (NDA) (2008)

According to the NAMC (2001:49), the demise of the Dairy Board, which led to the cessation of a successful dairy educational programme (promoting the health benefits of fresh milk), has contributed to lower per capita consumption of fresh milk since 1993. Reduced profit margins in milk production, following market deregulation, can act as a significant barrier to entry for South Africa’s emerging milk producers (NAMC, 2001:6) and as such may hamper rural development. Bischoff (2008) and Southey (2008) contend

that, although reduced profit margins may affect the attractiveness of dairy farming, adequate capital and technical skills are essential to ensuring success in dairy farming. These factors and reduced profit margins can act as a barrier for emerging milk producers to enter the industry.

1.8.3 Loss of market share for fresh milk and other dairy products

According to AGROCON (1989:G7), the market share for substitute products such as non-dairy blends and whiteners increased roughly 2% from 1984/85 to 1987/88 while the market share for butter declined by 1% over the same period. The objectives of the Marketing of Agricultural Products Act of 1996 (Act 47 of 1996) were broadly aimed at enhancing the international competitiveness of SA agriculture via trade reform from an import substitution to an export orientated policy (Vink and Kirsten, 2000). The reform of South Africa's trade regime from quantitative to tariff control led to increased importation of dairy products from 1994, resulting in a significant loss in market share for SA milk producers and processors. Increased imports are a result of South Africa's relatively low import tariff rates for dairy products (among the lowest in the world) and several loopholes in the tariff structure, exploited by importers of dairy products in the late 1990's (AGROCON, 1997:M15). Figure 1.2 illustrates the trend in the importation of fresh milk and dairy products, taken as five-year averages, from 1983 to 2005.

The estimated loss in income to the dairy industry since trade policy reform was estimated at approximately R190 million in 2001. This represents a direct negative impact of 10c/litre on the producer milk price (NAMC, 2001:26). Further downward pressure was put on producer milk prices with the 'dumping'⁷ of Irish cheese products in 2004. According to Bieldt (2004), the resulting decline in demand for locally manufactured dairy products caused an estimated 15c/litre decrease in the milk producer price between 2004 and 2005.

⁷ Dumping is said to occur if an exported product is sold in a foreign market at a lower price than is charged in its home market (World Trade Organisation, 2008).

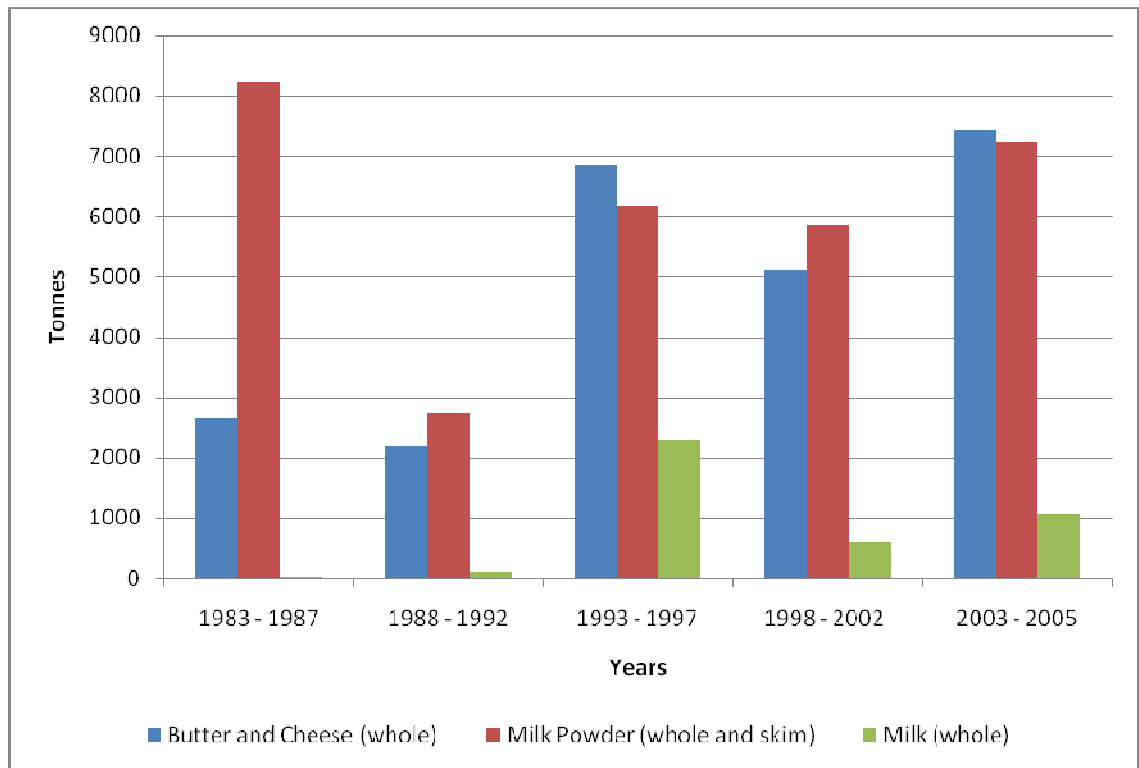


Figure 1.2 Imports of milk and other dairy products, South Africa, 1983 – 2005

Source: FAOSTAT (2008)

A contributing factor to the increase in imports of dairy products into South Africa was the overstatement of Minimum Market Access (MMA) commitments (AGROCON, 1997:M14; NAMC, 2001:30). MMA commitments are for products where little or no imports took place in the past. South Africa agreed to meet MMA quota commitments equal to 3% of the domestic consumption of dairy products in the base period (1986-1988). Imports were, however, calculated on 3% of the total South African Customs Union (SACU) consumption which included other southern African countries. The resulting overstatement in import quota led to increased imports of dairy products and an estimated 10% loss of market share for SA's milk producers and processors to international competitors (NAMC, 2001:30).

1.8.4 Expansion and consolidation of SA dairy farms

Numerous authors suggest that, given the unique marketing and production features of milk (discussed in sections 1.3 and 1.4), in an unregulated market characterised by volatile prices, the risks associated with investment in dairy farming are higher (than if the market

were regulated) and fewer milk producers would engage in milk production (Christ, 1980). The period 1983 – 1987 in the SA dairy industry was characterised by numerous amendments to pricing, registration and hygiene legislation as the deregulatory process began to gather momentum. Collins (1994:61) argues that these amendments led to increased uncertainty within the dairy industry, contributing significantly to higher producer exit rates. The reduced profitability of milk production, through declining real producer prices over time, has also been suggested as a possible cause of the increased producer exit rates from the industry (NAMC, 2001:30). Figure 1.3 shows the trends in commercial milk producer numbers and milk production per producer for South Africa from 1983 to 2004.

As Figure 1.3 illustrates, the declining trend in the number of commercial milk producers has been accompanied by an increase in the total annual production per producer over the period 1983 to 2004. South Africa's milk producer numbers have continued to decline from 28885 in 1983 to 3655 in 2008, while the average number of cows-in-milk per producer has risen from 88 in 1998 to 151 in 2008 (Coetzee and Maree, 2008). Milk production per producer has increased from 70175 litres per annum in 1983 to 583315 litres per annum in 2004 (NDA, 2008).

The shift from small, owner-operator dairy farms to fewer, larger, more sophisticated enterprises over time is a distinctive feature of dairy industries in regions and countries such as the US (Matulich, 1978; Bragg and Dalton, 2004), Korea (Kim, 1999), and the European Union (EU) (Dawson and Hubbard, 1987; Hopps and Maher, 2007). The US dairy sector has seen an increase in dairy farm consolidation since the 1970's (Matulich, 1978; Weersink and Tauer, 1991).

Matulich (1978) found that for US dairy farms in California, economies of size existed from 375 to 1200 cows-in-milk and that the long-run average cost (LAC) curve was L-shaped. Moreover, Matulich (1978) found discontinuities in the various herd size categories that were identified. He attributes these discontinuities to differences between milk producers with regard to milking technique, housing configuration and labour complement. For example, the LAC curve for a herd size of 450 cows-in-milk may lie below that of a herd size of 375 cows-in-milk due to differences in quantities of labour and capital used.

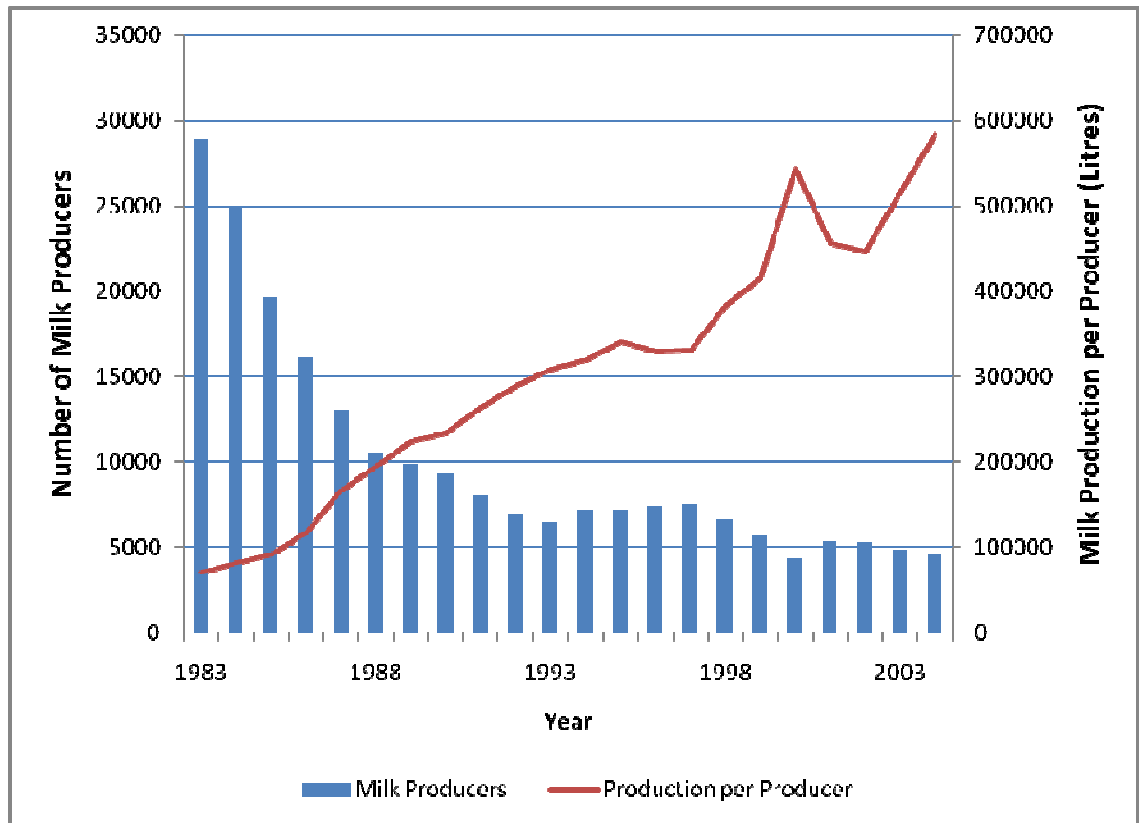


Figure 1.3 Number of commercial milk producers and annual milk production per producer, South Africa, 1983 - 2004⁸

Source: Collins (1994:61); Maree (2007); NDA (2008)

Between 1950 and 1982 the number of registered milk producers in England and Wales fell from 162000 to 43000 while the average herd size increased four-fold to 65 cows-in-milk (Dawson and Hubbard, 1987). Investigating the existence of size economies in the England and Wales dairy sector, Dawson and Hubbard (1987) found that the LAC curve for a sample of 405 milk producers was U-shaped (rather than L-shaped) but that the precise shape of the curve depended upon a milk producer’s managerial ability. They reported that economies of size existed up to 127 cows-in-milk (given average managerial ability) before diseconomies were found, but that these diseconomies were small and profits could still be made above the threshold level of 127 cows-in-milk.

In the European Union (EU) dairy farmer exit rates have typically been 4-5% per annum. Since 2000, Northern Ireland’s producer numbers have declined by 7000 whereas over the

⁸ Data for the years subsequent to 2004 were not available at the time of writing.

same period, the average quota size per producer has increased to 50 000 litres per annum (Hopps and Maher, 2007). Bragg and Dalton (2004) point out that, although low real milk prices paid to producers have been suggested to be the primary reason influencing a milk producer's decision to exit dairy farming in the US, age of the milk producer, higher off-farm income opportunities, lower returns and greater diversification of farm income are other important factors.

Several reasons, as well as institutional change, have been postulated for the consolidation of dairy farms. Huang (1973) suggests that a country's farm sizes are initially determined by that country's resource endowments, but with development, such as increases in off-farm employment, technology changes and changes in factor proportions, pressure to expand farm sizes increases. Comrie (1974:5) maintains that milk producers are faced with an economic problem, inherent in milk production, which forces milk producers to expand production capacity. This economic problem, he suggests, is the result of a large capital outlay on milking equipment, parlours and cattle which results in a producer's fixed costs per litre of milk being high. The milk producer, therefore, has an economic incentive to expand production capacity to capture the benefits of size economies.

Current size of the dairy enterprise plays an important role in influencing the decision to either expand the enterprise or exit the industry during periods of low or declining real producer prices. During periods of declining or low real producer prices small firms are under greater pressure to expand than larger firms and smaller enterprises may, therefore, not survive (Doll and Orazem, 1984:217). This is because expansion in farm size may require substantial investments in equipment and facilities which cannot be justified on small farms as the cost advantages can only be achieved by expanding output. Accounting for dairy enterprise expansion, Chavas and Klemme (1986) and Adelaja (1991) suggest that in the short-run supply response by milk producers is brought about through an increase in productivity per cow, whereas in the long-run the response by milk producers is to increase production capacity by increasing herd size. El-Osta and Johnson (1998) identify factors such as specialization in milk production, economies of size, tax reductions, and off-farm investment for causing dairy farm expansion in the US.

1.8.5 Efficiency gains as a result of deregulation

Doll and Orazem (1984:217) note that expansion of agricultural output usually increases efficiency, lowering a producer's average unit costs. Collins (1994:64) suggests that the increasing cost pressure incurred by milk producers and the declining producer's share of the consumer's Rand over time, has necessitated greater efficiency (producing at a lower cost per litre) and better management on the part of SA milk producers to ensure financial survival. According to Doll and Orazem (1984:195), a producer is able to change the size of the farm business in the long run and will implement changes that enhance the efficiency of the farming operation and enable financial and production goals to be more readily achieved.

Various authors have found that an institutional change, such as market deregulation, results in *consolidation* and an improvement in the *efficiency* of firms within an industry (Kalaitzandonakes, 1994; Nickerson and Silverman, 2003; Stiroh and Strahan, 2003). Accounting for firm consolidation in an industry following an institutional change, Nickerson and Silverman (2003) note that deregulation is an 'external shock' to a firm's environment. Further, they argue that if the primary goal of a firm is to achieve profitability and/or survive, poorly performing firms are compelled to *respond* to changes in their external environments by initiating actions to remedy that poor performance. If poor performance persists a firm either exits an industry or merges with other firms.

There is some evidence that accompanying the consolidation of SA dairy farms over the period of market deregulation has been an improvement in the technical efficiency of the primary sector. Mkhabela *et al.* (2008) found evidence of this improvement on dairy farms in KwaZulu-Natal (KZN) where they showed that from 1999 to 2007, these farms gained in technical efficiency, with large farms showing greater gains than small and medium farms. Kalaitzandonakes (1994) suggests that gains in technical efficiency typically result from an improvement in the productivity of existing rather than new resources through improved management practices. Therefore, gains in technical efficiency can be brought about by increasing managerial input into the dairy enterprise. Superior husbandry practices, more meticulous record-keeping systems and closer supervision of hired labour are ways in which to improve the technical efficiency of milk production. Although the

findings of Mkhabela *et al.* (2008) indicated increasing returns to scale on KZN dairy farms, they could not explain the reasons why these farms were expanding.

Deregulation alters the competitive environment that firms operate in (Stiroh and Strahan, 2003; David Cummins and Rubio-Misas, 2006). As discussed in section 1.2.3, regulation and statutory intervention in the SA dairy industry led to the protection of mainly small, inefficient milk producers. Following deregulation, these inefficient producers were exposed. The net effect of an institutional change such as dairy market deregulation may be, therefore, the consolidation of, and an improvement in, the technical efficiency of SA dairy farms.

Another reason for the increased rate of dairy farm expansion and improvements in efficiency over time is technological change (Matulich, 1978; Weersink and Tauer, 1991). Investigating the direction of causality between dairy herd (farm) size and productivity in the US dairy sector, Weersink and Tauer (1991) found that the direction of causality is from dairy herd size to increased productivity but both factors are influenced by price changes. They found that milk producers in the US dairy sector *expanded* production capacity (herd size) in response to price changes and were, therefore, in a better position to adopt new technologies and become more productive. Similarly, based on evidence presented in Figure 1.3, SA milk producers may have responded to declining real producer prices during the deregulatory process by expanding production capacities and adopting new technologies.

1.8.6 Changes in geographic distribution of milk production

Another structural change that is occurring in the SA dairy industry is a change in the geographic distribution of milk production with a shift from inland to coastal areas (Coetzee and Maree, 2008). As Table 1.3 illustrates, the dominant milk producing regions have shifted from the interior of the country to the higher rainfall, coastal regions such as the Western and Eastern Cape provinces and KwaZulu-Natal (Blignaut, 1999; Coetzee and Maree, 2008). Blignaut (1999) contends that the impetus for this shift has been the popularisation of pasture-based production systems, which are more suited to coastal areas. Lower collection costs per square-kilometre, due to less dispersion of milk producers, also makes coastal areas more attractive to milk buyers. Mkhabela *et al.* (2008) suggest that

milk producers in coastal areas may also have input cost advantages relative to inland producers due to their close proximity to sea ports. McKenzie and Nieuwoudt (1985a) note that high producer milk prices encourage intensive feeding milk production systems such as Total Mixed Ration (TMR) systems. The removal of price supports for milk producers resulting in lower real milk prices, therefore, may have promoted the adoption of low-input, pasture-based milk production systems. Coastal areas (KZN, Western Cape and Eastern Cape) accounted for 52.4% and 68.2% of total milk production in South Africa in 1997 and 2007 respectively (Coetzee and Maree, 2008).

Table 1.3: Changes in the geographic distribution of milk production, South Africa, 1997 – 2007

Province	% Distribution of Milk Production	
	December 1997	March 2007
Western Cape	22.9	25.3
Eastern Cape	13.8	21.8
Northern Cape	1.2	0.7
KwaZulu-Natal	15.7	21.1
Free State	18.0	12.8
North-West	12.6	7.1
Gauteng	4.4	3.1
Mpumalanga	11	7.6
Limpopo	0.4	0.5
Coastal regions	52.4	68.2
Inland regions	47.6	31.8
Total	100	100

Source: Coetzee and Maree (2008)

The low-input pasture-based milk production system, pioneered in New Zealand, has also been adopted in many other countries and regions such as the US, Australia and Europe. The rationale for adopting this system is due to the economic benefits offered by lower input (feed, labour, utilities and herd health) costs (Hanson *et al.*, 1998). Many SA milk producers have successfully adopted the low-cost, pasture-based milk production system in an effort to boost profitability and enhance competitiveness.

1.9 Current types of government support for milk producers in selected international markets

Internationally, many dairy industries are still highly regulated. As Table 1.4 shows, relative to other countries the SA dairy industry is highly deregulated. State support for the SA dairy industry has declined substantially since 1971 and current support to producers consists of providing funding for research and veterinary services and regulating the quality of fresh milk. Countries with relatively highly regulated dairy industries include the US, Canada, the EU and Japan. According to the NAMC (2001:16), milk producers in the EU benefit the greatest from government support and this has a disruptive effect on the international market. Further evidence of the reduction in statutory support to primary SA agriculture is provided by Kirsten *et al.* (2000) who estimated Producer Subsidy Equivalents (PSE) for SA agriculture in 1998. South Africa's PSE declined from 12.4% in 1995 to 5.2% in 1998, indicating a substantial reduction in government support.

Table 1.4: Direct government support to milk producers in selected countries, 1971 - 2006

Type of support	EU ^a (2006)	United States (2006)	New Zealand (2006)	Canada (2006)	Japan (2006)	RSA ^b (1971)	RSA (2001)
Subsidies	+	+		+		+	
Producer payments	+	+			+	+	
Surplus removal	+	+		+		+	
Funding research	+	+	+	+	+		+
Marketing quotas	+			+		+	
Veterinary services	+	+	+	+	+		+
Fixed price		+		+		+	
Quality control	+	+	+	+	+	+	+

Source: NAMC (2001:16); Blayney *et al.* (2006)

a. EU = European Union

b. RSA = Republic of South Africa

New Zealand, a major role-player in the global dairy market (Blayney *et al.*, 2006), was the only country with a lower PSE than South Africa with an estimate of 0.8% in 1998. With deregulation and trade policy reform have come greater exposure and vulnerability of market participants to global events and trends (Chitiga *et al.*, 2008). The reduction in government support and greater exposure to global trends suggest that, relative to dairy

industries in other countries, the SA dairy industry may be at a competitive *disadvantage* in terms of global trade in dairy products. South African exports of milk and dairy products (milk, cream and other processed products) to Southern Africa Development Community (SADC) countries has shown an increasing trend over the period 1994 to 2000 when exports increased by 97.5% (Vink *et al.*, 2002). Opportunities for exports to developed countries such the US and United Kingdom (UK) are difficult for market participants in the SA dairy industry to take advantage of due to the relatively poor quality of milk produced. In recent years many countries have introduced stricter milk quality standards especially in terms of milk's Somatic Cell Count (SCC), which is used as a non-tariff trade barrier to protect domestic milk producers in those countries (Phillips, 2007a).

Blayney *et al.* (2006) note that, globally, consumer preferences for dairy products, especially concentrated dairy products, are shifting rapidly with consumers now favouring foods with added features. For example, in countries with higher disposable income per capita, consumption of yoghurt products is rising faster than in countries with lower disposable incomes. They also found that the per capita consumption of milk is declining in developed countries, such as Australia, the US and Japan but is growing in developing countries such as Mexico, Singapore and China. Since deregulation, market participants in the SA dairy industry have, therefore, had to re-position themselves as competitors within the global environment and become more receptive and responsive to changing policy and market conditions, locally and internationally, in order to sustain and improve their domestic and international market share or competitiveness.

CHAPTER 2

COMPETITIVENESS DEFINED AND STUDY RESEARCH METHODOLOGY

2.1 Introduction

According to Esterhuizen (2006:99), globalisation and trade liberalisation have provided the impetus for business and governments to assess and improve the competitiveness of firms, sectors and industries. With deregulation of agricultural markets and trade policy reform, SA agricultural producers and agribusinesses have had to adapt to a new competitive environment in order to sustain and grow their domestic market share and contribute to national economic growth.

The definition of competitiveness, which depends on the level of competitiveness analysis, is also crucial in guiding the research methodology. Therefore, it is imperative that an unambiguous definition of competitiveness be determined so that an applicable measure of competitiveness can then be chosen. Since the objectives of this research are to assess changes in competitiveness of milk producers and to analyse factors influencing competitiveness at the producer level, an appropriate measure of competitiveness also needs to be identified. The aims of this chapter are to define and discuss the concept of competitiveness, adopt an appropriate definition of competitiveness to guide the research methodology, introduce some common measures of competitiveness, and present the Unit Cost Ratio method of measuring competitiveness.

2.2 Competitiveness defined

Siggel (2006) notes that whereas comparative advantage is the *true* source of competitiveness, the concepts of comparative advantage and competitiveness differ in terms of distortions created by government policies, e.g. protectionist policies, producer price supports, etc. Actual competitiveness is then derived from comparative advantage as well as from the advantage gained by domestic firms from government support policies. At the microeconomic level, a producer has a comparative advantage if his/her costs of production are lower than those of competitors (international and domestic) at the equilibrium factor price level, implying a cost advantage. The sources of comparative

advantage include abundance or relative cheapness of either primary or intermediate inputs, the use of different or superior technology, or the production of output on a larger scale (size economies) (Siggel and Cockburn, 1995; Siggel, 2006). Although, theoretically, comparative advantage is the true source of competitiveness, Vollrath (1991) notes that researchers are generally confronted with trade data generated in a distorted world under conditions of *post-trade* equilibria where the concept of competitiveness, rather than comparative advantage, is more applicable.

Previous research literature notes that the precise definition of competitiveness is subject to ambiguity (Kennedy *et al.*, 1997; Ortmann, 2000; Esterhuizen, 2006:90; Siggel, 2006). Siggel (2006) accounts for this ambiguity by suggesting that unlike comparative advantage, competitiveness has not been as rigorously defined in the early economic literature. The difficulty in defining competitiveness has been attributed to its multi-dimensional applications and interpretations. Some definitions focus on the underlying sources of competitiveness whilst others place more emphasis on the indicators of competitiveness (Kennedy *et al.*, 1997; Ortmann, 2005; Esterhuizen, 2006:173).

Porter (1998:40) notes that competitive advantage (a form of competitiveness) is derived from a firm's organizational structure and the way in which it performs its activities. Furthermore, he argues that to gain competitive advantage, a firm must perform crucial activities more efficiently than rivals (lower cost advantage) or perform these activities in a unique way thereby generating increased buyer value and commanding a premium price (differentiation advantage).

Cantwell (2005:544) defines competitiveness as the possession of necessary capabilities needed for sustained economic growth in a competitive environment in which there are others that have equivalent but different sets of capabilities. Spies (1999) refers to the societal conditions and structures that promote an environment of 'continuous technical innovation' as being the most crucial in improving national competitiveness. Also implied is that in the pursuit of competitiveness, innovation has an increasingly important role to play in that through meaningful competition, innovation is stimulated and results in lower costs and improved product quality within an industry, thereby increasing product demand (Cantwell, 2005:544).

There is, however, general consensus in the literature regarding the following characteristics of competitiveness: competitiveness is a *relative* concept and relates to the *profitable* maintenance and/or gain of domestic and/or international *market share* by a firm, sector or industry (Frohberg and Hartmann, 1997; Kennedy *et al.*, 1997; Cantwell 2005:545; Esterhuizen, 2006:89). Esterhuizen (2006:89) provides the following definition of competitiveness: “Competitiveness is the ability of a sector, industry or firm to compete successfully in order to achieve sustainable growth within the global environment while earning at least the opportunity cost of returns on resources employed”.

Esterhuizen’s definition of competitiveness incorporates all the essential features required for the purposes of this study. Therefore, based on Esterhuizen’s definition, competitiveness in this study is defined as the ability of a milk producer to achieve sustainable *business* growth while earning at least the opportunity cost of management. Therefore, a producer is considered to be competitive if positive returns to land are earned.

2.3 Levels and measures of competitiveness analysis

Macro and microeconomic concepts of competitiveness differ distinctly in terms of their objectives in competitiveness analyses due to the desired outcomes of those analyses (Esterhuizen, 2006:89). Methods such as the Revealed Comparative Advantage (RCA) and Relative Trade Advantage methods developed by Balassa (1965) and Vollrath (1991), respectively, are examples of commonly used macroeconomic measures of competitiveness. Porter (2005:43) argues that most of the discussion regarding competitiveness is focused on macroeconomic, social and legal policies that form the basis of a successful economy and that these factors are necessary but not sufficient in explaining competitiveness. Porter (2005:43) maintains that although the implementation of proper statutory institutions provides the opportunity to create wealth (competitiveness), these do not create wealth themselves. This is due to the fact that wealth is created at the microeconomic level by the capabilities of a nation’s companies, a process driven by the microeconomic business environment in which these companies compete.

Siggel (2006) concurs and suggests that the microeconomic concept of competitiveness has a firmer theoretical foundation than the macroeconomic concept. He attributes this to the fact that at the microeconomic (firm or producer) level the concept of competitiveness

focuses on the particular characteristics of each individual producer or firm competing directly for market share. According to Frohberg and Hartmann (1997), competitiveness analyses may differ spatially, ranging from the farm/firm to national levels and also in terms of product aggregation. Table 2.1 provides an overview of the various ways competitiveness can be measured spatially and in terms of product aggregation.

Table 2.1: Analyses of competitiveness according to level of product aggregation and spatial extension

Product Aggregation	Farms	Regions within a country	Countries
Entire Economy	No	No	Yes
Single Industry	No	Yes	Yes
Single Commodity	Yes	Yes	Yes

Source: Frohberg and Hartmann (1997)

Table 2.1 shows that, depending on the level of investigation, analyses of competitiveness may differ both spatially and in terms of the level of product aggregation. For example, the competitiveness of a single product can be measured at the country, region or single farm/firm basis.

Frohberg and Hartmann (1997) and Siggel (2006) further note that in addition to the various spatial and product level analyses of competitiveness, past competitive performance (*ex-post*) or the outcome of competitiveness and potential competitive performance (*ex-ante*) can also be measured. The difference between the two concepts is that *ex-post* indicators or measures of competitiveness are deterministic in nature, in that costs, prices and market shares are directly observed. Some commonly used *ex-post* measures of competitiveness include Trade and Market Share Indicators, Real Exchange Rate, and Foreign Direct Investment. Real Exchange Rate usually measures the competitiveness of an entire economy (Frohberg and Hartmann, 1997). *Ex-ante* measures are, however, stochastic in nature and consist of a number of variables which are composed within a model used to measure potential competitiveness. The following section discusses the findings of previous competitiveness analyses in South Africa.

2.4 Previous research on the competitiveness of agricultural commodities in South Africa

Vink *et al.* (1998) studied the international competitiveness of Western Cape wheat production using producer profitability comparisons of wheat production per hectare as a proxy for competitiveness. Producer gross incomes and production costs were also included in the comparison. Data from international competitors incorporated in the study included Argentina, Australia, Canada, Britain, Germany, the US and Zimbabwe. The study found that Western Cape wheat production was not internationally competitive. Wheat producers in countries having lower yields per hectare were found to have three times the net gross margin of SA producers. The study attributed this finding to the newly deregulated wheat industry, noting that producers were still in a transition phase where production inefficiencies were still apparent. The study concluded that to survive in the global market, SA wheat producers needed to adapt their production practices to the market's willingness to pay.

Venter and Horsthemke (1999) applied Porter's Diamond Model approach in their study on the competitive nature of the SA sheep meat value chain. Southern African countries included in the analysis were Namibia and South Africa and data from these countries were compared with data from Australia. The study found that Australia was more competitive than both South Africa and Namibia in terms of mutton production but was not competitive in terms of lamb production. The study identified that an important factor constraining improvements in the competitiveness of the sheep meat value chain was the high cost associated with value adding by market participants in the retail sector. The study recommended that SA producers add more features to sheep meat products thereby generating greater customer value, and also that role-players within the red meat industry form strategic alliances to improve the overall value chain competitiveness.

Mosoma (2004) investigated agricultural competitiveness and supply chain interactions between South Africa, Argentina and Australia using the Relative Trade Advantage (RTA) method developed by Vollrath (1991). Using export data, Mosoma (2004) found that a number of South Africa's value chains were marginally competitive relative to Australia and Argentina. These were the tobacco, maize, tomato, sugar and grape value chains. Mosoma (2004) recommended that more attention needs to be paid to creating value-

adding opportunities through aggressive research and the development of new products and production techniques.

Esterhuizen and van Rooyen (2006) measured the competitiveness of the SA wine industry and identified factors affecting that competitiveness. Using the Relative Trade Advantage (RTA) method, Esterhuizen and van Rooyen (2006) measured the operational trading performance of SA wines relative to international competitors. Key success factors affecting the competitiveness of the wine industry were found to be intense competition between market participants, the production of affordable, high quality products, efficient supporting industries and the availability of internationally competitive local suppliers of primary inputs. The study found that the SA wine industry was highly competitive internationally relative to countries such as Australia, Chile, Italy and New Zealand. In conclusion, Esterhuizen and van Rooyen (2006) noted that fluctuations in the exchange rate, trust in the political support system, the competence of administrative personnel in the public sector and the growth and size of the SA market were important factors for market participants to consider to enhance the competitiveness of the SA wine industry in the future.

Esterhuizen (2006) analysed the competitiveness of 16 selected food commodity chains in South Africa using Balassa's (1965) RCA method for the period 1961 to 2002. He noted that the majority of these commodity chains were marginally competitive and except for the maize, pineapple and apple chains competitiveness was found to decline when moving from primary to processed products. Fresh milk showed increasing competitiveness in both the long- and short-run whilst the competitiveness of other dairy products such as cheese, butter, and skim milk have remained unchanged over the period 1961 to 2002. Esterhuizen (2006:173) noted that it is of vital importance that the underlying reasons for the non-competitiveness of some commodity chains be identified. The reasons for the non-competitiveness of these commodity chains may relate to a lack of technical innovation, unproductive labour, high input costs or government trade policy. He concluded by noting that strategic international alliances may be a possible solution to improving the competitiveness of poorly performing commodity chains.

2.5 Measure of competitiveness used in this study: Unit Cost Ratio (UCR) method

Based on the literature review, the most appropriate method for measuring the competitiveness of milk production for the purposes of this study is considered to be the UCR method. Popular macroeconomic methods of measuring competitiveness, such as RCA and RTA, were not considered suitable because these methods require aggregate production and trade data, which were not available for the study area. Porter's diamond model, an analytical method of determining competitive advantage for a firm, industry or sector, was also not considered suitable as this method is predominantly used to measure current and not past trends in competitive advantage.

The UCR method, developed by Siggel and Cockburn (1995), is a microeconomic method of competitiveness analysis best used to distinguish between comparative advantage and competitiveness. The method uses three variants, UCR_d (domestic competitiveness), UCR_x (international competitiveness) and UCR_s (comparative advantage), of a unit cost indicator derived from Ricardian comparative advantage to determine the sources of competitiveness for a particular firm or industry. The unit cost indicator used in this study is based on one of the three unit cost variants, namely the indicator of domestic competitiveness, UCR_d , proposed by Siggel (1997). The domestic unit cost indicator for a particular firm is structured as follows:

$$UCR_d = \frac{TC}{VO} = \frac{TC}{Q \cdot P_d} \quad (2.1)$$

where UCR_d = domestic unit cost ratio, TC = total costs, VO = value of output (total revenue), Q = quantity of product, P_d = domestic producer price

UCR_d is a simple ratio of total costs to total revenue for a particular firm and is similar to the Private Profitability (PP) ratio used in the Policy Analysis Matrix (PAM) (Monke and Pearson, 1989). The UCR method is preferred to the PAM because the UCR method is able to measure the competitiveness of individual producers rather than that of a representative farm. Siggel (1997; 2006) maintains that the UCR method has the benefits of overcoming differences in product mix and quality that have generally made inter-firm comparisons problematic. Secondly, the unit cost indicator can be considered without the

need for data from an international competitor (whose costs and prices would be used as a comparison) to estimate international competitiveness (UCR_x) as the border price, representing the unit cost of an international best-practice producer, P_w , can be substituted into equation (2.1). The hallmark of the UCR method, however, is the distinction that can be drawn between comparative advantage and competitiveness by using shadow prices, P_s , and calculating the distortions created by government policies (Siggel 1997; 2006).

Total costs, reported in equation (2.1), are costs reported by firms that include tradable inputs, non-tradable inputs, labour costs and capital costs. In the long-term total costs per unit of product, including the opportunity costs of all resources, are expected to equal total revenue per unit (product price) (Pasour, 1981; Doll and Orazem, 1984:211-213). In this study, an opportunity cost of management is added to total accounting costs while the returns to land are regarded as a residual. A UCR_d of less than one indicates that a firm covers all costs, including the opportunity cost of management, and has positive returns to land. Positive returns to land can be a reflection of high factor productivity, relatively low factor or input prices and/or higher product prices. A UCR_d indicator exceeding one indicates that a firm's returns to land are negative and the firm is, therefore, not considered locally competitive.

2.6 Description of the study area and data collection

For the purposes of assessing changes in, and factors influencing, the long-term competitiveness of milk producers, data from the East Griqualand (EG) milk producer study group were collected for the period 1983 – 2006. The data comprised detailed production and financial data for individual milk producers for the study period. Efforts were made to incorporate other regions of South Africa in the study but due to logistical and time constraints, this objective was not achieved.

East Griqualand (EG) encompasses the areas of Kokstad in southern KZN and Matatiele and Cedarville in the Eastern Cape Province. The area is a summer rainfall region and is characterised by 'sourveld' grazing conditions. Average annual rainfall ranges from 620mm to 816mm (Camp, 1999). Because of high summer rainfall and relatively high altitude, sourveld becomes relatively unpalatable to livestock in autumn and winter. This has important implications for the type of farming systems the region can support. In the

case of milk production, a seasonal fluctuation in rainfall and temperature in EG can give rise to greater seasonal variability in milk production (Tainton, 1988:41).

Milk production in EG has traditionally been pasture based with varying rates of supplementation of purchased feed. In recent years, however, EG milk producers have increased the proportion of pasture in their feeding regimes and are moving towards seasonal calving in an effort to improve profitability. This shift has been driven by reduced profit margins and more efficient use of facilities and management time (Bischoff, 2008). Over the study period a total of 30 milk producers were members of the EG study group, which was formed with the objective to improve the production and financial performance of its members. This group has received advice from the same consultant throughout the study period. Since 1983 a number of milk producers have left while others have joined the study group. Currently, the group consists of 23 active commercial milk producers.

Many milk producers in the EG study group include other enterprises (maize and other cash crops, sheep, beef) as a means of portfolio diversification whilst others specialise in dairy production, taking advantage of size and scope economies. Data collected for each EG milk producer are comprised of financial and production data. If the milk producer had a diversified farm of which a dairy enterprise is a component, fixed or overhead costs were allocated on the basis of gross margin; e.g. if the dairy enterprise contributes 70% to the gross margin, 70% of the fixed costs were allocated to the dairy enterprise. Bischoff (2008) contends that although this method of allocating fixed costs to an enterprise may be arbitrary, experience has confirmed it to be the most suitable.

2.7 Background to marketing arrangements for milk in EG

Prior to 1994 milk production in EG was subject to milk marketing quotas and price discrimination administered, on behalf of the Milk Board, by a major milk buyer. Price discrimination meant that “quota” milk commanded a higher price than “non-quota” milk, acting as an incentive to restrict milk production to quota levels. Following deregulation, EG milk producers are no longer obligated to market their product through a single channel such as the Milk Board or any of its agents (Southey, 2008).

According to D'Haese and Bostyn (2001), trade policy reform in 1994 increased the import opportunities available to international competitors but also allowed entry of international competitors into the SA market. Faced with a changing competitive environment many co-operatives responded by transforming co-operative principles and structures to those of private companies. In 1994 the major milk buyer in EG registered as an operational company and in 1997 a holding company was formed. The process of transforming its operational principles from those of a co-operative to a private company was officially completed by the milk buyer in 2003 (CloverSA, 2008).

There are currently three major milk buyers operating in EG. Two of the buyers are multinational companies who collectively purchase 30% of EG milk. The remaining 70% is purchased by the former dairy co-operative (Bischoff, 2008). Bischoff (2008) and Broom (2008) suggest that with the major milk buyer in EG now operating as a private company, milk producers have lost bargaining power and are subject to relatively greater price volatility. The perception by EG milk producers is, therefore, that deregulation has largely impacted negatively on their dairy enterprise profitability. Methods of data analysis for each of the competitiveness analyses will be discussed in the next two chapters.

CHAPTER 3

THE IMPACT OF MARKET DEREGULATION ON THE COMPETITIVENESS OF SELECTED COMMERCIAL MILK PRODUCERS IN EAST GRIQUALAND: A UNIT COST RATIO ANALYSIS: 1983-2006

3.1 Introduction

Deregulation in the SA dairy industry was characterised by incremental policy reforms over the period 1971 to 1996 giving market participants in the dairy and supporting industries time to adapt to the impending change. The objective of the analysis in this chapter is to investigate the impact of dairy market deregulation on the competitiveness of milk producers who comprise the East Griqualand (EG) study group in KwaZulu-Natal and the Eastern Cape Province over the period 1983 to 2006.

3.2 Data

Individual commercial milk producer data from the EG study group were collected for the period 1983 – 2006. Although membership of the study group has changed over time, the data have been averaged on an annual basis so that trends in real prices and costs, and hence UCR_d , could be identified. Over the study period the composition and size (volume of milk produced per annum) of EG milk producers have changed. These changes are summarised in Table 3.1. According to Bischoff (2008), changes in the composition and relative sizes of EG milk producers are due to reduced profit margins over the study period. There has also been a shift on EG dairy farms from a higher-cost production system to a lower-cost pasture-based system. Over the period 1985 to 2005 many EG farmers producing a relatively low annual milk output have been replaced by fewer, larger producers who have expanded production capacity, taking advantage of size economies. Milk buyers, by offering significant price premiums based on milk output (up to 25c/litre), have also encouraged producers to increase herd sizes and milk output.

Based on a definition by Esterhuizen (2006), competitiveness in this study is defined as the ability of a milk producer to cover all accounting costs plus an opportunity cost of management. Therefore, a producer is considered to be competitive if positive returns to

land are earned. Competitiveness in this analysis is measured at the individual milk producer level using the UCR method. Total accounting costs, comprised of variable and fixed costs, were recorded for each EG milk producer. To total accounting costs an opportunity cost of management⁹ at 5% of milk turnover for producer *i* at time *t* (Calkins and DiPietre, 1987:117) was added - returns to land are regarded as a residual. Thus, milk producers with higher revenue will have a higher opportunity cost of management than producers with lower revenues. Positive returns to land can be a reflection of high factor productivity, relatively low factor or input prices and/or higher product prices.

Table 3.1: Changes in milk production and contribution to total milk production, EG milk producers, 1985 - 2005

Annual milk production (litres/year)	% of milk producers		% of milk production	
	1985	2005	1985	2005
1 – 500000	50	9	27	1
500001 - 1500000	33	55	27	34
> 1500001	17	36	46	65
Total	100	100	100	100

Source: Bischoff (2008)

3.3 Method of analysis

Three unit cost indicators of domestic competitiveness, namely UCR_L , UCR_T and UCR_N , based on the original UCR_d indicator used by Siggel (1997), were used in this analysis. These unit cost indicators vary in terms of the domestic price (P_d) used in the calculation of VO or total revenue in equation (2.1). P_L , used in the calculation of UCR_L , is the net local milk price paid to producers which, prior to 1992, was determined by milk buyers acting as agents for the Milk Board. Premiums have always been paid to milk producers on the basis of milk quality (reflected by the milk solid content, i.e. butterfat and protein content) but prior to 1992, milk transport was paid by the milk producer. Since 1992 the pricing policy

⁹ A questionnaire was sent to all current EG milk producers in May 2008 so that individual opportunity costs of management time could be derived (see Appendix B). The weighted average of these producers' own opportunity costs of management, derived from the questionnaire, was 4.87% of milk income.

of milk buyers has varied substantially between buyers and numerous factors such as seasonal production fluctuations, the bacterial content of the milk (reflected by the somatic cell count), the volume of milk produced and the distance from the milk buyer depot are taken into account when producer prices are determined. The price received by each milk producer is, therefore, net of transport costs and other levies and dependent on quality, volume and locational factors.

P_T , used in the calculation of UCR_T , is the net local producer milk price, P_L , plus dairy cattle trading income¹⁰. Dairy cattle trading income can often play an important role in the profitability of the dairy enterprise (Broom, 2008). P_N , used in the calculation of UCR_N , is the national producer milk price (net of transport costs) obtained from the NDA (2008). Since P_N is a standard milk price received by producers, price premiums, based on locational and milk volume/quality characteristics received by producers, are removed.

3.4 Results of the UCR analysis

The results of the UCR analysis for different time periods are summarised in Table 3.2 overleaf. The number of milk producers varied over time and the low number of producers from 1983 to 1987 was due to a lack of sufficient data and data collection problems. Competitiveness is a relative and dynamic concept and the results presented in Table 3.2 reflect average sample milk producer competitiveness over time under prevailing government policies. For example, a milk producer who was competitive in 1983 may not be considered competitive in 2006.

3.4.1 Unit Cost Ratio based on P_L (UCR_L)

The UCR_L shows the relative competitiveness of an average sample milk producer over time based on the net local milk price paid to producers, P_L . The mean UCR_L indicator for the EG group fluctuated around one between 1983 and 2006. During this period, the average EG milk producer was earning negative returns to land based on the net price received for milk. Between 1988 and 1997 the mean UCR_L were 1.197 and 1.153, showing a decline in competitiveness from 1983. The real net local producer price (2000=100), P_L ,

¹⁰ Trading income = (livestock sales + herd closing value) – (livestock purchases + herd opening value)

declined by 19% from R2.04 in 1983 to R1.65 in 1997 while real average total costs per litre declined by only 13% over the same period. The decline in relative competitiveness can, therefore, be attributed to a larger decline in real price relative to real total costs. Relative competitiveness improved in the 1998 to 2006 period but returns to land were still negative.

Table 3.2: Results of UCR analysis for the sample EG milk producers, 1983 – 2006

Years	Mean UCR _d		
	UCR _L	UCR _T	UCR _N
1983 – 1987	1.050	0.938	1.139
(n=5)	(0.120)*	(0.074)	(0.094)
1988 – 1992	1.197	1.031	1.240
(n=8)	(0.060)	(0.062)	(0.086)
1993 – 1997	1.153	1.015	1.203
(n=14)	(0.054)	(0.040)	(0.060)
1998 – 2002	1.083	0.982	1.056
(n=16)	(0.062)	(0.044)	(0.079)
2003 – 2006	1.061	0.956	1.005
(n=10)	(0.047)	(0.043)	(0.046)

*Figures in parentheses show the standard deviation of UCR

Responses to rising purchased feed (maize) prices relative to milk prices over time (Collins, 1994:63) are evident in the substitution of own-produced forage crops for purchased feed by EG milk producers. For example, the average percentage of purchased feed costs to total milk revenue for the sample EG milk producers declined from 28.6% in 1983 to 22.7% in 1988 while the average percentage of own-produced forage costs increased from 9.3% to 15.8% in the same period. The relatively high standard deviation of UCR_L of 0.120 in the period 1983 – 1987 indicates that there was a relatively high variation among this (small) group of producers in terms of their returns to land. The standard deviation decreased to 0.047 in the period 2003 to 2006 indicating that the variation in returns to land among milk producers decreased over time.

3.4.2 Unit Cost Ratio based on P_T (UCR_T)

The UCR_T shows the relative competitiveness of an average milk producer over time based on the net total price, P_T , which is the net local price, P_L , plus dairy cattle trading income.

Milk producers commonly use trading income to supplement milk income. The inclusion of trading income impacted positively on the relative competitiveness of the average EG milk producer when compared to the UCR_L measure. Returns to land were, however, still negative from 1988 to 1997 as the mean UCR_T was greater than one. Relative competitiveness, however, improved from 1998 to 2006.

The contribution of trading income to P_T increased from 8.91% in 1983 to 15.6% in 1989. This may be further evidence of reduced profit margins that milk producers were experiencing in the late 1980s, with producers relying more on trading income to survive. The average contribution of trading income to the net total price declined from 12.1% in the period 1983 to 1997 to 9.8% in the period 1998 to 2006. This suggests that gains in competitiveness since 1998 were derived from growth in the average real net local price, P_L , relative to the average real total costs per litre for this period.

3.4.3 Unit Cost Ratio based on P_N (UCR_N)

The UCR_N shows the relative competitiveness of the average sample EG milk producer over time based on the national price (net of transport costs), P_N , as reported by the NDA (2008). The results suggest that the average sample EG milk producer would be earning negative returns to land from 1983 to 2002 if P_N was received for milk. Relative competitiveness declined from 1983 to 1992 and improved slightly from 1993 to 1997. The decline in relative competitiveness in the former period can, firstly, be attributed to a decline in real P_N , which fell from R2.00/litre to R1.41/litre from 1983 to 1992. Secondly, real average total costs per litre for the EG group have, in the past, been relatively high and have not declined at the same rate as P_N . For the period 1983 to 1992 the real total cost per litre averaged R1.97 compared with R1.51 for the period 1993 to 2006. The substitution of own-produced forage for purchased feed has been an important factor in reducing the average total cost per litre for the EG group over time. Relative competitiveness improved from 1998 to 2006 with an average UCR_N of 1.005 for the period 2003 to 2006.

3.5 Categorisation of EG milk producers based on UCR_T

The sample EG milk producers were divided into top one-third and bottom one-third categories based on their individual UCR_T indicators from 1983 to 2006. This was done to

investigate the impacts of deregulation on different groups of milk producers and to explain why deregulation affects a milk producer more than others. The results for the UCR_T analysis based on the two categories are presented in Table 3.3.

Table 3.3: Mean UCR_T indicator results for two categories of the sample EG milk producers, 1983 – 2006

UCR_T		
Years	Top 1/3	Bottom 1/3
1983 – 1987	0.855	1.029***
	(0.058) ^a	(0.086)
1988 – 1992	0.952	1.142**
	(0.033)	(0.141)
1993 – 1997	0.912	1.140***
	(0.037)	(0.072)
1998 – 2002	0.881	1.095***
	(0.051)	(0.054)
2003 – 2006	0.834	1.054**
	(0.055)	(0.063)

a. Figures in parentheses show the standard deviation of UCR_T

Note: **,*** denote significant differences between the means at the 5% and 1% levels of probability, respectively (see Steel and Torrie, 1980:95).

As Table 3.3 shows, the mean UCR_T values were statistically significantly different between the two categories of milk producers indicating that the ability to manage deregulation differed among the top and bottom one-third sample of milk producers. Appendix C shows the average real P_L and real total costs per litre for EG milk producers in the top and bottom one-third categories from 1983 to 2006. EG milk producers in the top one-third category were able to remain relatively competitive from 1983 to 2002 despite declining national producer milk prices over this period by consistently achieving a higher real P_L and producing at a lower real cost than producers in the bottom one-third category. This finding is consistent with that of Dawson and Hubbard (1987) who found that better managed dairy farms in the England and Wales dairy sector were able to produce at a lower average cost at any given level of output in 1980/81.

Higher real prices can reflect higher product quality, greater volume produced and/or locational advantage (lower transport costs). Lower real costs can reflect the use of superior or cost-reducing technologies and/or size economies. Real total costs per litre for

the top one-third producers declined steadily from 1983 to 2002 and rose on average by 6% in the period 2003 to 2006 relative to the period 1998 to 2002. Returns to land over this period remained positive as the increase in average real total costs was offset by a larger increase in the average real producer price, P_L , of 17%.

3.6 Discussion

Results from the UCR_L analysis showed that the average sample EG milk producer did not cover all costs, including an opportunity cost of management, based on the net local price, P_L , received for milk for all periods. Based on the net total price, P_T , which included dairy cattle trading income, the competitiveness of the average milk producer improved. This suggests that during periods of relatively low real milk prices and rising costs, trading income plays an important role in enhancing the profitability of a dairy enterprise. The UCR_N analysis based on the national producer milk price, P_N , suggested that the average EG milk producer received a real milk price above the national average over the study period.

The differences in relative competitiveness between the top and bottom one-third of the sample EG milk producers reflects differences in their abilities to manage dairy market deregulation. Producers in the top one-third category, based on UCR_T , were able to remain competitive and earned positive returns to land despite declining real local producer prices from 1983 to 2002. Milk producers in the bottom one-third category were not competitive over the study period and the differences in relative competitiveness between the top and bottom one-third categories were statistically significant. Real price differences between the two producer categories can be attributed to milk quality differences, milk volume produced and/or locational (dis)advantages and managerial ability. Real cost differences can be attributed to the use of superior or cost reducing technologies and/or size economies.

During the period of dairy market deregulation, the relative competitiveness of sample EG milk producers can be partitioned into two distinct phases, namely: an initial negative phase from 1983 to 1997 and a positive phase from 1998 to 2006. The initial negative phase, during which EG milk producers were not competitive (based on UCR_T), can be attributed to declining real net local prices relative to real total costs over the period 1983

to 1997. Real local net producer prices were initially high in 1983 but declined steadily towards 1997; during this period the net local producer price, P_L , was determined by local milk buyers in conjunction with the Milk Board. The positive phase from 1998 to 2006, during which sample EG milk producers were relatively more competitive (based on UCR_T), can be attributed primarily to declining real total costs and improving real local milk prices. Declining real costs, in response to declining real milk prices from 1983 to 1997, could have been due to the use of superior technologies, cost-reducing feeding regimes (e.g., relative greater use of pastures), and size economies as EG milk producers have expanded their production capacity and herd sizes.

This analysis also shows that although there may be correlation between deregulatory changes in the dairy industry over the study period and changes in the relative competitiveness of EG milk producer, it is difficult to attribute changes in competitiveness at the producer-level exclusively to a macroeconomic change such as market deregulation. The managerial abilities of sample EG milk producers seem to be crucial in determining the impact of deregulation on the relative competitiveness of these producers. Further investigation into other factors affecting EG milk producer competitiveness will be addressed in the next chapter by analysing panel data of EG milk producers. Results of the panel data analysis may also reveal more specific reasons for the improvement in relative competitiveness for the average sample EG milk producer from 1998 to 2006.

CHAPTER 4

FACTORS INFLUENCING THE LONG-TERM COMPETITIVENESS OF SELECTED COMMERCIAL MILK PRODUCERS IN EAST GRIQUALAND: 1990 - 2006

4.1 Introduction

Based on the findings and recommendations of the UCR analysis of the sample EG milk producers from 1983 to 2006, this chapter investigates the influence of policy and other factors on the *long-term* competitiveness of selected EG milk producers (who had continuous physical and financial records) for the period 1990 to 2006. The period 1990 to 2006 was chosen due to insufficient data from 1983 to 1989 and the completeness of records over the period 1990 to 2006. Previous research in the United States (US) suggests that factors such as dairy herd size, milking rate, specialisation in milk production and level of farm debt are important determinants of profitability and hence competitiveness of a dairy enterprise (El-Osta and Johnson, 1998; El-Osta and Morehart, 2000; Short 2000; Gloy *et al.*, 2002). Much of the previous research has not investigated the factors influencing competitiveness *over time*. This analysis aims to update such past research by empirically investigating the factors affecting the *long-term* competitiveness of a panel of EG commercial milk producers. A brief literature review of factors influencing the profitability and competitiveness of a dairy enterprise follows in the next section.

4.2 Factors affecting long-term performance of a dairy enterprise

4.2.1 Production factors

According to Hopps and Maher (2007), the competitiveness of milk production is dictated by numerous factors, the most important of which are the (gross) margin per litre of milk and the total literage (output) of the dairy enterprise. Although the profitability and hence competitiveness of the dairy enterprise are jointly dependent on the quantity of factors of production employed and the methods with which these factors are employed (Gloy *et al.*, 2002; Hopps and Maher, 2007), Slater and Throup (1983:73) stress that the highest returns are made when a good farming system is effectively managed. Further, they suggest that

dairy enterprise gross margin is influenced by two interrelated forces, namely enterprise and system (herd and pasture management) efficiencies. Enterprise efficiency involves the interplay and management of the primary contributors to enterprise income and variable costs, namely milk sales, purchased feed costs and herd maintenance costs. System efficiency relates to the general management of the dairy herd (including young stock) and the effective utilisation of available forages.

Previous research suggests that a strong link between farm size (total number of cows) and dairy enterprise profitability exists (Manchester and Blayney 1997; El-Osta and Johnson, 1998; Gloy *et al.*, 2002;). This linkage is supported by Doll and Orazem (1984:217), Short (2000) and Clark and Langemeier (2007) whose findings suggest that larger farms produce at lower unit cost than smaller farms. Tauer (2001) contends, however, that small, efficiently managed farms may be competitive relative to large farms in terms of their production costs. However, Tauer's analysis ignores the imputed costs of family labour which would reduce the claimed cost advantages of the smaller dairy farms.

Short (2000) found that feed and labour efficiency were positively related to dairy herd (farm) size. Possible reasons for this finding are differences in herd composition, the use of superior genetics, ration composition, intensity of feed management and/or more modern parlour facilities. Using regression analysis, Short (2000) also showed that dairy herd size, production per cow and debt-to-asset (DA) ratio had a significant effect on net farm income (NFI), accounting for 95% of the total variation in NFI.

El-Osta and Johnson (1998) identify factors such as specialization in milk production, economies of size, tax reductions, and off-farm investment for causing farm expansion in the US. Many authors have also noted that, in general, the degree of management skill and technological sophistication increases with the size of a dairy farm businesses (El-Osta and Johnson, 1998; Blignaut 1999; El-Osta and Moehart, 2000). Other production factors that have a significant influence on the profitability of the dairy enterprise are the milking rate (production per cow) (Short, 2000; Gloy *et al.*, 2002), and the type of parlour and record keeping system used (Gloy *et al.*, 2002). The type of parlour, firstly, influences the rate at which cows are milked and, hence, the total number of cows that can be milked, and, secondly, modern parlour types have been designed to meet more stringent hygiene standards which ultimately impact on milk quality attributes. The collection and analysis of

crucial herd production data is more easily achieved by using electronic rather than manual record-keeping systems which means that valuable management time can be spent on more important management tasks. Modern parlours are also able to integrate the design of the parlour with the record-keeping system which can reduce the costs of collecting and analysing production data and free-up management time (Gray, 2009).

4.2.2 Financial, management and risk factors

Diversification is an important risk-management strategy employed by producers to reduce the overall risk in their portfolio of farm enterprises (Hardaker *et al.*, 2004:273). However, in terms of milk production Slater and Throup (1983:24) suggest that, over time, due to technological advancements and a “cost/price squeeze”, milk producers tend to become more specialized towards milk production by eliminating less profitable enterprises. The inference, therefore, is that, over time, milk producers will tend to specialise in milk production to become more competitive. Milk producers are then expected to adopt alternative risk-management strategies. El-Osta and Morehart (2000) suggest that as milk producers in the US became more specialized towards milk production the likelihood of becoming a top producer increased by 23%. The latter statement may seem ambiguous but it should be interpreted as the odds of a producer being in one performance group relative to another.

Financial ratios are commonly used as measures of farm financial management (Van Zyl *et al.*, 1999:77). The debt-to-asset ratio, measuring the proportion of a farm’s assets financed with debt, is a popular measure of farm solvency (El-Osta and Johnson, 1998; Short, 2000; Gloy *et al.*, 2002). Associated with higher levels of debt is an obligation on the part of the producer to pay greater principal and interest. Higher debt may, therefore, lower profitability. El-Osta and Johnson (1998) note that the use of debt is closely related to age of the producer. Older, established producers are less likely to use debt and tend to scale down production while younger producers are more likely to accept relatively greater risk to expand their farm businesses. Both El-Osta and Johnson (1998) and Tauer and Mishra (2006) found that older milk producers were less efficient than younger milk producers and had higher unit costs. Gloy *et al.* (2002) found that human capital factors such as age and education did not significantly affect profitability, while the labour wage rate did have a significant effect.

4.3 Key physical and financial characteristics of the panel of EG milk producers

Data were collected from 11 commercial milk producers from the EG study group who had continuous physical and financial records for the period 1990 to 2006. The sample of 11 producers represents 48% (11/23) of the current group of 23 commercial EG milk producers and is, according to Bischoff (2008), typical of EG milk producers. The total sample size for the panel of EG milk producers is 187 (17 years × 11 milk producers) with 10 observations missing from the dataset.

Some key physical and financial characteristics of this panel of producers is summarised in Table 4.1.

Table 4.1: Mean physical and financial characteristics of panel of EG milk producers, 1990 - 2006

Milk producer characteristics	<u>1990 – 1995</u> n = 63*	<u>1996 – 2001</u> n = 63*	<u>2002 – 2006</u> n = 51*
Real milk price^a (R/litre)	1.52	1.42	1.49
Real costs^{a,b} (R/litre)	1.55	1.40	1.40
Dairy herd size (cows in milk)	143	202	299
Production per cow (Litres per annum)	5180	4882	4585
Enterprise Mix (% contribution to gross farm income)			
Dairy	69	70	79
Beef	10	9	7
Sheep^c	7	3	1
Cash crops	6	10	4
Maize	5	5	7
Other income	3	3	2
Debt-to-asset ratio^d	0.33 (0.38)	0.35 (0.39)	0.32 (0.49)
Pasture and forage feed cost to total feed cost (TFC) (% of TFC)	39%	43%	48%
Trading income^e to total income (% of total milk income)	13%	10%	11%

Source: Bischoff (2008)

* periods 1990-1995 and 1996-2001 consist of 6 years of data while period 2002-2006 has 5 years of data.

a. Prices measured in Rands (2000=100)

b. Total real costs include an opportunity cost of management at 5% of milk turnover (following Calkins and Dipietre 1983:117).

c. The sheep enterprise includes income from the sale of wool.

d. Range of debt-to-asset ratio shown in parentheses

e. Trading income = (livestock sales + herd closing value) – (livestock purchases + herd opening value)

Table 4.1 shows that the real milk price and real total costs per litre of milk for the sample of EG milk producers have declined marginally over time. Under conditions of declining producer prices, the pressure on a relatively small firm to expand is great if size economies exist (Doll and Orazem, 1984:215).

Although these producers have expanded the size of their dairy enterprises over the study period from a mean of 143 to 299 cows in milk, Bischoff (2008) contends that water availability (rather than farm area) has constrained further expansion of EG dairy enterprises (Bischoff, 2008). The decline in mean milk production per cow may be attributed to the substitution of pasture and forages for purchased feeds (to reduce total feed costs) as shown by the increasing ratio of pasture and forage costs to total feed costs for the sample of EG milk producers over the study period.

Cross-breeding has also played a role in lowering production per cow over the study period due to smaller, more mobile type cattle being favoured over larger, heavier animals which also have higher feed requirements (Bischoff, 2008). Although milk production per cow is lower when smaller animals are used, production per unit area is greater as the producer is able to increase the stocking rate on pasture. However, increased productivity per unit area reaches a critical threshold, which depends on the pasture and animals, past which productivity declines (Jones and Sandland, 1974). Approximately five of the 11 (45%) EG milk producers practice cross-breeding to some extent while the remaining six producers have herds of mixed breed or purebred (Holstein or Jersey) cattle.

In general, a milk producer needs to consider several factors before deciding on an appropriate husbandry practice to implement. These are: (1) the relative prices of inputs such as purchased feeds and fertiliser, (2) the viability of expanding the pasture area, and (3) the pricing policy of the milk buyer and premiums offered (quality, volume/distance). None of the 11 EG milk producers are registered dairy cattle breeders and, therefore, trading income reflects mainly the sale of bull calves and cull cows (Bischoff, 2008).

The mean debt-to-asset ratio fluctuated marginally over the study period. Relatively higher average debt use during the 1996 to 2001 period may have been used to fund enterprise expansion over this period. The range in debt-to-asset ratio, however, suggests that although during the 2002 to 2006 period EG milk producers on average made use of less

debt, a number producers made greater use of debt. Bischoff (2008) notes that most of the expansion in dairy enterprise size took place in the past five years. The debt-to-asset ratio in periods 1990 to 1995, 1996 to 2001 and 2002 to 2006 had ranges of 0.38, 0.39 and 0.49 respectively. The enterprise mix shows that the sample of farmers are somewhat diversified, although specialisation in milk production has increased with milk income increasing from 69% to 79% of gross farm income over the study period. Diversification is a common risk management strategy in EG due in part to large farm sizes and existing output-specific facilities, e.g. sheep and cattle handling facilities which may be a vestige of previous generations (Bischoff, 2008). The proportion of trading income to total milk income has declined marginally over the study period.

4.4 Panel data regression analysis

4.4.1 Theoretical model

Panel data regression analysis differs from conventional time series and cross-section regression analyses in that time series as well as cross-section dimensions are incorporated into the model's structure (Baltagi, 2005:11; Gujarati, 2003:636). There is substantial debate on the suitability of either a random or fixed effects model to a panel data set. Baltagi (2005:12) notes that a fixed effects model is an appropriate specification if the focus is on a specific set of N firms and inference is limited to the behaviour of these firms. Baltagi (2005:12) notes further that the random effects specification is appropriate if N individuals are randomly drawn from a large population as in the case of household studies. Since this study examines firm-specific effects, a fixed effects specification is considered the most appropriate. Equation (4.1) shows the general form of a fixed effects regression model:

$$Y_{it} = \alpha_1 + \alpha_k D_{ki} + \beta_l X_{lit} + \mu_{it} \quad (4.1)$$

Where i denotes individual milk producers, t denotes time, α_1 represents the intercept of the base category producer, α_k is the differential intercept coefficient indicating the difference between α_1 and the intercept estimates for the other milk producers ($k = 2, \dots, 11$ milk producers), D_{ki} are differential intercept dummy variables used to account for the 'individuality' of each producer, β_l is the coefficient of explanatory variable X_l ($l = 1, \dots, 7$

explanatory variables), and μ_{it} is the error term. If the researcher wants to analyse for statistically significant differences between firms or individuals, the fixed effects regression model can be easily modified by using differential intercept dummies to take into account the ‘individuality’ of each firm or individual. The fixed effects model can then be referred to as a least-squares dummy variable (LSDV) model (Gujarati, 2003:642).

According to Baltagi (2005:4-9), panel data have several advantages over purely time-series or cross-section data. Firstly, panel data suggests that heterogeneity exists amongst individuals, firms, industries or countries. Not controlling for this heterogeneity, as is the case in purely time series and cross-section data, may lead to biased results. Secondly, panel data can give more information, greater variability, less collinearity among variables, more degrees of freedom and lower standard errors of the estimated coefficients (efficiency). Thirdly, because panel data take into account changes in the characteristics of individuals over time, they are better able to analyse the dynamics of adjustment. Finally, panel data are better able to identify and measure effects not observed in purely time-series and/or cross-section data.

4.4.2 Selection of variables used in the panel data regression model

(i) Unit Cost Ratio (UCR_{it})

Variables that were considered in the fixed effects panel regression models are presented and defined in Table 4.2 overleaf. Following Siggel and Cockburn (1995) and Siggel (2006), a microeconomic method, the UCR, is used to measure competitiveness at the milk producer level in this study (dependent variable). The UCR methodology has been adapted and simplified in this study and is the ratio of total dairy enterprise costs to total dairy enterprise revenue for a milk producer. An opportunity cost of management, calculated at 5% of total milk revenue for producer i at time t , following Calkins and Dipietre (1983:117), was added to total accounting costs. The UCR_{it} indicator (based on local price plus trading income, P_T) is interpreted as follows: a score of >1 indicates that producer i earned negative rents (returns to land) at time t and was *not competitive* (total costs $>$ total revenue). A score of <1 indicates that producer i earned positive rents at time t and was *competitive* (total costs $<$ total revenue).

(ii) Natural logarithm of number of cows ($LNCOWS_{it}$)

El-Osta and Johnson (1998), El-Osta and Morehart (2000), Short (2000) and Gloy *et al.* (2002) have used dairy herd size as a measure of dairy farm size. For the purposes of this study, the natural logarithm of size, $LNCOWS_{it}$ was used. The effect of this transformation is to normalise the size distribution by compressing the upper tail of the distribution whilst expanding the lower tail (Havemann, 1993). *Ceteris paribus*, a unitary change in the dairy herd size for a small milk producer will have a greater impact on competitiveness than for a large milk producer. Because dairy herd size could be positively related to profitability, it is hypothesised that there will be a negative relationship between farm size and UCR_{it} . Therefore, as dairy herd size increases UCR_{it} is expected to decrease, *ceteris paribus*, indicating an improvement in competitiveness.

Table 4.2: Definition of variables used in fixed effects regression models

Variables	Definition	Expected sign of β/a coefficients
UCR_{it}	Unit Cost Ratio: Measure of milk producer competitiveness (dependent variable).	
$LNCOWS_{it}$	Dairy herd size (number of cows-in-milk).	-
$PRODCOW_{it}$	Production per cow (litres per annum).	-
$SPECIALISE_{it}$	Specialisation index (proportion of gross farm income made up of milk income).	-
$TRADINC_{it}$	Ratio of trading income to total milk income.	-
$PASCOST_{it}$	Ratio of pasture and forage costs to total feed costs.	-
$DEBTASSET_{it}$	Solvency ratio (farm assets financed by debt capital).	+
$YEAR_t$	Trend variable	-
D_i	Differential intercept dummies accounting for differences between milk producers.	+/-

(iii) Milk production per cow ($PRODCOW_{it}$)

El-Osta and Johnson (1998), Short (2000) and Gloy *et al.* (2002), have found that milking rate (production per cow) is significantly related to farm profitability. Although in the long run responses to changes in milk prices are brought about by increasing/decreasing herd

size (Chavas and Klemme, 1986), the productivity of dairy cattle is still considered to be an important factor contributing to the profitability of the dairy enterprise. According to Gloy *et al.* (2002), milking rate (production per cow) is assumed to contain latent characteristics of the milk producer's knowledge, experience, husbandry policy and feeding practices. It is hypothesised, therefore, that a higher milk production per cow, $PROD_{it}$, will enhance milk producer competitiveness and therefore lower UCR_{it} , *ceteris paribus*.

(iv) *Specialisation in milk production (SPECIALISE_{it})*

The specialisation index, $SPECIALISE_{it}$, was used in preference to more complex measures of diversification such as the Herfindahl Index¹¹. The specialisation index used in this study is defined as the ratio of total milk enterprise income to gross farm income. As a producer reaches complete specialisation in milk production, the specialisation index, therefore, tends towards one. A similar index was used by El-Osta and Morehart (2000). Since previous research has shown that greater specialisation in dairy farming is positively correlated to enterprise profitability (El-Osta and Johnson, 1998; El-Osta and Morehart, 2000; Short, 2000), it is hypothesised that as a milk producer tends towards specialisation in milk production, competitiveness improves (UCR_{it} declines), *ceteris paribus*.

(v) *Trading income as a ratio of total milk income received (TRADINC_{it})*

Chavas and Klemme (1986) note that the capital value of dairy animals is influenced by milk prices, total feed costs, slaughter prices and animal age. Dairy cows are generally culled due to low milk productivity and/or reproduction problems that lower their breeding and/or milk producing value relative to their slaughter value. According to Broom (2008) and Bischoff (2008), dairy enterprise trading income, $TRADINC_{it}$, is an important contributor to the overall profitability of the dairy enterprise. Richards and Jeffery (1997) suggest that milk producers also have an incentive to cull older cows if they are expanding their overall herd size. This is because a slower rate of herd adjustment may slow the rate of the herd's genetic progress, ultimately resulting in slower productivity growth and a loss

¹¹ $D = \sum_{i=1}^n p_i^2$ where D = diversification index and p_i = the proportion of income contributed by the i th enterprise to the total farm income (Pope and Prescott, 1990).

of competitive advantage relative to other milk producers. Milk producers with a higher ratio of trading income to total milk income could, therefore, be considered to be *more competitive* than milk producers with a lower ratio, *ceteris paribus*.

(vi) *Forage costs as a proportion of total feed costs (PASCOST_{it})*

The PASCOST_{it} variable measures the ratio of forage and pasture costs to total feed costs. According to Standard Bank (2007), between 60% and 80% of a milk producer's total cost comprises feed costs. Studies by Hanson *et al.* (1998) have shown that milk producers in the US have tended towards a New Zealand style pasture milk production system to try and lower feed costs and improve enterprise profitability. In recent years many SA producers have also followed the New Zealand pasture-based system (Bischoff, 2008). Therefore, in this study it is hypothesised that, due to the incentive to lower feed costs, EG milk producers will tend to rely less on purchased feeds and more on pastures and forage, given the availability of land and water, to enhance competitiveness in the long-term. A higher ratio of pasture costs to total feed costs is expected to improve competitiveness (UCR_{it} declines), *ceteris paribus*.

(vii) *Farm solvency ratio (DEBTASSET_{it})*

DEBTASSET_{it}, a measure of farm solvency, was also included in the model. Data on debt levels attributable exclusively to the dairy enterprise were not available and, therefore, the farm business debt-to-asset ratio was used. The use of debt has been shown by previous research to negatively affect profitability as by using debt the producer is obligated to pay more interest (and capital) (El-Osta and Johnson, 1998; Short, 2000; Gloy *et al.*, 2002). Therefore, as debt use increases, competitiveness is expected to decline (UCR_{it} increases), *ceteris paribus*.

Gloy *et al.* (2002) suggests that the debt-to-asset ratio would be an *endogenous* variable in a profitability model, i.e. that a two-way relationship between the debt-to-asset ratio and competitiveness (UCR_{it}) exists. If a two-way relationship exists, estimation using OLS will result in biased, inefficient parameter estimates due to correlation between the dependent variable and the stochastic disturbance (error) term. Gloy *et al.* (2002) postulate that a reason a two-way relationship between farm debt and profitability may exist is that

expansion of a dairy enterprise, to increase profitability, may require greater use of debt. For the purposes of this study, the possibility of $DEBTASSET_{it}$ being an endogenous variable was not taken into account as, firstly, the debt-to-asset ratio used reflects overall farm business debt and, therefore, debt attributable to other enterprises is also included. Secondly, milk producers may also utilise liquid assets as an alternative to using more debt. For example, a milk producer may consider reducing the herd's culling rate in the short-run to expand herd size. Thirdly, according to Bischoff (2008), most EG milk producers have utilised more debt to invest in capital intensive technologies (parlours, milking equipment, etc.) only in the latter part of the study period (2002 – 2006).

(viii) Trend variable ($YEAR_t$)

A trend variable, $YEAR_t$, is used as a proxy for technology and policy changes over the study period. New technologies, such as herringbone or rotary milking parlours, Artificial Insemination (AI) practices and dairy animal genetics, are continuously being improved and are expected to raise productivity and lower unit costs (El-Osta and Morehart, 2000) thereby improving competitiveness. Since institutions play a crucial role in either enhancing or constraining the competitiveness of firms, sectors and industries within a nation's economy (Porter, 2005:43), $YEAR_t$ is also expected to capture deregulatory changes over the study period. To remain profitable, EG milk producers are expected to adapt to this change. The expected sign of the coefficient for $YEAR_t$ is negative as technological change enhances competitiveness.

(ix) Differential intercept dummy variables ($D_{2i} \dots D_{11i}$)

Ten differential intercept dummy variables, D_i , were added to the model to avoid the dummy variable trap (11 producers). These individual milk producer dummy variables were added on the basis of a restricted F -test (Appendix C) which suggested that management factors such as husbandry policy, parlour type, record keeping system and the breed of cow used may differ between EG milk producers. According to Gujarati (2003:642), selection of the base category individual is at the discretion of the researcher. The base category milk producer chosen had the largest dairy herd size (1472 cows in milk) in 2006 and was chosen so that differences between milk producers could be better highlighted.

4.5 Ridge regression

Initial results for the panel data regression analysis revealed evidence of multicollinearity between the dairy herd size variable, $LNCOWS_{it}$, and the individual milk producer dummies. The term multicollinearity refers to a linear relationship between the explanatory variables in a regression model (Gujarati, 2003:342). Regression coefficients estimated in the presence of multicollinearity have large standard errors and cannot be estimated reliably or precisely and will cause the researcher to make erroneous inferences on the relative effects of the explanatory variables on the dependent variable (Zhang and Ibrahim, 2005). According to Gujarati (2003:362), a Variance Inflation Factor (VIF) that exceeds 10 is a positive indication of collinearity between explanatory variables. When testing for multicollinearity VIF values as well as zero order correlations between explanatory variables should be used.

Ridge regression is one of a host of remedial measures used to overcome multicollinearity. Ridge regression is a modification of OLS regression that introduces a small bias into the regression model so that the estimated coefficients have a greater probability of estimating their true parameters (Neter *et al.*, 1990:412). The biasing constant, c , is estimated subjectively from a simultaneous plot of standardised regression coefficients known as a *ridge trace*. Values of c vary between 0 and 1. As c is increased, values of the estimated coefficients fluctuate greatly until a point where these fluctuations decline in magnitude. The lowest value of c for which the regression coefficients become stable is the biasing constant used in the ridge regression model. The biasing constant, c , in this study was 0.75.

4.6 Multiple imputation

Due to problems with data availability 10 of the 187 total observations (17 years x 11 milk producers) were missing. Therefore, two separate regression models were estimated; an imputed and unbalanced¹² model. Missing data is a common problem in economic research (Baltagi, 2005:165). Single imputation or the filling in of missing observations is the simplest and most naive method of completing a dataset. One of the major flaws with

¹² A panel dataset is referred to as unbalanced when the number of observations differs between panel members (Gujarati, 2003:640).

single imputation, however, is that it does not take into account the extra variability created by missing observations, causing inferences on the imputed dataset to be too sharp (Rubin, 1987:13).

To estimate the missing observations, this study used Multiple Imputation (MI) and Markov Chain Monte Carlo (MCMC) methods in the EG milk producer dataset. For each missing observation m values are imputed to create m complete datasets; in this case $m = 20$. Imputations, to replace missing values, are then randomly drawn from the imputed datasets whose distribution corresponds to the distribution of the original data (assumed to be normal in this analysis). Because only 5.3% of the dataset is missing, significant differences between the imputed and unbalanced ridge regression models are not expected. (For a full discussion on MI and MCMC, please see Rubin (1987) and Gilks *et al.*, (1996)). The imputed and unbalanced regression models were estimated using the SAS Version 9.1 Statistical Package for Windows (SAS, 2003).

4.7 Results of the Ridge regression analysis

The results for the fixed effects model with imputed observations for the panel of EG milk producers is presented in Table 4.3 overleaf. Results of the fixed effects model for the unbalanced panel dataset are shown in Appendix D. The overall fit of the model was statistically significant with an F -statistic of 13.7. The R^2 value of 0.58, indicating that 58% of the variation in UCR_{it} was explained by the explanatory variables, is comparable to similar studies on dairy enterprise profitability and milk producer competitiveness. The estimated coefficient for dairy herd size, $LNCOWS_{it}$, had the expected negative sign which supports *a priori* expectations that the size of the dairy enterprise influences competitiveness in the long-term. This finding provides evidence of returns to size on EG dairy farms. The gain in competitiveness from increasing herd size, however, will tend to be greater per unit increase for smaller rather than larger producers, *ceteris paribus*.

Table 4.3: Results of a fixed effects Ridge regression model for a panel of EG milk producers, including imputed observations, 1990 – 2006 (n=187)

Parameter	β -coefficient	Standardised coefficient	Std error	t - statistic
LNCOWS	-0.0352	-0.182	0.0527	-6.68***
PASCOST	-0.0264	-0.0408	0.0189	-1.40
TRADINC	-0.198	-0.0902	0.0678	-2.93***
SPECIALISE	1.60×10^{-3}	2.60×10^{-4}	0.0152	0.105
PRODCOW	-1.64×10^{-5}	-0.133	3.45×10^{-6}	-4.75***
YEAR	-2.73×10^{-3}	-0.122	6.54×10^{-4}	-4.17***
DEBTASSET	1.90×10^{-3}	0.171	3.09×10^{-4}	6.15***
	α-coefficient			
Base category	1.235		0.0394	31.3***
D₂	-0.0231	-0.0610	0.0107	-2.16**
D₃	-0.0347	-0.0916	0.0109	-3.18***
D₄	0.0282	0.0744	0.0110	2.56***
D₅	0.0126	0.0332	0.0112	1.12
D₆	0.0153	0.0404	0.0114	1.34
D₇	3.64×10^{-4}	9.61×10^{-4}	0.0107	0.0340
D₈	0.0575	0.152	0.0107	5.37***
D₉	-0.0248	-0.0655	0.0109	-2.28**
D₁₀	0.0246	0.0649	0.0107	2.30**
D₁₁	-0.0175	-0.0462	0.0984	-1.78*
	$R^2 = 0.58$		Adjusted $R^2 = 0.54$	df = 169
	F - statistic = 13.7***		$d = 2.29$	

Note: *, **, *** denote significance at the 10%, 5% and 1% levels, respectively

- LNCOWS = natural logarithm of number of cows
- PASCOST = ratio of pasture and forage costs to total feed costs
- TRADINC = ratio of trading income to total milk income
- SPECIALISE = ratio of milk income to gross farm income
- PRODCOW = production per cow
- DEBTASSET = debt/asset ratio
- YEAR = Trend variable
- D₂...D₁₁ = Differential intercept dummy variables.

The estimated coefficient of $PASCOST_{it}$ had the expected sign but was not a statistically significant determinant of long-term competitiveness for the 11 EG milk producers. The non-significant coefficient of this variable may indicate that pasture-based dairy farming is already an established method of production among the 11 milk producers, suggesting that there is little variation in this variable in the data. Another possible explanation is that many EG milk producers are unable to utilise more pasture due to constraints such as farm size, suitability of soil type to pasture and water availability. The negative sign of the estimated coefficient suggests, however, that an increased utilisation of forage and pasture enhances competitiveness. The coefficient estimate of $TRADINC_{it}$, is statistically significant and has the expected sign, supporting *a priori* expectations that trading income affects the overall profitability of the EG dairy enterprise.

The coefficient estimate of $SPECIALISE_{it}$, a measure of specialisation in milk production, did not have the expected sign and was not statistically significant. A possible explanation for this can be found in research by Beca (2005), who analysed the variation in profitability of average and top milk producers in South Africa, New Zealand and Australia. He found that costs of production for SA milk producers are higher than in New Zealand and Australia. High costs of production coupled with higher interest rates in South Africa relative to New Zealand and Australia suggests that SA milk producers face significantly higher financial risk. Diversification is an important risk management strategy for EG milk producers, as shown in Table 4.1, and although over the study period 1990 to 2006 the contribution of milk income to gross farm income increased from 69% to 79%, the benefits of diversification may outweigh those of specialisation in EG.

The coefficient estimate of $PRODCOW_{it}$ had the expected negative sign and was statistically significant. Bischoff (2008) suggests that concentrates (purchased feeds) are essential to maintaining high milk yields but that a feeding regime incorporating high levels of purchased feed can also raise production costs. The price premiums offered by milk buyers (based on quality, volume and proximity from the milk buyer's depot) may play a crucial role in determining which feeding and husbandry regime EG producers adopt. For example, a higher milk price may warrant additional feeding in the short-run, i.e. the profit maximizing level of output may shift (to where marginal cost equals marginal revenue) (Doll and Orazem, 1983:66). Regardless of which feeding and husbandry regimes

are implemented, however, high producing dairy cattle have a positive influence on the long-term competitiveness of these producers, *ceteris paribus*.

The coefficient estimate of $YEAR_t$ was statistically significant and had the expected negative sign, showing that the competitiveness of these producers has been improving over time. Possible reasons for this positive trend are: (1) consolidation of the dairy enterprise enabling these farmers to produce higher milk volumes and capture economies of size; (2) improved production techniques such as superior irrigation methods and improvements to milking parlours; and (3) greater focus on dairy enterprise management by these milk producers. $YEAR_t$ was also a proxy for policy change (deregulation) over the study period. The statistical significance and expected negative sign of the estimated coefficient suggests that some of the sample EG milk producers have adapted favourably to policy change over the study period. The results indicate that these producers have become more efficient (produce at lower cost) and have adopted strategies that enhance their competitiveness in a deregulated dairy market.

The coefficient estimate of $DEBTASSET_{it}$ was statistically significant and shows that the level of farm debt negatively influences competitiveness of the sample EG milk producers in the long-term. The positive sign of the estimated coefficient of $DEBTASSET_{it}$ shows that as farm debt levels increase, competitiveness declines. This decline can be attributed to an obligation on the part of the producer to pay higher levels of principal and interest associated with increased indebtedness. This finding is consistent with those of other studies on the financial performance of dairy farm businesses but may be misleading in the context of EG milk producers. This is because the debt-to-asset ratio used reflects the debt level of the entire farm business and, hence, the influence of debt on profitability or competitiveness of the dairy enterprise may be overstated.

The standardised coefficients, which show the relative contribution of each explanatory variable to the explanation of the dependent variable (UCR_{it}), indicate that $LNCOWS_{it}$, $DEBTASSET_{it}$, and $PRODCOW_{it}$, contribute relatively more to the explanation of UCR_{it} than do $YEAR_t$ and $TRADINC_{it}$. This finding is consistent with other studies that dairy enterprise size and debt-to-asset ratio (El-Osta and Johnson, 1998; Short, 2000), and production per cow (Short, 2000; Gloy *et al.*, 2002) are important determinants of the profitability of US dairy farms.

4.8 Differences between milk producers

The inclusion of individual milk producer dummy variables, on the basis of a restricted F -test, improved the overall significance and fit of the model. The coefficient estimates of D_2 , D_3 , D_4 , D_8 , D_9 , D_{10} and D_{11} are statistically significant. The negative signs of the estimated coefficients of D_2 , D_3 , D_9 and D_{11} and positive signs of the estimated coefficients of D_4 , D_8 and D_{10} indicate that these producers were significantly *more* and *less* competitive than the base category producer, respectively. The differences in competitiveness between these milk producers and the base category may be due mainly to differences in management experience and ability.

4.9 Discussion

Results of the Ridge regression show that size of the dairy enterprise, the debt level of the farm business, production per cow, technological and policy changes, and the ratio of trading income to total milk income influence the long-term competitiveness of milk producers in EG. The findings are consistent with those of similar studies.

The importance of dairy herd size suggests that economies of size exist on the sample EG dairy farms. The study also found that while pasture based production systems were not a statistically significant determinant of the long-term competitiveness of EG milk producers over the study period, pasture-based systems can enhance competitiveness by lowering real total costs per litre. The finding that dairy trading income contributed significantly to the overall profitability of the dairy enterprise was important as during times of relatively low milk prices, milk producers generally can fall back on the 'beef' value of their cull cows to survive in the short-term. Specialisation in milk production was not a statistically significant determinant of the long-term competitiveness of EG milk producers. A possible reason is that relative to other countries, SA milk producers face higher financial risk and, therefore, have an incentive to adopt appropriate risk-management strategies. With regard to the 11 EG milk producers, relatively large farm sizes may encourage enterprise diversification and, therefore, complete specialisation in milk production may be less likely in EG. Of course, the decision to diversify or specialise in the long-term depends on the particular risk preferences of each EG milk producer.

The level of farm debt was found to be an important financial factor influencing the long-term competitiveness of milk producers in EG. With an increase in indebtedness comes an obligation to pay higher levels of interest (and principal) which may reduce competitiveness. The importance of debt in the context of milk production in EG may be overstated, however, due to the use of the overall farm business debt-to-asset ratio in the Ridge regression model. Milk production per cow, a proxy for managerial ability in previous studies, was a statistically significant determinant of the long-term competitiveness of EG milk producers. Technological change over the study period, such as improvements in AI practice, parlour design and irrigation methods, also influence competitiveness of EG milk producers in the long-term. These producers have responded to policy and technological changes over the study period by increasing dairy herd size, substituting pasture for purchased feed, and many have used cross-breeding to increase milk output per unit area rather than production per livestock unit.

CONCLUSIONS AND POLICY IMPLICATIONS

This study used two competitiveness analyses to investigate the changes in, and factors affecting, the long-term competitiveness of a group of commercial milk producers from East Griqualand (EG). Competitiveness in this study is defined as the ability of a milk producer to achieve sustainable *business* growth while earning at least the opportunity cost of management. Using a microeconomic method of competitiveness analysis, the Unit Cost Ratio (UCR) method, the study, firstly, investigated the impact of deregulation on the competitiveness of sample EG milk producers over the period 1983 to 2006.

The UCR analysis suggested that sample EG milk producers were not competitive based on the local price received for milk over the study period but relative competitiveness improved when dairy cattle trading income was included. This suggests that trading income plays an important role in contributing to the overall competitiveness of the sample EG dairy enterprise. The UCR analysis also showed that over the study period, during which the dairy industry was gradually deregulated, sample EG milk producers generally responded to declining real producer prices by reducing real costs of milk production per litre. Reductions in real total costs per litre may have been facilitated by: (1) expansion of dairy enterprise size, (2) the shift from high to low cost production systems (such as pasture systems), and (3) technological improvements over the study period.

The response by sample EG milk producers to deregulation is consistent with evidence from national milk producer trends which indicate that the number of SA commercial milk producers has declined while milk output per producer has increased. Although sample EG producers were not competitive based on the local price received for milk, they were more competitive relative to the average SA milk producer as sample EG producers received higher local prices than the national average over the study period. There was also a statistically significant difference in the effects of, and response to, deregulation by producers in the top- and bottom-one third of the EG study group milk producers. Producers in the top one-third category, generally, received higher product prices and produced milk at lower real cost than producers in the bottom one-third category. Real cost advantages may have been due to the use of superior/cost-reducing technologies and/or size economies. Study results also suggest that, although correlation between deregulatory

(institutional) changes in the SA dairy industry and changes in the relative competitiveness of a panel of milk producers from EG exists, it is difficult to attribute changes in relative competitiveness exclusively to institutional change. Based on the findings of the UCR analysis a further investigation into other factors influencing the competitiveness of EG milk producers was needed.

The second competitiveness analysis used Ridge regression to investigate factors influencing the competitiveness of 11 selected commercial EG milk producers for the period 1990 to 2006. The results of this analysis found that size of the dairy enterprise, the level of farm debt relative to assets, production per cow, technological and policy changes, and the ratio of trading income to total milk income influenced the long-term competitiveness of these sample EG milk producers. The findings were consistent with those of other international studies on factors affecting the profitability of a dairy enterprise.

The importance of dairy herd size suggests that economies of size exist on the sample of EG dairy farms. While the ratio of pasture and forage costs to total feed costs was not a statistically significant determinant of the long-term competitiveness of sample EG milk producers over the study period (due possibly to a lack of variation in this variable), pasture-based systems can enhance competitiveness by lowering real total costs per litre. The finding that dairy trading income contributed significantly to the overall profitability of the EG dairy enterprise was important as during times of relatively low milk prices, milk producers can fall back on the slaughter value of their cull cows to survive in the short-run. Contrary to the findings in other studies, specialisation in milk production was found not to be a statistically significant determinant of the long-term competitiveness of sample EG milk producers in this analysis. A possible reason for this is that, relative to milk producers in other countries, SA milk producers face higher costs of production and interest rates and, therefore, are subject to greater risk. Diversification is a commonly practiced risk management strategy for sample EG milk producers due to relatively large farm sizes and, therefore, complete specialisation in milk production is unlikely. This variable may also have lacked variation.

The level of farm debt relative to assets was found to be an important financial factor influencing the long-term competitiveness of the panel of milk producers in EG. With an

increase in indebtedness comes an obligation to pay higher levels of interest (and principal) which reduces competitiveness. The importance of debt in the context of sample EG milk producers may be overstated, however, due to the use of the overall farm business debt-to-asset ratio. Milk production per cow, a proxy for managerial ability in previous studies, was a statistically significant determinant of long-term competitiveness for the selected EG milk producers. Technological change over the study period, such as improvements in herd genetics and AI practice, parlour design and irrigation methods, also influence competitiveness of sample EG milk producers in the long-term. The response to policy change, captured by a proxy (trend) variable, was also shown to positively influence the competitiveness of EG milk producers in the long-term. To enhance competitiveness in a deregulated environment, profitable sample EG milk producers should consider increasing their dairy herd sizes, utilise more pasture and forage based production systems and select dairy cattle of superior genetic merit that produce high milk yields on pasture. The availability of sufficient data prior to 1990 was a particular problem in this analysis. Missing values for the 1990 to 2006 study period were accounted for using MI and MCMC methods and these were shown to be viable methods of accounting for the missing observations in the sample of EG milk producers.

The study results can also be used to assess the perception amongst many SA milk producers that the current marketing arrangements for milk, following dairy market deregulation, have negatively affected the profitability of their dairy enterprises. From the findings of previous research and of this study, the net effect of deregulation over the study period on the profitability and competitiveness of sample EG milk producers manifests itself in the response of these producers to that change. Therefore, the impact of policy reforms on agricultural producers should not merely be assessed in terms of positive and negative effects on producers, but should also be assessed in terms of the production and management responses by producers in the long-term. Milk producers in the EG sample have, generally, responded to reduced real milk prices, following deregulation, by increasing dairy herd size, substituting pastures and forages for purchased feed, and many use cross-breeding to optimise milk output per unit area rather than production per livestock unit. The statistically significant differences between milk producers in the top and bottom one-third categories of the panel group suggest that, *ceteris paribus*, producers in the top one-third category are more profitable because they have been better able to deal with the changes in their competitive environment as a result of dairy market deregulation.

Policy recommendations that can be made, based on the findings of this study, are that the SA government should continue contributing funding towards research and development, veterinary services and to the maintenance of adequate milk quality standards in the dairy industry. Pitfalls of government intervention in agriculture have been well documented and findings in this study support proportional reward for efficient and competitive agricultural producers and the competitive market process which exposes inefficiencies. However, increased imports of milk and other dairy products from countries subsidizing exports could pose a threat to domestic milk producers and government should, therefore, review its tariff policy for imported milk and dairy products as South Africa has one of the world's lowest tariff rates for milk and dairy products.

Since dairy market deregulation, SA and sample EG milk producers face numerous challenges such as fluctuating producer and input prices, increased imports, land reform, the introduction of land taxes and the possible passing of a land expropriation act. These challenges necessitate that SA milk producers, generally, need to become more perceptive and responsive to future economic and policy changes by adapting their management styles and production systems. More effective collaboration between producers and other stakeholders in the dairy supply chain is one strategy that producers may adopt to increase their bargaining power in the dairy marketplace.

The development of South Africa's emerging milk producers also needs consideration and it should be recognised that the needs of these producers differ from those of large commercial milk producers. For example, emerging milk producers often lack the capital resources and practical and financial management expertise required to become successful milk producers. To aid in developing a viable emerging milk producer sector, government and other role-players in the SA dairy industry, such as the Department of Agriculture (DOA) and the Milk Producer's Organisation (MPO), should consider providing the necessary capital, extension and training to emerging milk producers. Policymakers should also note, however, that the development of successful emerging milk producers under challenging circumstances is a long-term process and, therefore, a long-term planning horizon should be adopted.

This study addressed some gaps in previous local research on the impacts of deregulation in the SA dairy industry, with particular regard to the industry's primary sector. Study results can also be used by milk producers, consultants advising milk producers, organisations such as the MPO, the NAMC and the DOA to better understand the determinants of long-term profitability and competitiveness at the producer level. The SA dairy industry's important role-players, both private and government, should address the need for greater research into the industry and, in particular, the industry's primary sector. Relevant aggregate and detailed milk producer data are currently not available and this should be rectified by the SA milk industry to promote further research in the industry. Funds for future research could possibly be raised from a small levy payable by milk producers to an organisation such as the MPO who could direct funds to researchers.

Areas for further research include extending the analysis to investigate the determinants of milk producer competitiveness in other major milk producing regions such as the Eastern Cape and Western Cape. The inclusion of human capital and management factors (such as age, education and experience) may also add value to future research. These factors were omitted in this study due to the length of the study period as it was assumed that milk producers would not be able to give reliable estimates of decisions they made more than 10 years ago. Further analysis should also investigate the specific management responses to an institutional change over time so that a better understanding of how market deregulation affects management responses can be gained. It is also important to understand what management strategies agricultural producers adopt to manage the challenges brought about by institutional change so that policymakers and other role-players are informed about potential implications of policy decisions at the producer level.

SUMMARY

Government intervention in the SA dairy industry (and in agriculture as a whole) began amid turbulent and difficult economic conditions in the early 20th century. Proponents of control argued that the unique production and marketing features of milk and dairy products necessitated regulation and control in the dairy industry. Restrictions on the competitive market process in the SA dairy industry, imposed by regulation under the Marketing Acts of 1937 (Act 27 of 1937) and 1968 (Act 59 of 1968), altered the competitive dynamics of the SA dairy industry, resulting in higher prices to consumers, the development and proliferation of an oligopsonistic market structure, and a largely inefficient primary sector (producing at a relatively high cost). Failing to meet its objectives, the Marketing Act of 1968 (Act 59 of 1968) was abolished in 1996 and a new Act, the Marketing of Agricultural Products Act of 1996 (Act 47 of 1996), was promulgated. Although deregulation of the dairy industry was initiated in 1971 the process was officially completed with the promulgation of the new Act in 1996. Previous local research found that the effects of deregulation on SA milk producers included reduced profit margins, loss of market share for fresh milk and other dairy products, expansion and consolidation of SA dairy farms, and a shift in milk production from inland to coastal regions. Associated with deregulation, however, was also some evidence of an improvement in the technical efficiency of the primary sector in KZN.

For the purposes of this study, individual milk producer data were collected from the East Griqualand (EG) milk producer study group for the period 1983 to 2006. Data collected comprised detailed production and financial records for each milk producer member of the study group. The EG study group was established in 1983 and its objective is to improve the production and financial performance of its members. The current size of the study group is 23 commercial milk producers. East Griqualand is located on the eastern seaboard of South Africa and is characterised by relatively high summer rainfall and sourveld grazing conditions. Milk production systems in EG are predominantly pasture-based with varying rates of purchased feed (concentrates) also utilised.

Based on a definition by Esterhuizen (2006:89), competitiveness in this study is defined as the ability of a milk producer to achieve sustainable *business* growth while earning at least

the opportunity cost of management. Thus, a producer is competitive if positive land rents (returns to land) are earned. A microeconomic indicator of competitiveness, the Unit Cost Ratio (UCR), developed by Siggel and Cockburn (1995), is used to measure the long-term competitiveness of EG milk producers. The Unit Cost Ratio is defined as the ratio of total dairy enterprise costs (accounting costs plus an opportunity cost of management calculated at 5% of milk income) to total dairy enterprise income. This ratio can also be considered as a measure of enterprise profitability.

The objectives of this study were, firstly, using a UCR analysis, to investigate the impact of dairy market deregulation on the competitiveness of the group of EG commercial milk producers over the period 1983 to 2006. Based on the findings of the UCR analysis, a second study objective was to investigate the influence of other important factors on competitiveness of a panel of selected commercial EG milk producers over the period 1990 to 2006 using Ridge regression. Ridge regression was used due to multicollinearity between the explanatory variables. Eleven milk producers were selected on the basis of the completeness of their financial and production records in this analysis.

The first UCR analysis found that, based on the local price received for milk, EG milk producers were not competitive over the period 1983 to 2006. When dairy cattle trading income was included, however, relative competitiveness improved. This suggests that trading income has been an important contributor to the profitability of EG dairy enterprises over the study period. The role of trading income is emphasised during times of relatively low local milk prices. Had EG milk producers received the national milk price, their dairy enterprises would not have been competitive from 1983 to 2002. This suggests that EG milk producers, on average, received higher milk prices than the national average price over the study period. The results of the UCR analysis indicated that further analysis be undertaken to investigate other factors influencing the competitiveness of EG milk producers.

Using Ridge regression, the second analysis investigated factors influencing the competitiveness of a panel of 11 EG milk producers for the period 1990 to 2006. The total sample size was 187 (11 producers x 17 years). Ten observations were missing, however, and these were estimated using Multiple Imputation and Markov Chain Monte Carlo

methods. Using the UCR scores for each producer-year (UCR_{it}) as the dependent variable, other variables included in the regression analysis were: the natural logarithm of herd (farm) size ($LNCOWS_{it}$), the ratio of pasture and forage costs to total feed costs ($PASCOST_{it}$), the ratio of dairy cattle trading income to total milk income ($TRADINC_{it}$), the ratio of milk income to gross farm income ($SPECIALISE_{it}$), annual milk production per cow ($PRODCOW_{it}$), a proxy (trend) variable capturing policy, technological and other changes over the study period ($YEAR_{it}$), and the debt-to-asset ratio, a measure of farm solvency ($DEBTASSET_{it}$).

The results of this analysis showed that the size of dairy enterprise, the debt level of the farm business, production per cow, technological and policy changes, and the ratio of trading income to total milk income influence the long-term competitiveness of the selected EG milk producers. Recommendations to EG milk producers to enhance competitiveness in a deregulated dairy market were also made. Small (relative to the base category producer), profitable EG milk producers should consider expanding their herd size to capture the benefits of size economies as the importance of herd size to the overall profitability (competitiveness) of EG dairy enterprises suggests that size economies exist. Milk producers in EG should also consider utilising more pasture and forage based production systems (to lower production costs) and to select dairy cattle of superior genetic merit that produce high milk yields on pasture. Trading income will continue to play an important role in determining the overall profitability of the dairy enterprise.

A number of conclusions were drawn from the study. Based on the findings of previous research and this study, government should continue to assist in providing support to and funding for dairy research and development, veterinary services and regulations for the maintenance of milk quality. The study also recommends that government consider raising tariff levels for milk and other dairy products to protect South Africa's milk producers from imports derived from countries whose exports are subsidised. Although SA milk producers face many challenges, the perception that dairy market deregulation has impacted negatively on the profitability of their enterprises is disputed by the findings of this study. These challenges, amongst other things, necessitate better management and responsiveness to changes on the part of South Africa's milk producers. With regard to emerging milk producers, they face reduced profit margins (diseconomies of size) and capital and skills constraints. Government should consider adopting a long-term planning

horizon in order to effectively develop emerging milk producers. Role-players in the SA dairy industry should also consider providing funds for future research into the industry's primary sector. Investigating the impact of dairy market deregulation on, and determinants of, competitiveness for milk producers in other regions of South Africa, and including its effect on human capital and management factors and management responses, are areas which warrant further research.

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APPENDIX A

Producer price calculation for a typical commercial milk producer in East Griqualand, South Africa.

The determination of producer prices for fresh milk post-deregulation is a complex matter and varies considerably between producers. Subsequent to dairy market deregulation, it is the responsibility of the respective milk buyers to determine the producer price and this is often based on quality and quantity attributes (comparative base-pricing system). As an incentive for the production of high quality milk, milk buyers generally offer price premiums for butterfat and protein concentration. An outline of the producer price determination scheme for a large milk buyer in 2007 for a typical milk producer in East Griqualand is presented below:

Butterfat average	: 3.84% = 63.28c/litre
Protein	: 3.50% = 54.27c/litre
Volume	: 122.5 c/litre
Somatic cell count	: 400000 = 0c/litre
Collection cost	: 11.37c/litre (based on volume/distance calculation)
Production stimulation	: 15c/litre
Full delivery supply	: 10c/litre

Total price received by producer = 256.80c/litre

Source: Wallis (2007)

APPENDIX B

**EAST GRIQUALAND DAIRY PRODUCER QUESTIONNAIRE: MAY
2008**

Farmer's Name*: _____

1. If you had to hire a suitably-qualified manager to manage your farm on your behalf, what would the annual cost (including benefits) of such a manager be?
R_____
2. If you had to look for employment off the farm, what do you estimate your annual remuneration (including benefits) would be in your next best line of work?
R_____
3. What probability would you give to actually being able to get such a job (e.g., there could be a 70% chance of getting the job)? _____%
4. If you have a mixed farm, what proportion of your overall management time is spent on your dairy enterprise (including the associated activities such as pasture management, feed mixing and office work)? _____%

*Required to match the answers in the questionnaire to your production data. This information will not be published.

PLEASE INSERT YOUR COMPLETED QUESTIONNAIRE INTO THE BROWN ENVELOPE PROVIDED.

THANK YOU!

APPENDIX C

Table C1: Average real net local milk prices (P_L) and average real total costs per litre of the top and bottom one-third of East Griqualand milk producers, 1983 – 2006 (2000 = 100).

	Top one-third		Bottom one-third		Average real national producer price (R/litre)
	Real producer price (R/litre)	Real total costs* (R/litre)	Real producer price (R/litre)	Real total costs* (R/litre)	
1983 – 1987	2.01	1.99	1.77	1.97	1.66
1988 – 1992	1.60	1.78	1.58	2.02	1.35
1993 – 1997	1.56	1.57	1.38	1.77	1.23
1998 – 2002	1.34	1.31	1.30	1.53	1.28
2003 – 2006	1.57	1.39	1.49	1.69	1.52

* include an opportunity cost of management

Restricted F test

$$F = \frac{(R_{\text{squaredUR}} - R_{\text{squaredR}})/m}{(1 - R_{\text{squaredUR}})/(n - k)} = 8.12^{***}$$

Where,

$$R_{\text{squaredUR}} = 0.53$$

$$R_{\text{squaredR}} = 0.29$$

$$m = 10$$

$$n = 177$$

$$k = 18$$

Critical F value for 10 numerator degrees of freedom and 159 denominator degrees of freedom = 2.41 at 1% level of significance. Therefore the hypothesis that the intercepts for each milk producer are the same is rejected. There seem to be strong individual effects and statistically significant differences amongst the sample EG milk producers.

APPENDIX D

Table D1: Results of fixed effects Ridge regression model for a panel of EG milk producers with missing data, 1990 – 2006 (n=177)

Parameter	β -coefficient	Standardised coefficient	Std error	t - statistic
LNCOWS	-0.0346	-0.186	5.25×10^{-3}	-6.59***
PASCOST	-0.0270	-0.0442	0.0191	-1.41
TRADINC	-0.196	-0.0891	0.0685	-2.86***
SPECIALISE	6.23×10^{-4}	1.08×10^{-3}	0.0152	0.0410
PRODCOW	-1.57×10^{-5}	-0.131	3.37×10^{-6}	-4.66***
YEAR	-2.91×10^{-3}	-0.130	6.82×10^{-4}	-4.27***
DEBTASSET	1.96×10^{-3}	0.181	3.08×10^{-4}	6.36***
α-coefficient				
Base category	1.230		0.0390	31.5***
D₂	-0.0233	-0.0615	0.0108	-2.16**
D₃	-0.0380	-0.100	0.0113	-3.36***
D₄	0.0276	0.0729	0.0111	2.49**
D₅	0.0120	0.0317	0.0113	1.06
D₆	0.0146	0.0385	0.0116	1.26
D₇	-1.46×10^{-5}	-3.85×10^{-4}	0.0108	-0.0136
D₈	0.0570	0.150	0.0108	5.28***
D₉	-0.0276	-0.0729	0.0116	-2.38**
D₁₀	0.0320	0.0845	0.0124	2.58***
D₁₁	-0.0210	-0.0554	0.0101	-2.08**
	$R^2 = 0.61$		Adjusted $R^2 = 0.54$	df = 159
	F - statistic = 14.5***		$d = 1.77$	

Note: **,*** denote significance at the 5% and 1% levels, respectively

- LNCOWS = natural logarithm of number of cows
- PASCOST = ratio of pasture and forage costs to total feed costs
- TRADINC = ratio of trading income to total milk income
- SPECIALISE = ratio of milk income to gross farm income
- PRODCOW = production per cow
- DEBTASSET = debt/asset ratio
- YEAR = Trend variable
- D₂...D₁₁ = Differential intercept dummy variables.