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# THE EFFECT OF MARKET LIBERALIZATION ON MAIZE MILLING/RETAIL MARGINS IN SOUTH AFRICA

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## ABSTRACT

THE EFFECT OF MARKET LIBERALIZATION ON MAIZE MILLING/RETAIL MARGINS IN SOUTH AFRICA

By

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Maize meal is the most important consumer staple food in South Africa. Studies of Southern Africa have shown that South African maize-meal milling/retail margins tended to be high when compared to other countries within the region. In particular, the milling/retail margin in South Africa was found to be more than twice that of neighboring Zimbabwe, although both industries faced comparative cost structures and Zimbabwe's milling industry was concentrated among fewer millers. The objective of the research, reported in this paper, is to determine, econometrically, the effect of market liberalization on the maize milling/retail margins within South Africa. Economic theory of market liberalization would predict a reduction in the real price margins between processed and raw agricultural products due to entrance into previously closed markets by the informal sector, thereby increasing competition among industry players. Feasible General Least Squares method of estimation is applied to two reduced form linear models of the milling/retail margins in which a binary explanatory variable has been included to capture the effect of market liberalization. The period of study covers the marketing years from 1976/77 through 2000/2001. From this study we find that despite market liberalization the maize milling/retailing margin continues to grow in real terms within South Africa, indicating a need for further investigation into the concentration of the market and the possible entry barriers at this stage of the maize marketing system.

This Thesis is dedicated to my father, M. F. H. Ndibongo; who besides fighting for the abolishment of apartheid continued to work for the freedom of the South African poor, up until his death on November 9th, 2001.

## ACKNOWLEDGEMENTS

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I would also like to thank my family for their continued love and support. I especially want to thank my mother for being my point research person in South Africa and uncovering hard-to-find data; as well as my husband, who bore the brunt of my stress and anxiety.

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# CHAPTER 1: INTRODUCTION

## 1.1: Context

The maize sector is without a doubt one of the most important sectors within the South African Economy. During the decade of the 1980's, 40% to the total land under cultivation was dedicated to maize production, 75% of the total grain produced during this period was maize, and maize constituted 56% of all grains consumed domestically (World Bank, 1994). Maize is a vital earner of foreign exchange for South Africa as well as an important food source for the majority of the population, primarily low-income consumers (USDA-FAS, 2000; Department of Trade and Industry, 1998). Therefore, maize as a commodity becomes important to issues of food-security within the country.

Through most of the 1980's and up until the mid-1990's, South Africa's national food policy was directed at ensuring food self-sufficiency (van Rooyen et al, 1997). The White Paper (RSA, 1984: 8-9) established this policy aim by stating:

> For any country, the provision of sufficient food for its people is a vital priority and for this reason it is regarded as one of the primary objectives of agricultural policy. Adequate provision in this basic need of man not only promotes, but is also an essential prerequisite for an acceptable economic, political and social order and for stability.

This conceptualization of food policy was consistent with general global practices in most other countries, and was further entrenched by the threat of sanctions from the international community. Table 1.1 below summarizes the self-sufficiency indices of selected agricultural commodities. This table indicates that in maize production, South Africa was self-sufficient and able to produce enough maize to meet domestic demand for both white and yellow maize. In contrast, red meat commodities with self-sufficiency

indices below 100 were dependent on foreign markets, mainly Namibia, Botswana and EU to meet domestic shortages (Thirtle et al., 2000).

**TABLE 1.1: Self-Sufficiency Indices (SSI) of Selected Agricultural Commodities in South Africa**

| COMMODITY | Self-Sufficiency Index [1] | | |
|---|---|---|---|
| | 91-94 | 85-90 | 85-94 |
| Wheat | 95 | 115.5 | 107.4 |
| Maize (White & Yellow | 109.5 | 121.1 | 116.5 |
| Potatoes | 100.6 | 100.3 | 100.4 |
| Vegetables | 100.9 | 101.3 | 101.1 |
| Sugar | 163.5 | 162.5 | 162.9 |
| Beef | 93.1 | 89.9 | 91.2 |
| Mutton, Goat's meat & lamb | 82 | 93.3 | 88.8 |
| Pork | 96.1 | 100.9 | 99 |
| Chicken | 99.1 | 99.4 | 99.3 |
| Eggs | 101.7 | 101.7 | 101.7 |
| Deciduous & sub-tropical fruit | 156.5 | 152.3 | 154 |
| Dairy products | NA | 101 | NA |
| Condensed milk | 123.5 | 105.5 | 112.1 |
| Fresh milk | 100 | 100 | 100 |
| Cheese | 100 | 100.3 | 100.8 |
| Butter | 100 | 100 | 100.7 |
| Sunflower seed oil | 60.3 | 87.5 | 76.6 |
| Citrus fruits | 235.5 | 254 | 246.6 |
| Rice | 0 | 0 | 0 |
| **COMMODITY GROUP**[2] | | | |
| Grains and Field crops | 88.2 | 97.2 | 94 |
| Horticultural crops | 164.3 | 169.2 | 167.2 |
| Livestock products | 96 | 99 | 99.3 |

**Source**: Food balance sheets of the Directorates of Agricultural Trends & Agricultural Statistics of the Department of Agriculture

Although the objective of food self-sufficiency was largely achieved during the late 1980's and early 1990's, this sufficiency was accompanied by occurrences of widespread poverty and malnutrition (Thirtle et al., 2000). The Committee for Development of a Food and Nutritional Strategy for Southern Africa, using income and nutritional status of children and pregnant and lactating women as a means to measure the proportion of the population who were nutritionally deprived, found that in 1989 malnutrition was a

[1] Self-Sufficiency Index = (Total production/Total local consumption) x100

problem in South Africa. They found that 2.3 million children and pregnant and/or lactating women (87% of which were black) were malnourished and could be considered for nutritional assistance (Thirtle et al, 2000). Another study, conducted by the South African Vitamin A Consultative Group in 1995, found that Vitamin A deficiency was a serious problem in South Africa. In particular, they found that 30% of the children in South Africa had marginal Vitamin A status (Thirtle et al, 2000).

It is highly conceivable that observed malnutrition was related to the high cost of the primary staple food. Table 1.2 below summarizes the annual percentage increase in the consumer prices of cereal products (which includes maize meal) for South Africa.

**TABLE 1.2: South African Food Price Percentage Increases for Cereal Products**

| Commodity | % Increase per year when compared with previous year |
|---|---|
| 1990 | 13% |
| 1991 | 18% |
| 1992 | 18% |
| 1993 | 12% |
| 1994 | 8% |
| 1995 | 6% |

**Source**: Annual Report of the Director General: Agricultural Economics and Marketing, National Department of Agriculture

Cereal, therefore maize meal, prices were continually increasing in the first half of the 1990's. An article published in Dialogue, a publication of the National Economic Development and Labour Council, stated that in 2001, the maize meal price to consumers more than doubled, while the food price index rose by 11.4%, which is 8.4% higher than the price increase for non-food items. Increasing food prices have a greater effect on low-income households than on the high-income population since food makes up a larger share of spending for the poor. In 2001, the CPI rose between 8% and 9% for households

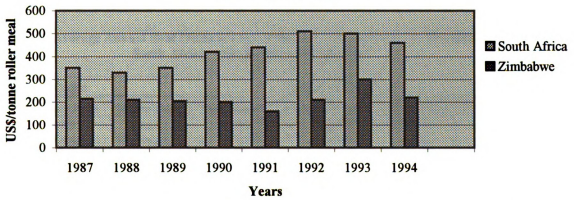
[2] Unweighted average figures for all commodities of the same group.

with incomes below R2500 (approximately $250) per month, compared to the 6.0% for the very high-income households (Dialogue, 2001). In a country such as South Africa where 85% of all households depend on purchased food, these increasing prices have serious implications on food security.

**1.2: Regional Price Comparison**

Previous studies within the region have noted that in general South African consumers have tended to pay higher retail prices for maize meal than their neighboring countries' consumers. In a study conducted by T.S. Jayne, T. Takavarasha, and J. van Zyl in 1994, it was found that between 1987 and 1994 South African consumers were paying more than Zimbabwean consumers for commercially sifted maize meal. Figure 1.1 below summarizes their findings.

**FIGURE 1.1: Retail Maize Meal Prices in South Africa & Zimbabwe (constant 1995 US$)**




From this graph it clear that between 1987 and 1994 South African consumers paid more, sometimes twice as much as Zimbabweans consumer for commercially sifted maize meal.

Another study conducted by Lawrence Rubey in 1992, found that not only were South African retail prices higher than those found in Zimbabwe but also milling/retail

margins in South Africa were more than double the margins found in neighboring Zimbabwe. Table 1.3, row F below presents data showing the comparative maize-milling margin earned by the millers in South Africa vs. millers in Zimbabwe in 1992.

**TABLE 1.3: Comparison of White Maize Marketing & Milling Margins in South Africa & Zimbabwe, in metric tons (U.S. $)**

| | April 1992 | |
|---|---|---|
| | **South Africa** | **Zimbabwe** |
| **A. Parastatal Producer Price** | $115 | $110 |
| **B. Parastatal Selling Price** | $166 | $138 |
| **C. Ex-mill Price, w/o govt. Subsidy** | $342 | $210 |
| **D. Retail price for 80% extraction rate meal, w/o govt. subsidy** | $370 | $233 |
| **E. Retail price for 80% extraction rate meal, w/ govt. subsidy** | --- | $155 |
| **F. Maize Miller Margin (C-B)** | $176 | $72 |

**Source**: Rubey, 1992

Furthermore, when 1996 and 1999 retail prices of maize meal in South Africa are compared to neighboring Mozambique, there are similar results. Table 1.4 below summarizes the findings.

**TABLE 1.4: Average Annual Real Prices per ton of Maize Grain and Flour in Mozambique and South Africa: 1996 & 1999 (US$2000=00)[3]**

| Year | Mozambique | | | South Africa | | |
|---|---|---|---|---|---|---|
| | Maize Grain | Maize Flour | Price Spread | Maize Grain | Maize Flour | Price Spread |
| 1996 | 107.91 | 186.82 | 78.90 | 210.09 | 620.70 | 410.61 |
| 1999 | 130.08 | 203.65 | 73.57 | 136.29 | 502.81 | 366.52 |

**Source**: Arlindo, 2001

Comparing the price spread between the two countries, it is clear that in 1996 the difference between wholesale and retail prices of maize in South Africa was more than four times the amount of the spread in the case of Mozambique. Although in 1999 there

[3] Used the exchange rate of MZH 23134.91=US$1 for both 1996 and 1999 calculation for Mozambique market and R4.30=US$1 for 1996 and R6.12=US$1 for 1999 calculation in the case of South Africa.

is a reduction in the gap, South Africa's spread continued to remain high relative to that of Mozambique's milling/retail spread.

These finding are pertinent to the issue of food security. Although the agricultural sector in South Africa does have the inherent ability to feed the nation, malnutrition continues to be a problem in South Africa. It is important that national food policy move in the direction of recognizing the importance of access to food and the role of the entire food system in ensuring national food security. As Rukuni and Eicher (1987) note, one of the primary issues of management of a national food system is identifying the least-cost method of securing national food requirements. In a country such as South Africa, where maize meal is a staple food for the majority of the population, it is important that the government uncover why its consumers were paying substantially more for maize meal than in most neighboring countries, many of whom were not even self-sufficient in maize. Since approximately 68% of the maize meal cost is generated in the processing stage of the maize sub-system, then government policy that focuses on achieving productivity gains in the marketing system would potentially have a larger effect on food prices for consumers than policy that only succeeded in raising farm-level productivity. Although the farm-productivity stage is important to achieving food security within a nation, it is clear that the entire food industry is a significant and strategic economic sector. Without an efficient food industry sector, the food system of the nation will create bottlenecks, with large quantities of agricultural commodities unable to reach consumers at the end of the food system.

## 1.3: Regional Market Reform

Studies that looked at the effects of market reform in neighboring countries, such as Zimbabwe, and Mozambique, have found that, in general, reform has lead to a reduction in pricing margins within the effected markets thereby indicating lowered retail prices. It was found that in each country the ultimate result of deregulation was declining processing/retail margins in real terms.

The study, conducted by Jayne et al., looked at the effects of grain market reform on low-income consumers access to maize meal in Eastern and Southern Africa. The study found that in Zimbabwe, Kenya and Zambia, the removal of selected food marketing controls such as subsidies on refined meal and controls on private grain movement resulted in increased demand in urban areas for whole maize meal. They concluded that the two major benefits of market reform in these countries were: 1) increased availability of cheaper and more nutritious whole maize meal produced by hammer mills in urban areas that were formerly banned in the controlled marketing system; and 2) increased competition from hammer millers that put pressure on large-scale, refined-meal manufacturers to reduce their margin, given that whole maize meal and refined maize meal are close substitutes in consumption.

## 1.4: Purpose of this Paper

The purpose of the analysis in this paper is to understand whether market reform in South Africa led to reductions in the milling/retail margins. Large marketing margins, according to Timmer, occur for two reasons: high real marketing costs and/or a monopolistic element in the marketing process that is earning excessive profits. Although the government, prior to market reform, found there to be adequate competition

among the maize grain processors, the regional retail price comparison seems to indicate either high costs or collusive behavior among millers and retailers within South Africa (Rubey, 1992). If monopoly power does exist, market reform would not be expected to have much effect on price margins between processed and raw agricultural products, and might actually increase them. The discrepancy in the retail prices of maize meal in South Africa compared to neighboring countries leads to the formulation of several questions that will require research and analysis of the South African maize sub-sector. The questions that arise are as follows:

1. What were the structural adjustment and market liberalization policies; and how were they implemented?
2. How has market adjustment affected the retail price of processed maize?
3. Do the same high margins exist in the post-liberalization market as in the pre-liberalization period?
4. If so, what would be reasonable policy options to address these margins; and what would be the anticipated effects?

The goal of this paper is to develop answers to these questions and to provide some guidelines to policy makers for further research. The objective of the research is to econometrically determine the effect of market liberalization on the maize milling/retailing margins within South Africa.

The remainder of this paper is divided into five parts. Chapter 2 attempts to put the topic of this paper within a conceptual framework by looking at market liberalization and its anticipated affects on prices and margins. Chapter 3 gives an overview of the evolution of agricultural policies in South Africa and its implications on the maize sub-

sector. Chapter 4 presents the methodology, data and model to be used in the empirical analysis of the milling/retail margins. Chapter 5 gives the results and interpretation of the model findings. In Chapter 6 conclusions are drawn regarding the achievement of food security based on the model's findings and policy implications of this study.

# CHAPTER 2:THEORETICAL FRAMEWORK FOR ASSESSING THE EFFECTS OF MARKET REFORM

## 2.1: Historical Context

In general the rationale behind the emergence of controlled marketing systems are two-fold. Firstly, it was during the Great Depression of the 1930's that many nations first introduced government-run programs with the purpose of reducing the negative effects of deteriorating economic conditions (Essinger, 1998). These programs included subsidies, which gave governments control over prices, supplies, investments and exports; and led to the increasing substitution of market forces in agriculture and industry with government control. For example, in Argentina and other Latin American countries mining, utilities and other such industries were government owned and operated until recently (Essinger, 1998). Secondly, each government faces the challenge of keeping producer prices high enough in order generate an adequate food supply, while keeping food prices low enough so that the entire population has access to food. This food-price dilemma faced by governments has historically been addressed with a controlled marketing system (Jayne et al., 1995). For example, many Eastern and Southern African governments have used producer and consumer subsidies on staple agricultural commodities as a means of dealing with this dilemma (Jayne, et al., 1995).

However, in the case of Eastern and Southern Africa a third reason is responsible for existence of a controlled marketing system, particularly within the maize sub-sector of these countries. The goal of the former "white" governments in Zimbabwe, Kenya, Zambia and South Africa was to ensure the viability of the European farmers (Jayne et al., 1995). In these countries, as the number of European farmers involved in maize production grew, so did the perception of the African farmer as a threat. In Kenya,

Zambia and Zimbabwe there is evidence that African farmers were able to produce at costs well below those of the European farmers (Jayne et al., 1995). With the depression of the 1930's and the successful lobbying of the European Farmers, the governments of these countries adopted policy measures aimed at undermining the effectiveness of the African farmers. These policies led to the creation of government-owned crop buying board, allowed for a two-tiered pricing scheme, which gave higher prices to European farmers, and enforced restrictions on grain movements from African growing areas to urban centers (Jayne et al., 1995).

By the late twentieth century, a combination of fiscal debt and changing ideology lead to many countries reversing the trend of government-controlled markets and movement towards privatization (Essinger et al., 1998). For example, Argentina in 1992 privatized almost every industry in attempt to reduce its national debt, while the disintegration of the USSR in the late 1980's led to the replacement of government controls with private enterprises in Russia and its satellite countries (Essinger et al, 1998). Similarly, in Africa, with the external donor and internal fiscal pressures, many governments began in early parts of the 1990's to establish structural adjustment programs, which entailed the removal of subsidies and the role of government as the sole buyer from within staple food markets.

## 2.2: Theoretical Framework

The term "Market Liberalization", like "Free Markets", is a vague term. Liberalization can be implemented in very different ways in different countries and the term does not adequately capture the specifics of the policy changes that actually take place in a particular country. For this reason, the effects of "liberalization" can vary

widely across countries not necessarily because the effects are so indeterminate or varied, but because the set of policy changes actually implemented vary so much. However, the theoretical framework used in this study borrows largely from standard Industrial Organization (IO) theory. This theory posits that if there are regulatory barriers in a market that lead to oligopoly and no controls on pricing (which a was formerly the case in RSA), firms that enjoy the oligopoly situation may collude and derive rents from setting marginal cost equal to marginal revenues; prices will be higher than marginal costs in that case. If the regulatory barriers are removed, i.e. restrictions on trade in maize and maize meal, and if this really reduces the barriers to entry and investment in maize trading, milling and maize meal retailing, the IO theory would indicate that there should be increased competition in the markets, and that prices would fall as the milling retailing stages of the market change from an oligopoly one to a competitive market.

Although market liberalization, depending on the structure of a nation's economy, addresses the removal of many facets of a controlled market system (such as removal of government parastatals); one of the core facets addressed are price subsidies. Much of the literature on market liberalization hypothesizes that with the removal of food subsidies economies are likely to slip into a trap: the short-term effect of price subsidy removal will be a sharp increase in food prices and therefore a decrease in real incomes for the poor. If pricing signals between consumers and producers are obstructed then food supply will be unable to respond accordingly, so instead of increasing will decrease which will lead to further increases in food prices[1](Jayne et al., 1995).

[1] See Lele (1990), Oyjide (1990), Pinstrup-Anderson (1988), and Cornia, Jolly, and Stewart (1987). These studies conclude that the short-term effects of structural adjustment are severe on the urban poor.

The key problem of price liberalization, which leads to this trap, lies with the unresponsive nature of supply, particularly in the supply of agricultural products (Guba et al., 1998). Guba, Wei, and Burcroff II, in their 1998 work on the hog-pork sector in Poland, give two reasons why supply may be slow in responding to increasing food prices. Firstly, in transition economies where farms were state-owned or collectively owned, the farming sector may be slow to respond to market signals. Secondly, the food processing and marketing system may be dominated by monopoly forces, which offer low prices to farmers for their output. In a marketing system, where the transactions across vertical marketing chains are not competitive, price transmission between consumers and farmers is obstructed. Also, if within the sector, there exists high levels of segmentation across vertical marketing chains, when price liberalization is introduced the market segmentation and obstructed price transmission will result in ineffective supply response.

In their study, Guba et al. found that after the 1989 price liberalization, although the nominal price margin between hog and pork increased substantially, this increase was driven by inflation. In fact, when properly deflated, both retail and farm prices declined steadily in real terms. At the same time, the supply of live hogs and pork continued to increase until the 1992 drought, when consumer preferences shifted towards fruits and vegetables. They accredit this successful ability of transcending the price liberalization trap to two reasons; firstly, the restructuring of the pork processing and retailing industry to a more competitive system and secondly, the willingness of farmers to explore diversified marketing channels as well as actively reacting to market signals.

In the case of the South Africa's maize sub-sector, since maize production is dominated by large-scale privately owned farms to avoid the price liberalization trap the primary challenge for South Africa lays in the marketing system. As noted in the previous chapter, although the government, prior to market reform, found there to be adequate competition among the maize grain processors, the regional retail price comparison seems to indicate either high costs or collusive behavior among millers and retailers within South Africa. If monopoly power does exist, market reform would not be expected to have much effect on price margins between processed and raw agricultural products, and might actually increase them. The analysis to follow in the remaining chapters will establish whether or not South Africa's maize sub-sector was successfully able to avoid the liberalization trap. However before this can be done it is important to look at the market structure of the maize sector and various policies that affect it both before and after market reform.

## CHAPTER 3: AGRICULTURE AND THE MAIZE SUB-SECTOR

The purpose of this chapter is to give an outline of the evolution of South African agricultural policies and their impact on the maize sub-sector. The first part of the chapter looks at the changes enacted in the agricultural policy environment ranging from the early 1900's through to the market liberalization and structural adjustment era of the late 1990's. The second part focuses exclusively on the maize sub-sector and its development under the various phases of South African agricultural policy.

### 3.1: Overview of South African Agricultural Policies

Agriculture is regarded in South Africa as a highly sophisticated and successful sector because of the country's self-sufficiency with regards to most of its agricultural commodity requirements (World Bank, 1994). In 1989, the South African GDP was US$80.4 billion, with 13% derived from services, 45% from industry, 26% from manufacturing, 11% from mining and 5% from agriculture. In comparison, 12% of GDP was derived from the agricultural sector in 1960 (World Bank, 1994); indicating a decreasing share of national GDP of the agricultural sector.

Agricultural policies in South Africa, as in most countries of the world, tend to be intertwined with social, economic and political objectives. The policy environment throughout the 1900's can be divided into four phases.

Phase 1. 1913 to 1940 - institution of the Land Act

Phase 2. 1940 to 1980 - post war era

Phase 3. 1980-1994 - policy reform & structural adjustment

Phase 4. 1995 onwards – post-apartheid market liberalization

*Institution of the Land Act: 1913-1940*

In this period the basic institutional framework of a dualistic agrarian structure was established. The overall purpose of the Land Act of 1913 and 1936 was to ensure the dominance of European settler agriculture and to force African families, who were formerly independent farmers on sharecropped land, into the labor force in order to meet the growing demand for labor by the newly emerging mining sector. The long-term goal of these polices, which were successful, was to end African farming above the subsistence level, to convert African families into a cheap source of labor, and to protect and strengthen large-scale commercial white farmers (Thirtle, 2000).

*Post-War Era: 1940-1980*

During this era the agricultural sector was transformed into a highly mechanized and capital-intensive farm structure (World Bank, 1994). The introduction of the Marketing Act of 1968 established a pricing and marketing system, which, with the combination of controlled input and output prices and single-channel marketing systems for most agriculture commodities, resulted in restricted competition. The Marketing Act allowed for the development of subordinate legislation called schemes. A scheme was generally established for a commodity or a group of commodities and a control board was established to administer the scheme (World Bank, 1994). The duties or function of these boards, among other things, included: buying the commodity at an approved price, and the single channel sales of said commodity. Under the Marketing Act there were four types of schemes established:

1. Single-channel fixed price schemes: Here, the farmers were only allowed to market their goods through the Board or a licensed agent. The prices were set for

the year by the board. This scheme was applied to major domestic crops such as maize, wheat barely and oats.

2. Single-Channel pool schemes: Under this scheme, the farmers marketed their goods through a pool organized by the board. There was often a guaranteed minimum price offered, with actual prices being determined by export prices and marketing board operating costs. Crops facing this type of scheme tended to be products meant for exportation.
3. Surplus-removal/Price-support schemes: Here, producers would sell their products on the open market and the Board would only become involved if prices fell below a minimum fixed price. In such cases they would buy the surplus supplies and store it for later distribution. Products such as red meat tended to be marketed under this scheme.
4. Supervisory schemes: Under this scheme, the Board's role was that of a supervisor or mediator between buyer and seller of the product. It would help supervise the arrangement of the price and purchase contracts. Products such as fruit and cotton were marketed under this scheme.

The outcome of the above marketing schemes was an agricultural sector that was highly concentrated and which catered predominately to large-scale commercial white-owned farmers (World Bank, 1994).

*Food Self-Sufficiency and Structural Adjustment: 1980-1994*

Although at times paradoxical, the general policy goals during this period included food self-sufficiency as well as the pursuit of orderly government-controlled

marketing, while considering the principles of the free-market system (Thirtle et al., 2000).

The White Paper of 1984 motivated the policy aim of food self-sufficiency as primary objective for agricultural policy (White Papers, 1984). In order to achieve this aim, the agricultural bureaucracy within South Africa was focused on large-scale, white commercial farmers. The bureaucracy's involvement ranged from protection of said producers from international competition through various forms of direct subsidies to the supply of such producers with state-of-the-art productive mechanical and biological technology (Thirtle et al., 2000). The result of such a focus materialized not only into the ability of the nation to meet domestic demand for most agricultural commodities but also allowed it to maintain its position as a surplus agricultural producer. See Chapter 1 for the table on South African self-sufficiency index measures.

It was within this policy framework of food self-sufficiency that the agricultural sector faced, in the mid-1980, increasing pressure for deregulation due to changes that were occurring within the macro-economy (Thirtle et al., 2000). For example, the extensive liberalization of the financial sector in the late 1970's led to scaling down of subsidies on interest rate from the Land Bank, while government subsidies to marketing boards were phased out in the early 1980's (Oxford Policy Management, 2000). De-regulation in the macro-economy coupled with international trends of market liberalization, South Africa established the Agricultural Marketing Policy Evaluation Committee (AMPEC) (van Dijck et al., 1995). The goal of this committee was to evaluate the current market structures and propose guidelines for future marketing policies.

By the early 1990's, within the context of political reform, there was an increase in criticism of the marketing system due to its obvious bias towards large-scale white commercial farmers, and concerns were also raised about relatively high consumer prices for many commodities. During this time a number of interest groups within South Africa appeared to arrive at an agreement on strategic notions with regards to issues of agriculture and rural development (van Rooyen et al., 1997). The consensus favored comprehensive rural restructuring programs, with the aim of creating access to land, support services and other resources for the portion of the population that was previously denied such access. It was within this socio-economic background that the Reconstruction & Development Program (RDP) (1994), the Broadening Access to Agriculture Thrust (BATAT) initiative and the 1995 White Paper on Agriculture were drafted and adopted.

The principles set out in 1995 White Paper on Agriculture called for transparency and all-inclusiveness for all market participants, product marketing to become market orientated, and price fixing by the government to be limited to certain situations (van Dijck et al., 1995). The RDP can be defined as:

> ". . .an integrated and coherent socio-economic policy framework that seeks to mobilize all people of the country as well as the country's resources towards the final eradication of apartheid and the building of a democratic, non-racial and non-sexist South Africa (RDP, 1994:4)

Within this context the Department of Agriculture developed the BATAT initiative, which was to serve as a vehicle to achieve the goals of RDP within the agricultural sector. Under these programs, various aspects of the agricultural sector came under review or restructuring. Firstly, land reform was seen as being a vital force behind rural

reconstruction and development. The aim of land reform was to redress the injustice of the forced removal and historical denial from land access by redistributing 30% of agricultural land within the first five years of the program (van Rooyen et al., 1997). Secondly, the programs expressed support for the commercial farming sector, which was expected to operate in a market-orientated environment with less government support than in the past. Government support would be directed to small-scale farms and newly emerging commercial farms (van Rooyen et al., 1997). Commercial farms were expected to develop their own support system from the private sector rather than the government. Finally, although the RDP and BATAT refer only briefly to agricultural marketing, the ANC policy document on agriculture expanded on this topic (van Rooyen et al., 1997). The overall goal of this policy document was to ensure affordable and sustainable prices of basic foodstuffs for low-income groups by broadening the objectives of agricultural marketing policies as they related to food security issues. In order to achieve this level of food security, four key goals are established:

1. Removal of most Agricultural Marketing Boards except in cases of strategic commodities, such as maize, where a state-supported Board would remain to serve as at buyer of last resort.
2. Removal of uniform national pricing, placing greater emphasis on market forces to determine commodity prices.
3. Regulation of certain agricultural commodities by government justified only in cases of the existence of monopoly power, food insecurity, nature of the world market, or the promotion of agro-industrial linkages.

4. Provision of uniform regulatory and legislative system of agricultural marketing to both small-scale and commercial farmers within South Africa.

These adopted programs and initiatives served to change the environment in which agricultural policy was written; whereas in the past agricultural markets were under stringent government control, the emphasis by the early 1990's shifted towards a market oriented system in order to achieve the goals of equity within agricultural marketing. In consequence to the changing policy environment, the country saw the voluntary shutting of smaller agricultural marketing boards and the scaling down of some of the activities of the remaining boards.

*Post-Apartheid Market Liberalization: 1995 onwards*

Although it was determined that the old agricultural marketing system was to be terminated in the early months of 1995, by the end of the year the most important control boards and many of their powers were still intact (Bayley, 2000). The newly elected government was faced with the choice of either accelerating deregulation or reorienting the existing boards to promote the interest of consumers and small-scale farmers. It decided on the latter. The final phase of deregulation was rapid and managed under the Marketing of Agricultural Products Act, 1996 (OPM, 2000). The primary goal of this act was to improve market access, agricultural efficiency, and to optimize export earnings through the creation of a market-driven marketing system. Essentially this act legislated the closure, within one year, of all schemes and control boards that were established under the Marketing Act of 1968 (OMP, 2000). Although this act was sweeping in nature, it allowed for limited intervention by government into the market provided that such intervention would be as a last resort.

The response of the private sector to the new agricultural environment has been impressive. In a study conducted by the Oxford Policy Management Review (OPM) (Bayley, 2000), they found that in the years following complete removal of government parastatals, there was an increase in the number of organizations involved in exportation of citrus and deciduous fruit, an increase in the number of enterprises involved in the food and agricultural sector, a drop in real land prices, and a recovery in real farm incomes to approximately two thirds of their level in the mid-1970's. The most significant development noted by OPM was the establishment of the South African Agricultural Future Exchange (SAFEX) in 1995. This organization trades futures and options contracts on white and yellow maize as well as sunflower seeds. The authors of the OPM review see this exchange as being a powerful instrument for both producers and processors to help manage risk.

**3.2: Maize Sub-Sector**

The maize sub-sector is without a doubt one of the most important sectors within the South African economy. During the decade of the 1980's, 40% of the total land under cultivation was dedicated to maize production, 75% of total grain produced during this period was maize, and maize constituted 56% of all grains consumed domestically by consumers (World Bank, 1994). Maize, besides being an important food source for the majority of the population, is a vital earner of foreign exchange for South Africa through the export of maize and maize products. According to the USDA/Foreign Agricultural Services (USDA-FAS), in the year 2000, 2% of the total world corn exports were comprised of South African maize (See Appendix A.1), the majority of which was comprised of white maize grain, which is the preferred maize for human consumption in Southern Africa. Table 3.1 below summarizes the white/yellow corn Production,

Supply & Distribution (PS&D) for the 1999/2000 and the estimates for 2000/2001 marketing years complied by the USDA-FAS.

**Table 3.1: White/Yellow PS&D – 1999/2000 to 2000/2001**

| May/April | MY 99/00 | | 000 Mt. | MY 00/01 | | 000 Mt. |
|---|---|---|---|---|---|---|
| Corn | White | Yellow | Total | White | Yellow | Total |
| B/Stocks* | 543 | 264 | 807 | 510 | 270 | 780 |
| Production | 4922 | 2802 | 7724 | 6460 | 4125 | 10585 |
| Imports | 0 | 569 | 569 | 0 | 0 | 0 |
| SUPPLY | 5465 | 3635 | 9100 | 6970 | 4395 | 11365 |
| Exports | 495 | 35 | 530 | 840 | 360 | 1200 |
| Cons.** | 4460 | 3330 | 7790 | 5015 | 3150 | 8165 |
| E/Stocks | 510 | 270 | 780 | 115 | 885 | 2000 |

*Excludes early new season deliveries; **Includes farm retention

This table shows that in the marketing year 1999/2000 South Africa exported more white maize than yellow maize grain. Although the estimated export of yellow maize is expected increase, white maize is estimated to remain higher relative to yellow maize.

As noted in the section 3.1, market deregulation began in the early 1980's, which resulted in the reduction of income supports and government control in the marketing channel of maize grain. Due to further deregulations by the government, in 1987, the Maize Board allowed for grain sales by producers to other sources besides the Board and changed from a cost-of-production system to a pool pricing system, which fixed the selling price based on the interplay of domestic market supply and demand (Essinger, 1998). However, with the crop failures in 1992, the one-channel marketing system became appealing once again for producers; therefore, the government responded by establishing a floor price for maize (Essinger et al., 1998). Towards the end of 1993, amid huge government debt, the new Marketing Bill was drafted. Although rejected in 1994, this bill put the concept of free markets into the maize industry players' heads. By 1995 further indication of market deregulation was seen as multinational grain companies

began exporting maize along with the Maize Board which no longer operated as the only buyer (Essinger et al., 1998). During the 1994/1995 marketing season, the second draft of the Marketing Bill was proposed, and it stipulated the elimination of the old marketing plan on April 30th, 1995. However, since Parliament had not arrived at agreed changes to the Agricultural Marketing Act, the Maize Board retained the one-channel marketing method as the buyer of last resort until the end of April 1997 (USDA-FAS, 1995).

Due to the phasing out of marketing control boards within South Africa, the agricultural products markets have changed dramatically over the past five years. However, in order to appreciate the nature and scope of such change, it is important to include a brief description of the maize sub-sector within South Africa prior to market liberalization as well as a description of the market structure after liberalization.

*Background Information*

Prior to liberalization, South Africa was divided into geographical entities called Area A, Area B and "Exempted area"(Rubey, 1992). Area A consisted of what was known as the Transvaal, Orange Fee State, and selected districts of the Cape Province and Natal. The majority of the nation's maize was produced in this area. The provinces included in Area B were the remaining districts of the Cape Province and Natal. In both Areas A and B maize producers were required by law to sell their maize to either the Maize Board, registered maize traders, registered mill traders or end-users of yellow maize. Mill traders were commercial millers that were registered with the Maize Board in order to buy directly from the producers, whereas maize traders were registered traders that could buy maize from the producers but at prices that could not be less than the prices set in Area A. In the homeland, or "exempted areas" there were no restriction on

trade, so producers could sell to anyone at whatever prices. However, their production of maize was so minimal that overall the Maize Board had virtually all the control over marketed maize (Rubey, 1992).

Today, with the changing of the national government and the restructuring of the various provinces, geographically, maize cultivation can be divided into two categories, the major and the minor growing areas. Included in the major growing areas are parts of the Orange Free State, North West Province and Mpumalanga. The minor growing areas include parts of the Orange Free State, Northern Province, Kawazulu Natal, Gauteng and the northern-most parts of the Eastern and Northern Cape Provinces (See Appendix A.2 for map of area). Depending on the rainfall pattern of a particular geographical area, maize is usually planted between October and January, with harvesting taking place anywhere between the beginning of May and the end of June (See Appendix A.3 for Crop Calendar of South Africa).

*Maize Production & Marketing*

In general, maize production is divided fairly evenly between white and yellow maize; however, since 1995 there has been a swing towards the production of white maize. Table 3.2 below shows the plantings, production and yield of white and yellow maize from 1995/96 to 1999/2000.

**TABLE 3.2: Planting, Production, & Yield of White & Yellow Maize – 1995/96 to 1999/00**

| Seasons | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---|---|---|---|---|---|
| **Plantings (ha)** | | | | | |
| White | 1904000 | 1794000 | 1797200 | 1829700 | 2223000 |
| Yellow | 1403000 | 1567000 | 1158800 | 1075000 | 1227440 |
| **Production (t)** | | | | | |
| White | 5836000 | 5183000 | 4806000 | 4669000 | 6154500 |
| Yellow | 3858000 | 4549000 | 2450000 | 2642000 | 39864400 |
| **Yield (t/ha)** | | | | | |
| White | 3.07 | 2.89 | 2.67 | 2.55 | 3.07 |
| Yellow | 2.75 | 2.90 | 2.11 | 2.46 | 3.25 |

**Source**: "Field Husbandry." Branches of Industry. National Department of Agriculture, Republic of South Africa. April 2001

As of 2000, the ratio of production was 60% white and 40% yellow (National Department of Agriculture, South Africa). In the 1999/2000 production season, 2.223 million ha (62%) of the total 3.23 million ha planted to maize were used to plant white maize; the remaining 1.227 million ha was used for yellow maize. In general, 75% of the domestic commercial requirement of white maize is used for human consumption, whereas, 85% of yellow maize total production goes towards animal consumption or as input in the production of animal feed. However, in years of white maize shortages, yellow maize is sometimes mixed with white maize for human consumption. But in general, yellow maize appears to be less acceptable by consumers.

Price setting of maize under a controlled marketing system was carried out by the Maize Board and consisted of a graduated pricing system. In August, a price scenario was posted for the upcoming season. This scenario linked a given national crop with a particular producer price. For example in 1991/1992 a 6.5 million metric ton crop was linked to a producer price of R387 (Rubey, 1992). The Board's price was based on variables such as expected demand, projected interest rates, inflation rates, export price trends, and the Board's budget. Based on these and predicted weather conditions, farmers, by October or November, made the decision on how much to plant. By March

of the following year, when the actual size of the crop was known, the Maize Board announced the buying and selling price for that marketing year. These producer prices were pan-territorial and pan-seasonal.

During the time of gradual market liberalization until full deregulation in 1997, although the Maize Board remained active within the marketing system, there were new rules to govern the operation of the maize market. No longer were prices fixed under statutory regulations; the board held little control over co-operatives that stored grain, and by 1996 the maximum levy to be collected as well as the minimum prices to be paid to producers were lowered (Essinger et al., 1998). However, with the enactment of the Marketing of Agricultural Products Act of 1996, the start of the 1997/98 marketing season saw the beginning of a new marketing system. Now no longer are farmers forced to sell their grain to the maize board at a set price, but rather they had to learn marketing skills to be competitive and stay in business.

Currently, maize producers deliver the grain to a cooperative and maintain ownership of the grain; therefore, the farmer is responsible for storage costs. Under the new marketing system, farmers are now faced with a variety of methods for selling their grain. In the study conducted by Stacy Essinger, the following options were discussed. The first option available allows the farmer to sell his/her grain in a pool and get an advance payment for the grain before prices are set for the marketing season. The second option, known as the back-to-back option, is similar to that of a spot price offer, where the buyer, who wants to take immediate possession of the grain, makes an offer to the producer. The outside purchase option refers to the situation where a buyer contracts directly with the farmer for the grain. The farmer then delivers the grain to the

cooperative, where storage costs are directly charged to the farmer. Finally, with the emergence of SAFEX, the farmer can use the marketing tools available to him/her to manage his/her own risk. The cooperatives do not offer hedging opportunities to the farmers, but farmers may do so through individual dealings with SAFEX.

*Maize Milling*

With human consumption of maize being approximately 3.5 million tons per year, the process of dry milling heavily influences maize processing (Essinger et al., 2000). There are two types of dry milling technology available to millers: (1) Hammer milling, which produces whole meal and, (2) roller milling technology, which produces a large range of partially or fully degermed maize meal (Jayne et al., 1995). Hammer mills consist of a hopper into which the grain is fed, a milling chamber where the maize is ground, and a filtering screen, which surrounds the hammers and allows the ground grain to escape when it reaches desired consistency. This technology does not separate the bran, germ or endosperm in the maize grain but rather it shears and grinds the whole kernel (Jayne et al., 1995). Roller mills, on the other hand, are generally large-scale machines, which involve a continuous process of shattering the kernel and then sifting out the bran, germ and endosperm (Jayne et al., 1995). The resulting maize meal from this process can be divided into four types:

a. Super – highly refined, de-germed product, with an extraction rate of 62.5%
b. Special Sifted – refined product with an extraction rate of 78.7% and which is enriched with proteins and vitamins. This type of maize meal comprises over half the market in South Africa.
c. Sifted – less refined product, with an extraction rate of 88.7%.

d. Un-sifted/straight-run – unrefined meal with an extraction rate of 98%.

The resulting maize meal is a staple food for the majority of the population in South Africa, particularly among black South Africans. It is eaten as either as thin breakfast porridge or a thick, stiff porridge known as *Pap* or *Invubo.* According to a study conducted by the Maize Board in 1992, the per-capita consumption in urban areas was 48 kg in 1991 and 78 kg in rural areas for the same time period.

In South Africa, maize millers are very closely tied to producers and cooperatives for the procurement of their grain. The reason is twofold. The first reason is related to the purchasing cost of the maize grain. Between 80%-85% of maize processing costs are accounted for by the cost of the raw material (Essinger et al, 1998). The second reason is that processors need a steady supply of raw material to keep the efficiency of processing high (Essinger et al., 1998). In the early 1990's, maize milling in South Africa was dominated by commercial millers that, when counted, amounted to over 60 different firms in the industry. Based on the number of firms within the market it was assumed that there was a significant degree of competition among the millers, regardless of the fact that the two largest firms, Tiger Milling and Premier Milling each held approximately 20% of the maize meal market (Rubey, 1992). Most millers at this time operated only one shift and it was therefore a common perception that the milling industry was operating below capacity, which again reinforced the perception that there was competition among the millers (Rubey, 1992).

Currently, the milling industry is dominated by seven, large-scale millers who have the capacity of processing quantities of whole grain maize greater than 100,000 tons each (Chabane, 2002; Essinger et. al. 1998). These millers process approximately 70%

of the total maize meal produced in the market (Hendricks, et. al., 2001). The concentration ratio of the largest four firms is approximately 42.5% of the total maize market (Chabane, 2002). Fifty small-scale millers account for about 10% of milled maize. The remaining 20% of maize meal is produced by an estimated 100 or 150 gristing (hammer) mills (Hendricks et. al. 2001).

With the advent of market reform, large-scale maize processors today use forward contracts in order to ensure an adequate supply of their raw material. These contracts are offered to the producers either directly by the millers or through the cooperatives on behalf of the millers; the major difference between the two methods being the point of delivery, i.e., the cooperative silos or the millers premises (Essinger, 1998). In 1998, approximately 80% of all maize procurement was done through the cooperatives with the use of the back-to-back contracting as previously discussed (Essinger, 1998). If a miller contracts directly with the producer, they are able to either use a specific-variety contract or a pre-harvest contract. With the first type of contract the millers draw up a contract, which specifies the specific variety to be used; however, they generally do not specify the method of production to be used by the farmer. The second type of contract tends to be more risky for both parties since an agreement is reached before weather dictates final crop yields (Essinger et al, 1998).

## 3.3: Conclusion

As stated previously, it has been found that market reform in other developing economies was able to successfully ensure reduced real consumer prices because of an increase in the level of competition in the processing stage of food production due to the emergence of small-scale processors (see Chapter 2). From this chapter it is clear that

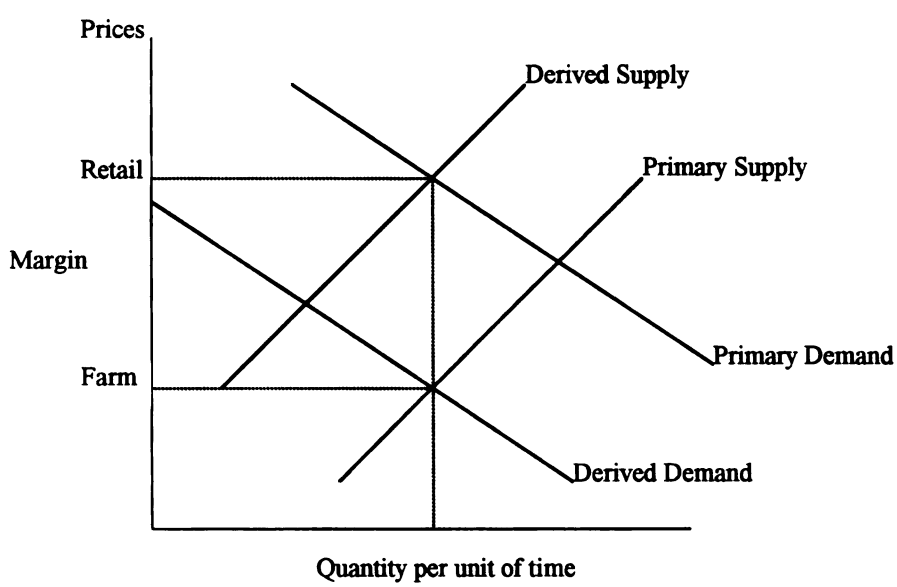
one of the goals of market reform in South Africa was to ensure affordable prices of basic foodstuffs for low-income groups through the operation of free-market mechanisms, i.e. mechanisms within a market in which the government sole role is as an institution that gives private entrepreneurs incentive to trade. In order to establish whether or not this goal has been attained, the chapters to follow will empirically determine the effects of liberalization (i.e. the removal of the government Maize Board and restriction of maize grain purchases by private traders) on the milling/retail margins within the maize sub-sector through the use of descriptive and econometric modeling.

## CHAPTER 4: THEORETICAL BACKGROUND ON MARKETING MARGINS

### 4.1: Literature Review

Marketing margins, in competitive markets, can be defined as; 1) the difference between retail prices and producer prices or as 2) the price of a collection of marketing services which is the result of the demand and supply of these services (Tomek and Robinson, 1981). Under the first definition, the marketing margin is essentially the difference between the primary demand and derived demand. Primary demand is defined as the joint demand for all the inputs that go into the final product and is determined by the demand characteristics of the final consumer (Tomek and Robison, 1981). The derived demand is essentially the primary demand function minus the per unit costs of marketing components. Figure 4.1 graphically illustrates the primary and derived functions and marketing margins.

**FIGURE 4.1: Primary and derived functions and marketing margins**



The primary supply refers to the relationships at the producer level, whereas the derived supply is obtained by adding an appropriate margin to arrive at the retail level of supply. As we see from the graph, the retail prices are found where the derived supply intersects with the primary demand, while the producer prices are found at the intersection of the derived demand and the primary supply. The second definition of marketing margins equates margins with the price of a collection of marketing services. This price (or margin) is a function of both the supply and demand of these services. These services include such items as the cost of assembly, processing, transportation and retailing (Tomek and Robinson, 1981). Both of these definitions imply that marketing margins are related to underlying supply and demand factors. However, this is true only under the assumption of competitive markets. If this assumption is relaxed, then market structure needs to be included as an important determinant of marketing margins. The milling and/or retailing market structure, for example, is likely to affect many forms of efficiency, including pricing efficiency and x-efficiency.

Over time, many empirical farm-retail price models have been developed under the rubric of price determination. In situations where adequate data for a structural specification is available, a simple markup equation has often been assumed to accurately reflect the relationship between the farm and retail prices (Lyon and Thompson, 1993). However, in conditions of limited structural data, single reduced form equations are generally specified. The marketing margin models that will be reviewed in this section of the paper will be single-equation reduced-form models. Hence there will be no explicit link of these models to a particular market structure.

*Markup Model*

This model has a long pedigree in empirical work and can be specified empirically as:

$$M = f(P_r, \mathbf{Z}) \quad M = (P_r - P_f) \qquad (1)$$

where M is the farm-to-retail margin, $P_r$ is the retail price, $P_f$ is the farm price and **Z** is a vector representing all the marketing input costs (Lyon and Thompson, 1993). This model allows margins to consist of either absolute or percentage markups or a combination thereof. The theoretical justification of the model lies in the argument that consumer demand is the determining factor in the relationship between retail and farm prices; therefore, food prices are determined at the primary level and farm-prices are simply retail prices minus marketing costs (Waugh, 1964). Bruce Gardner, in his study of the farm-retail price spread in a competitive food industry, gave further theoretical justification of this model by using the results of his study to imply the viability of simple rules of mark-up pricing by marketing firms.

*Relative Model*

This model is obtained from the inverse derived demand function for farm commodities that the food processors face (Lyons and Thompson, 1993). It defines a marketing margin as a function of retail prices, quantity and input costs and can be expressed as:

$$M = f(P_r, Q, \mathbf{Z}) \qquad (2)$$

where $P_r$ is the retail price, Q is the total quantity marketed, **Z** represents a vector of marketing cost. This model is consistent with Gardner's structural analysis where he models the determinants of supply and demand at each level of the marketing chain in

both a competitive factor and product market using a simultaneous equation system. This model suggests that depending on the source of change – whether it is retail prices, farm output or the supply of marketing services – the relative effects on the price margin will differ. However, because shifts in both demand and supply can cause changes in retail prices and farmer output, a complete analysis of the marketing margin would require structural equations for all market participants at all stages of marketing system, from production to consumption. Such a model of a vertical marketing chain would be very complicated and require extensive amounts of data. Another problem is that $P_r$ is contained in M since M is defined as $P_r - P_f$.

*Marketing Cost Model*

Wohlgenant and Mullen derived what is known as the marketing cost model. Here, they assumed that marketing firms provided services up to the point where the marginal cost of providing such services equaled the marginal revenue from offering that service. Therefore they argue that marketing margins are determined solely by the quantity of the farmers' output and the retail firms' cost function. This model can be expressed as;

$$M = f(Q, \mathbf{Z}) \qquad (3)$$

where Q is the quantity of the farmers' output and $\mathbf{Z}$ is the vector of input costs. This definition of the farm-retail spread is consistent with Tomek and Robinson's second definition of marketing margins, which states that margins are essentially the price of a collection of marketing services. The problem with this model is that once again there is a potential endogeneity. M will undoubtedly affect $P_r$ and $P_f$, which effects Q over time.

## 4.2 Methodology

The empirical model used in this paper relies on the basic economic justification of the Marketing Cost Model discussed in the previous section, with some modifications. Starting from the theory that price margins are the sum of marketing services (Tomek and Robinson, 1990), the maize marketing margin will be modeled as a function of processing and marketing cost and will follow the work of Guba et. al., 1998. The particular feature of the maize-milling regime within South Africa necessitates the need to redefine the marketing margin. Since the milling industry in general tends to be vertically integrated with the retailing of maize meal, retail prices and wholesale prices (at which millers purchase) are available; maize meal prices ex-mill are not. Hence, the marketing margins that will be estimated will essentially be a processing plus retailing margin. Secondly, as mentioned in the previous chapter, in the actual process of milling the maize whole grain, depending on the level of sifting used, there are by-products that result and are later sold. For instance, some of the by-products that result are used as an input to livestock feed, dog food and cooking oil. Therefore, for the purpose of this study, the formula used to estimate the milling margins will be an adaptation of Jayne and van Zyl's miller/distributor margin (1994). The formula is:

$$MM = PMM/z - PS + [(z-1)*PB] + S2 \qquad (1)$$

where PMM equals the retail price of maize meal, z represented the average extraction rate (i.e. tons of grain required to produce one ton of meal), PS is the wholesale price of the maize grain, PB the price of the by-product and S2 the direct subsidy given to maize millers. The difference in this study is that there is no subsidy when calculating the

milling-retail price margins since during the period under study there were no government transfers made to consumers or millers of maize grain.

To model the wholesale to milling/retail margin a general, a reduced form data generating process (DGP) can be formulated. The DGP equation is as follows:

$$M_t = X_t^*\beta i^* + U_t \qquad (2)$$

Where $M_t = P_r/z - P_w + [(1-z)^*PB]$ is the wholesale-to-milling/retail margin. Here $P_r$ is the retail price of maize meal, z the average extraction rate (i.e. tons of grain required to produce one ton of meal), $P_w$ is the wholesale price of the maize grain, PB the price of the by-product. In equation (2) $X_t^*$ includes all the exogenous variables affecting the margin within the market, and $U_t$ is an identically and independently distributed error term.

Not all of the $X_t^*$ variables can be identified because of the lack of observable data. Therefore we can re-write $X_t^*\beta i^*$ as being composed of two parts;

$$X_t^*\beta i^* = X_t\beta_i + H_t\alpha_i \qquad (3)$$

where $X_t$ contains the observable data and $H_t$ the unobservable data. We can now write the DGP equation as:

$$M_t = X_t\beta_i + V_t \qquad (4)$$

where:

$$V_t = H_t\alpha_i + U_t \qquad (5)$$

is the Wold representation of the stochastic component of $Z_t\alpha$ and $U_t$. Any deterministic mean, trend, or seasonal component of $H_t\alpha$ can be incorporated in the intercept, trend or seasonal component of $X_t$.

The variables included in $X_t$ are rainfall, marketing and processing costs (e.g. labor), macroeconomic risk, monthly seasonal dummy variables, time trend and a

categorical variable differentiating the period before and after market liberalization. Assuming that there is a linear relationship between the price margin and the independent variables, equation 4 becomes:

$$MM_t = \delta_0 + \delta_1 L_{t-1} + \delta_2 R_{t-1} + \delta_3 W_t + \delta_4 LIB_t + \delta_5 T_t + \Sigma^{11}_{m=1}\delta_i D_{mt} + V_t \quad (6)$$

L represents labor costs to the millers, R is a measure of macro-economic risk, W is a rainfall index, LIB is the categorical variable which differentiates the time period before and after market liberalization, T is the time trend, and $D_{mt}$ are 11 months dummy variables. Equation 6 is estimated on monthly data. In this model, it is assumed that one month is long enough for farmers or firms at different marketing levels to finish adjusting to market signals, therefore the labor costs and macro risk variables have been included as lagged variables.

There are three points that need to be made. Firstly, while other marketing margin models have used Q (the total quantity marketed or total quantity of farmer's output) as an explanatory variable, in this study we have chosen not to include Q because of potential endogeneity. Instead we have chosen to include an exogenous variable that affects Q, in particular the rainfall index. Secondly, since the calculation of the milling/retailing margins contain $P_r$ (retail prices) and $P_w$ (wholesale prices), to include them in model would lead to problems with endogeneity. Instead exogenous variables, such as L (labor costs) and R (macro-economic risk), which affect both retail and wholesale prices, have been included. Finally, in using time series data to estimate the model there exists the potential of a unit root in the milling/retail margin series which could potentially lead to the problem of I(1) cointegration. However, in conducting an Augmented Dickey-Fuller test for unit root, it was found that although the value of $\rho$ =

9.02 which is < 1 in the AR(1) model, the t-statistic for the unit root test was –3.80 < -3.66 which was the critical value for the 2.5% level of significance. In other words, we reject the hypothesis of a unit root at the 2.5% level of significance. This indicates that the time series process is I(0), in other words, the first difference of the process is weakly dependent; therefore, nothing needs to be done to the series before using them in the regression analysis.

When Ordinary Least Squares method of estimation was applied to equation 6, it was found that the milling/retail margin model exhibited serially correlated error terms. The *p*-values = 0.000 of the coefficient ρ on $V_{t-1}$ leads us to reject the null hypothesis of no serial correlation at the 1% level of significance and conclude that there exists autocorrelation of the 1st degree, i.e. AR(1) serial correlation. Furthermore, after the model had been corrected for serial correlation using the Cochran-Orcutt method and was tested for heteroskedasticity using the Breusch-Pagan Test, it is found that the F-statistic's *p*-values < 0.0005 therefore we reject the null hypothesis of homoskedasticity. In order to address these problems, heteroskedasticity and serial correlation shall be modeled and corrected for through a combined weighted least squares AR(1) procedure. The steps involved in this process include (Wooldridge, 2000):

a) Estimating equation (6) by OLS thereby predicting the residuals, $V_t$
b) Calculating $\log(V^2_t)$ on the independent variables and obtain the fitted values, $g_t$
c) Calculate the estimate of $G_t = \exp(g_t)$
d) Then estimate the transformed equation by standard Cochran Orcutt (CO) or Prais-Winsten (PW) methods.

$$G_t^{-1/2}MM_t = G_t^{-1/2}\delta_0 + G_t^{-1/2}\delta_1 L_{t-1} + G_t^{-1/2}\delta_2 R_{t-1} + G_t^{-1/2}\delta_3 W_t + G_t^{-1/2}\delta_4 LIB_t + G_t^{-/12}\delta_5 T_t$$

$$+ G_t^{-1/2}\Sigma^{11}_{m=1}\delta_i D_{mt} + V_t \quad (7)$$

The resulting feasible GLS estimators are asymptotically efficient and all the standard errors and test statistics from the CO or PW methods are asymptotically valid.

**4.3 Data and Variable Discussion**

The definition and expected sign for each of the right-hand side variables in (6) are discussed briefly as well as their calculation and source.

*Producer Price* ($P_p$)

The source of this pricing data was the "*Abstract of Agricultural Statistics: 2001*", which is published by the National Department of Agriculture in South Africa. The price schedule is reported in nominal terms, as the gross white maize producer prices. These are the estimated average prices aggregated over the entire country. The prices recorded in Appendix B are in real terms, having been deflated using the CPI with the base year 2000 = 1.

*Retail Prices* ($P_r$)

Between the marketing years 1970/71 and 1993/94, the retail prices were obtained from the Maize Board annual reports, measured in Rands per ton. However, since the Board stopped compiling retail price information after 1994, these prices were constructed for 1995/96 through to 2000/01 by extracting the prices from the retail CPI. This index is simply calculated by taking the average prices of all the different brands and qualities from across the entire country and calculating an average index. The retail price for maize meal in this index was measured in Rands per 5kg bag of meal, which is the most common sized package. To get this measurement in Rands per ton, we multiplied the 5kg price by 200 then deflated it using the CPI.

*Wholesale Prices* ($P_w$)

The source of the wholesale prices from 1970/71 to 1994/95 marketing season is the "Abstract of Agricultural Statistics, 2001". The reported figures are the selling price of large quantities[1]. We assume that after 1995, the millers' primary source of maize grain the open market via the grain market exchange, SAFEX[2]. Therefore, for the 1995/96 to 2000/01 marketing seasons, SAFEX spot white maize wholesale prices were used in our data set. As with the producer prices, the wholesale prices have been deflated using the CPI with the base year in 2000.

*Salaries and Wages* (L)

To control for the effect of labor costs on the milling margins, a wage variable was included in the model. Since the information regarding the wages specifically in the milling industry is not available, the average wage and salary measures for the manufacturing sector within South Africa was used. The primary sources of information included Labour Statistics Employment & Salaries & Wages: Mining and Quarrying, Manufacturing Construction and Electricity and Labour Statistics: Survey of Employment & Earnings in Selected Industries, both of which are statistical releases complied by the Statistical Services of South Africa. For the years 1997-2001, the total gross salaries and wages, which include severance, termination and redundancy payments, were divided by the number of full and part-time employees to get the average

[1] Large quantities: 190 tons and more
Prior to 1982/83: 216 tons and more
Prior to 1979/80: 380 tons and more
Prior to 1971/72: 453 tons and more

[2] The deregulation of markets led to the establishment of a futures market. Early in 1995 SAFEX Agricultural Derivative posted its first agricultural commodity on the exchange market. The exchange trades on average 90,000 tons of maize a day. Over 420,000 contracts have traded since 1995, with the bulk of the trades arising from the white maize contract.

quarterly salaries and wages per worker. Then this number was divided by quarterly payments into the marketing season (May 1st - April 30th). Finally, these wages were deflated, using the CPI(2000), in order to get them into real terms. The coefficients on labor costs can be either positive or negative. Therefore changes in this input cost can enlarge or depress the margin.

*Macroeconomic Risk* (R)

In an economy that undergoes transitions, such as in the case of South Africa, moving from a controlled agricultural market to a liberalized market-driven sector, macroeconomic risk will likely affect all markets involved in the sector. Therefore using price uncertainty in a given market may underestimate the real risk faced by marketing agents (Guba et al, 1998). Macroeconomic risk can reflect the uncertainty in both input and financial markets, as well as in output markets. It is for this reason that macroeconomic uncertainty has been used instead of price uncertainty to reflect the risk faced by the marketing agents in the maize subsector.

The exchange rate has been used to measure macroeconomic risk in our model. To calculate this rate, we assume that the maize industry's perception of macroeconomic risk is based on the past years' experiences as well as current observation. In other words, the macroeconomic risk R variable is measured as the squared value of $(E_t - E_{t-1})$. The coefficient of R is expected to be positive. The exchange rate data were compiled by Statistics South Africa.

*Weighted Average Critical Rainfall per Province* (W)

South African Weather Service (SAWB) and Weatherscape are the two main sources for the average monthly rainfall data, measured in millimeters, from 1970-2001.

Since maize marketing margins are not ultimately affected by rainfall in every month within the marketing year but specifically by rainfall in the critical months from October to April, a rainfall index, which placed higher importance on rainfall during those critical months, was used. In order to generate this rainfall index, the average rainfall during the months of October to April for each of the maize growing provinces was weighted by the proportion of maize production per province over the entire observation period, then summed the measurement over the entire country to get the final index for marketing year. See Appendix B.4 for the table that shows you the calculation of such weights. There are two potentially countervailing effects of rainfall on the milling/retail margin. If strong scale economies exist in the market, then increase in output Q could lead to a reduction in the margin. But also, since the margin can be defined as the difference between retail and producer prices, one could hypothesize that if output increased, this could lead to a reduction in producer prices, more so than retail prices, especially if retail industry is concentrated. Hence marketing margins will increase.

*Policy Change* (LIB)

If market liberalization has the effect of leveling the playing field, thereby allowing small, private processing and marketing firms to compete directly with large-scale millers, then the marketing margin would be expected to decrease. Then the coefficient on the dummy variable LIB would be negative if LIB takes on the value 1 in the post reform periods and 0 otherwise.

*Time Trend* (T)

Although nothing about trending variables necessarily violates the classical linear model assumptions of OLS, it is important to allow for the fact that many economic time

series have a common tendency to grow over time, and that the unobservable factors that cause the dependent variable to grow overtime might be correlated to the growth in explanatory variables. Therefore, it is important that a time trend variable be included in the model in order to capture this phenomenon or we may find a spurious relationship between the margins and one or more of the explanatory variables. If the coefficient on the time trend variable is positive, then we can conclude that over time the milling/retail margin is growing after netting out other factors in the other explanatory variables, which themselves might be trending. In other words, the milling/retail margin has an upward trend. However if the coefficient is less than zero, then we can conclude that $M_t$ has a downward trend, i.e., the marketing margins are shrinking over time.

*Seasonal Dummy Variable* (D)

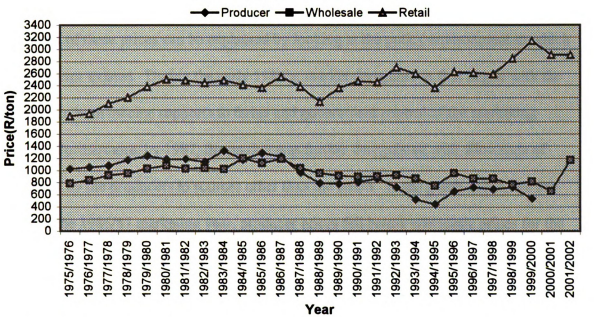
Since the data are collected on a monthly basis, it is very possible that they may exhibit seasonality. The way in which is capture this affect is to allow the expected value of the series on the dependent variables to vary in each month by including dummy variables for each of the 11 months in the year. If there exists no seasonality in the margins once the structural variables have been controlled for, then it would be expected that $\delta_6$ through $\delta_{16}$ would all be zero. This can be easily tested by an F-test.

## CHAPTER 5: RESULTS

### 5.1: Descriptive Statistical Results

Figure 5.1 below depicts the movement of deflated annual average producer, wholesale and retail prices in the maize market, starting in the marketing year 1975/76 through to 1999/2000 for producer prices, and 2001/2002 for wholesale and retail prices.

**TABLE 5.1: Producer, Wholesale, Retail Maize Price Spreads (Constant 2000 Rands): 1975/76 to 2001/02**




From 1975/76 through to 1979/80 marketing years there is a clear upward trend in producer, wholesale and retail maize prices. During this time frame, producer prices were above wholesale prices, indicating a negative farm-gate to wholesale margin. This is not surprising since the maize market was operating under a single-channel fixed price scheme during this period. Under this scheme, the Maize Board was the sole buyer of whole grain maize. From the price spreads, it appears that in general the Maize Board would buy high, then sell at an even lower price.

During the period spanning the 1980/81 marketing year through to 1994/95 marketing year there is an overall stabilization of all three prices the first half of the period, then from 1986/87 onwards there are two things occur that are of interest. Firstly, from 1985/86 to 1994/95 there is an overall slight decline in real terms of both producer and wholesale prices while retail prices appear to remain relatively constant. Secondly, in terms of the wholesale and retail price spread there is a closing of gap between the two price spreads with an eventual fall in producer prices to below wholesale prices. The movement of these prices can be explained by looking at the policy environment in which the sub-sector existed. During the early 1980's, market deregulation first began with the reduction in both income supports to farms and government control of the marketing channel. Furthermore, by 1987, the market was further deregulated with allowance of grain sales by the producers to sources other than the board. In the graph above, we see that after the 1986/87 marketing year, producer prices fell below wholesale prices for the first time during the period under observation. From 1987/88 until 1994/95, both price series display a downward trend. In the case of deflated retail prices, after the 1986/87 marketing year the average retail price fell for two consecutive years, then despite falling wholesale and producer prices, this price series shows a positive upward trend, further widening the gap between retail and wholesale prices, i.e. indicating an increase in the milling/retailing margin.

With the intended full market deregulation set for the beginning of the 1995/96 marketing season, there is a sudden increase in all three prices after the 1994/95 marketing year. However, since full deregulation did not materialize until the beginning of the 1997/98 marketing year, there is an almost constant growth in all three prices

during the period of market transition. However, after 1997/98 marketing season there is a clear divergence in the three prices. For instance, in the case of producer prices, there is a slight increase in prices from 1997/98 to 1998/99 then a sudden drop between the marketing years 1998/99 and 1999/00. With wholesale prices, there is an initial decreasing trend until after 2000/01 marketing season, when the wholesale prices suddenly increase dramatically. In the case of retail prices we see again an upward trend despite falling wholesale and producer prices, however between 2000/01 and 2001/02 marketing seasons, the annual average price remains constant despite the sharp increase in wholesale prices.

Looking at the movement of the calculated wholesale to mill/retail margins in real terms, it is clear that over the entire period under observation this margin has displayed an upward and increasing trend.

**FIGURE 5.2: Movement of Real Milling/Retail Margins ($P_r$-$P_w$) in South Africa (constant 2000 Rands): 1975/76-2001/02**

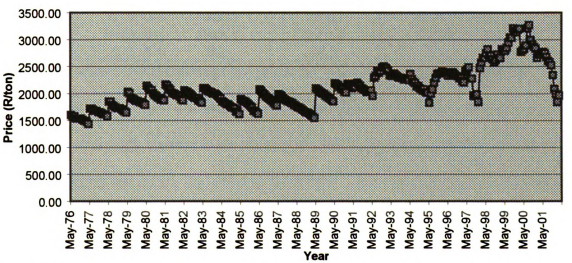



Figure 5.2 above depicts the movement of monthly real milling/retail margins ($P_r$-$P_w$) in the maize sub-sector. From May 1976 through to April 1983 the mill margin showed an upward trend. Although growth seemed to slow from May 1984 to April 1989, we see

that from May 1989 through to April 2000 there was again an upward trend in the milling/retail margin. However from May 2000 to April 2001 we see a decisive drop in the milling margin in real terms. This spread appears to indicate the existence of a unit root, but as we shall see in the next section, $\rho < 1$ in the AR(1) model, indicating that the time series process is I(0), i.e., the first difference of the process is weakly dependent; therefore, nothing needs to be done to the series before using them in the regression analysis.

As a prelude to econometric analysis, the CPI-adjusted producer, wholesale, retail, and milling/retail margin summary statistics were calculated for the periods 1976/77 – 1979/80 [Post-war era]; 1980/81 – 1994/95 [Policy reform and structural adjustment]; and 1995/96 – 2000/02 [Post-apartheid market liberalization]. The results are summarized in Table 5.1 below.

| TABLE 5.1: Summary Statistics<br>Producer, Wholesale, Retail Prices & Milling Margins | | | |
|---|---|---|---|
| | *1976/77-1979/80* | *1980/81-1994/95* | *1994/95-2000/02* |
| ***Producer*** | | | |
| Mean | 1134.2 | 962.6 | 666.2 |
| Std Deviation | 84.8 | 274.7 | 71.6 |
| Variance | 7196.1 | 75470.4 | 5131.9 |
| Minimum | 986.7 | 421.1 | 520.7 |
| Maximum | 1333.2 | 1383.4 | 760.2 |
| C.V. (%) | 7.5 | 28.5 | 10.8 |
| ***Wholesale*** | | | |
| Mean | 934.5 | 995.5 | 869.6 |
| Std Deviation | 77.1 | 127.2 | 217.5 |
| Variance | 5940.1 | 16182.8 | 47287.2 |
| Minimum | 786.7 | 713.3 | 500.4 |
| Maximum | 1110.3 | 1287.0 | 1810.9 |
| C.V. (%) | 8.3 | 12.8 | 25.0 |
| ***Retail*** | | | |
| Mean | 2154.2 | 2445.8 | 2800.0 |
| Std Deviation | 180.4 | 154.2 | 234.9 |
| Variance | 32561.7 | 23768.0 | 55181.9 |
| Minimum | 1813.3 | 1994.5 | 2295.2 |
| Maximum | 2565.2 | 2798.6 | 3291.9 |
| C.V. (%) | 8.4 | 6.3 | 8.4 |
| ***Mill Margin*** | | | |
| Mean | 1696.8 | 1992.0 | 2550.5 |
| Std Deviation | 143.4 | 205.4 | 355.5 |
| Variance | 20564.7 | 42174.8 | 126353.9 |
| Minimum | 1428.3 | 1544.2 | 1828.3 |
| Maximum | 2023.0 | 2498.3 | 3265.4 |
| C.V. (%) | 8.5 | 10.3 | 13.9 |

The results indicate that the average real prices for maize at the farm-gate fell from approximately R1134 per ton to about R666 per ton. In the case of wholesale prices, although there is slight increase in the average wholesale price from the post-war era to the policy reform era, during the period of full market liberalization there is a decrease in the average wholesale price below that of the controlled period price. This occurs despite the fact that from Figure 5.1 we see a sharp increase in wholesale prices in the 2001/02 marketing season. In the case of retail prices, from each period to the next there is an increase in the average retail price of maize meal from approximately R2154 per ton in

the post-war era to about R2706 per ton in real terms. Not surprisingly, then, the milling/retail margins increase from approximately R1697 per ton in the post-war era, to approximately R2550 per ton in the post-apartheid market liberalization era.

The variability in monthly producer, wholesale, and retail prices as well as in milling/retail margins are also presented in Table 5.1. Moving from the period of partial liberalization to full-fledged market liberalization, the coefficient of variation has declined for the producer prices, from 28.5% to 10.8%. This decline indicates an increase in stability of producer prices in absolute terms. However, the measures of variability, i.e. CV, for the wholesale price, retail price and the milling margin have increased in absolute terms, indicating that the mean level of the price spreads have declined to a greater degree than the absolute volatility of the spreads. The standard deviation of each of these spreads gives similar results. It is important to note here that price instability does not necessarily indicate price unpredictability. For instance, in a market such as the maize sub-sector, some variation in prices is predictable due to intra-seasonal price increases after the harvest used to induce incentives for grain storages for later consumption (Jayne, et al., 1998).

Table 5.2 below provides basic information on the variables in equation 7 of Chapter 4. Comparing the minimum with the maximum and the standard deviation with the mean, Wage, Rainfall, Macro Risk, Mill and Marketing Margins all display significant variation between 1976/77 and 2001/2002.

| TABLE 5.2: Descriptive Statistics, 1976/77 - 2001/02 | | | | | |
|---|---|---|---|---|---|
| | *Avg. Wage* | *Rainfall Index* | *Macro Risk* | *Mkt. Margin* | *Mill Margin* |
| Mean | 3901.1 | 575.1 | 0.0098979 | 2111.6 | 2095.5 |
| Standard Deviation | 464.8 | 116.3 | 0.0450523 | 461.8 | 383.6 |
| Sample Variance | 223344.0 | 13524.1 | 0.0020297 | 213226.8 | 147162.7 |
| Minimum | 2411.8 | 410.6 | 0.0000000 | 1289.2 | 1428.3 |
| Maximum | 5234.4 | 893.6 | 0.7012890 | 3487.9 | 3265.4 |
| C.V. (%) | 12.1 | 20.2 | 455.2 | 21.9 | 18.3 |

One point to note is the variation in the measure of macroeconomic risk, R. This high C.V. is an artifact of the mean being very close to zero; so even a small absolute standard deviation becomes a large C.V. as the mean approaches zero.

## 5.2: Econometric Results

The analysis so far has considered the effect of liberalization on marketing spreads without controlling for changes in other factors that are likely to affect marketing margins. Table 5.3 presents the results of the FGLS estimation results for the milling/retail margin.

**TABLE 5.3: Milling/Retail Margin Determination of the Wholesale-Retail Market in South Africa; May 76 - April '00**

| Dependent Variable | Regression 1 FGLS w/o Interaction Term | Regression 2 FGLS Piecewise |
|---|---|---|
| Constant | 4.019 | 6.58 |
| | (0.7805)** | (1.049)** |
| Wages lagged | 0.282 | 0.23 |
| | (0.029)** | (0.234)** |
| Macro Risk lagged | -167.93 | 296.44 |
| | (118.17) | (115.1)* |
| Rainfall Index | -0.08 | -0.35 |
| | (0.121) | (0.148)* |
| Liberalization Dummy | 148.54 | -379.72 |
| | (56.461)** | (97.993)** |
| Time Trend | 2.355 | 2.567 |
| | (0.337)** | (0.317)** |
| Liberalization*($T_t$ - $T_0$) | - | 14.36 |
| | - | (3.796)** |
| June | 25.464 | 67.39 |
| | (17.630) | (17.207)** |
| July | -128.26 | -51.84 |
| | (36.735)** | (23.121)* |
| August | -154.69 | -105.35 |
| | (36.735)** | (28.014)** |
| September | -125.45 | 29.62 |
| | (31.249)** | (29.179) |
| October | -159.61 | -5.88 |
| | (34.567)** | (28.863) |
| November | -229.97 | -152.49 |
| | (39.036)** | (30.014)** |
| December | -188.82 | -273.23 |
| | (31.856)** | (35.348)** |
| January | -441.95 | -456.42 |
| | (47.363)** | (45.957)** |
| February | -90.11 | -90.86 |
| | (26.237)** | (24.998)** |
| March | -111.28 | -215.86 |
| | (23.189)** | (24.782)** |
| April | -216.73 | -290.12 |
| | (20.504)** | (23.345)** |
| Diagnostics | | |
| # of Observations | 296 | 296 |
| $R^2$ | 0.9675 | 0.9578 |
| Adjusted $R^2$ | 0.9656 | 0.9552 |
| F Statistic (16, 279) | 518.83 | 370.75 |
| Prob > F | 0.0000 | 0.0000 |
| Rho | 0.861 | 0.892 |
| Durbin-Watson Statistic | 2.25 | 2.04 |

*Significant at 5% level **Significant at 1% level (.)Standard deviations

*Regression 1: FGLS without an interaction term*:

$\delta_0$ = 4.019 is the predicted milling/retail margin that will result when all other variables are set at zero. However, since no one would work without wages, the intercept in this equation in not by itself meaningful.

$\delta_1$ = 0.282: The slope coefficient on wages indicate that the lag affect of a R1 increase in average monthly wages, above its long-run trend, on the milling/retail margin is an approximate twenty-eight cents increase in the margin, ceteris paribus.

$\delta_2$ = -162.93: The slope coefficient on the Macro-economic risk variable suggests that when the macroeconomic risk index increases by one unit above its long-run trend, the milling/retail margin is expected to decrease by approximately R163 per ton, ceteris paribus. However, in the regression this coefficient is found to be statistically insignificant, i.e. it has little explanatory power in the existing model.

$\delta_3$ = -0.077: The slope coefficient for rainfall indicates that as the rainfall index increases by one above its long-run trend, the milling/retail margin is expected to decrease by approximately R0.08 per ton, ceteris paribus. This outcome is not what would be expected, however this coefficient is not statistically significant and therefore has little explanatory power.

$\delta_4$ = 148.54: The slope coefficient for the market reform dummy indicates the difference in the monthly milling/retail margin between the pre and post liberalization periods. In other words, given the same level of wages, rainfall, macro-risk, the milling/retail margins were approximately R148 per ton higher after market liberalization.

$\delta_5$ = 2.355: The time trend variable's coefficient implies an approximate R2 per ton increase in milling/retail margin per month, on average, ceteris paribus.

$\delta_7$-$\delta_{17}$ = the test of the joint significance of the 11 monthly dummy variables yields a *p* -value < 0.005, therefore leading to the conclusion that the seasonal dummies are jointly significant at the 5% level of significance.

DW= 2.25: This allows us to assume no further autocorrelation.

$\rho$ = 0.861: Since this value is < 1, it indicates that the time series process is I(0), i.e. the first difference of the process is weakly dependent; therefore, nothing needs to be done to the series before using them in the regression analysis.

In this model, the $R^2$ measure indicates that approximately 96% of the sample variation in the milling/retail margin is explained by the independent variables included in our model.

The coefficient on lagged macro-economic risk was found to be statistically insignificant at both the 1% and 5% level of significance. This finding is surprising since from theory one would expect changes in the exchange rate to influence milling/retailing margins since maize is an important export commodity in South Africa.

Most notable, the liberalization dummy variable has a very large and highly significant positive coefficient. This situation can be depicted graphically as an intercept shift between milling/retail margins over time. In the model, the intercept for milling margins before market liberalization is $\delta_0 = 4.018529$, whereas the intercept after liberalization is $\delta_0 + \delta_4 = 152.555829$. Although it would be expected that market liberalization would lead to a decrease in the real milling/retail margin due to increased competition from the informal sector and other small-to-medium scale millers, our finding indicate otherwise. Therefore, we conclude that this margin differential is due to market reform policies or factors associated with market reform that we have not controlled for in the regression.

*Regression 2: Piecewise Regression Allowing for Discontinuity*

If we wanted to allow for changes in the slope of the milling/retail margins with the restriction that the line being estimated not be discontinuous, we would use a piecewise linear model, which allows us to assume no discontinuity or shift in the intercept of milling/retail margin from year to year. The model to be estimated is as follows:

$$MM_t = \delta_0 + \delta_i Z_{it} + \delta_5 T + \delta_6 Lib(T - T_0) \qquad (9)$$

where Z is a vector containing all the explanatory variables used in the original model, T is the time trend and $T_0$ is the month in which the structural change occurred. The interpretation of this model is as follows:

1. The estimated milling/retail margins years prior to liberalization is found by;

$$E(MM_t) = \delta_0 + \delta_i Z_{it} + \delta_5 T \qquad (10)$$

where the slope of the line is $\delta_5$ and the intercept is $\delta_0$.

2. The estimated milling/retail margins after liberalization is found by;

$$E(MM_t) = \delta_0 + \delta_i Z_{it} + \delta_5 T + \delta_6 Lib(T - T_0) \qquad (11)$$

Where the slope of this line is $\delta_5 + \delta_6$ and the intercept is $\delta_0 - \delta_6$. However if we were interested in estimating the change in the milling/retail margins just after the regime change occurs, i.e. allowing for discontinuity, we would include the liberalization dummy variable in our new model. The resulting model to be estimated that allowed for a discontinuous slope change would be as follows:

$$E(MM_t) = \delta_0 + \delta_i Z_{it} + \delta_4 Lib + \delta_5 T + \delta_6 Lib(T - T_0) \quad (12)$$

In this equation $\delta_4$ measures the estimated milling/retail margin differential at the point when the maize market moves from pre-reform to post-reform period, i.e. from April to May 1997.

The results of equation 12 are summarized in Table 5.3 above. Below is an interpretation of the coefficients estimated in the regression.

$\delta_0$ = 6.58: is the predicted milling/retail margin that will result when all other variables are set at zero, i.e., it is the intercept term when we plot the milling/retail margins against time.

$\delta_1$ = 0.227: The slope coefficient on wages indicate that the lag affect of a R1 increase in average monthly wages above its long-run trend, is an expected increase in the milling/retail margin by about twenty-two cents, ceteris paribus. This estimate is not much different from the first regression.

$\delta_2$ = 296.44: The slope coefficient on the Macro-economic risk variable suggests that when the macroeconomic risk index increases by one unit above its long-run trend, the milling/retail margin is expected to increase by approximately R296 per ton, ceteris paribus.

$\delta_3$ = -0.347: The slope coefficient for rainfall indicates that as the rainfall index increases by one above its long-run trend, the milling/retail margin is expected to decrease by approximately R0.65 per ton, ceteris paribus.

$\delta_4$ = -379.72: This coefficient measures the estimated milling/retail margin differential at the time when the maize market moves from the pre-reform to post-reform period. It implies that in the month following market liberalization the milling/retail margin fell by an approximate R380 tons per ton, ceteris paribus.

$\delta_5$ = 2.567: The time trend variable's coefficient is the slope of the line which plots the milling/retail margin against time. It is essentially the rate that the margin grows

over time before market liberalization. It implies an approximate R3 per ton increase in milling/retail margin per month, on average, ceteris paribus.

$\delta_6$ = 14.361: This coefficient gives us the difference between the slope of the milling/retail margin before and after market liberalization. This measure implies that after the structural change occurred, the milling/retail margins rate of growth increased by an approximate R14 per ton, ceteris paribus.

$\delta_7$-$\delta_{17}$ = the test of the joint significance of the 11 monthly dummy variables yields a *p* value < 0.001, therefore leading to the conclusion that the seasonal dummies are jointly significant at the 1% level of significance.

The result of this regression raises several interesting points that are worthy of comment. Firstly, looking at the estimated coefficients on the Macro-Risk and Rainfall Index, we see that unlike the first regression, they become statistically significant at the 5% level of significance when we model our milling/retail margin as a spline-function. Particularly in the case of the Macro-Risk parameter, it not only became statistically significant, it also changed signs.

Secondly, from this regression we see that in the month immediately following market liberalization, the milling/retail margin fell by approximately R380 per ton, ceteris paribus. This result is not surprising since it is what we would expect given Figure 5.2, which depicts the movement of real milling margins throughout the entire observation period. In this figure it is clear that there was a decline in the milling margin in the month following May 1997. In fact, according to the graph, the milling margin does not return to normal levels until approximately two years later. One plausible interpretation of these results is that the regulatory reforms did introduce greater competition temporarily, but that over time, firms were able to adjust, somehow restrict entry by small-scale millers, and reintroduce an oligopolistic pricing structure once again. However, this is just one interpretation of the results. The results do not indicate the

reason for the rise in margins after a temporary fall; it would require future research to discover the reasons behind these findings.

Finally, comparing the coefficient $\delta_5 = 2.567$ and $\delta_6 = 14.361$ it clear that there is a significant difference between the slope of the milling/retail before and after market liberalization. In essence, what this means is that in the period prior to market reform, the slope of the milling/retail margin was approximately 2.56, i.e. the milling/retail margin was growing at an average rate of R2.56 per ton each month, ceteris paribus. After market reform, this rate of growth changed to 16.927673, i.e. the milling/retail margin grew at an average rate of approximately R17 per ton each month, ceteris paribus.

If we were to plot milling/retail margins against time, the results from our second regression would show an upwards sloping function which, at T=May 1997 had a discontinuous drop of approximately 379, then continues grow over time with a steeper slope than before until approximately 25 months later, when milling/retail margins becomes higher than milling/retail margins in the pre-reform period.

## 5.3: Conclusion

The results of our empirical analysis lead us to conclude that despite market liberalization in the maize sub-sector, milling/retail margins have not only continued to grow in real terms in the post-reform period but appear to be growing at a faster rate. Although economic theory would tell us that market liberalization should lead to an increase in competition from the informal sector and other small-to-medium scale millers and therefore a reduction in the real milling/retail margin, in the case of South Africa, this has not been the case. Our results indicate that market liberalization had no impact on the marketing behavior of the milling/retail industry except to see a continued increase in

retail prices in real terms, leading us to assume an existence of monopoly power within the market or at the very least collusion among industry players.

# CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATONS

## 6.1: Summary

Pre-liberalization studies of Southern Africa have shown that South African maize-meal milling/retailing margins tended to be high compared to other countries within the region. In particular, the miller/retailer margin in South Africa was found to be more than twice that of neighboring Zimbabwe, although both industries faced comparable cost structures and Zimbabwe's milling industry was concentrated among fewer millers.

Within the context of political reform and international trends of market liberalization, the South African agricultural sector, throughout the late 1980's and most of 1990's underwent gradual stages of market liberalization. The goals and methods of market reform are clearly laid out in the Reconstruction & Development Program (RDP) document, the Broadening Access to Agriculture Thrust (BATAT) initiative, as well as the 1995 and 1997 White Paper on Agriculture. In particular, the ANC policy document on agriculture, as the over-reaching goal of market liberalization, explains the need to ensure affordable and sustainable prices of basic foodstuffs for low-income groups.

The objective of this study was to determine econometrically the effect of market liberalization on the maize milling/retailing margins within South Africa in order to evaluate the effectiveness of market reform in attaining its goal of "affordable and sustainable prices" on maize-meal, a basic food good.

## 6.2: Research Finding

Standard Industrial Organization theory would predict a reduction in the real price margins between processed and raw agricultural products due to entrance into previously

closed markets by the informal sector, thereby increasing competition among industry players. Feasible General Least Squares method of estimation was applied to two reduced form linear models of the milling/retailer margins in which a binary explanatory variable was included in both to capture the effect of market liberalization. The findings are summarized below:

1. The first model looked at the difference between the pre and post-reform periods. The model showed that despite the market change, the milling/retail margin increased overall by about R148 per ton of maize meal within the post-reform period.
2. The second model allowed for changes in the slope, with the restriction that the line being estimated only be discontinuous just after the regime change. The results of this model indicate that although the milling/retail margin fell just after the structural change occurred, its rate of growth increased by approximately R14 per ton of maize meal per month following the reforms.

These model findings are clear; despite market liberalization, the maize sub-sector's milling/retail margins not only continued to remain high, but grew at an increasing rate. The overall implication of these margins on the nation's food security is clear. The existence of these high margins indicates high real retail prices of maize meal, a staple food for many South Africans, and therefore an overall decline in the real income of the poor, resulting in increased food insecurity within the nation. In essence, it appears that market liberalization has not be successful in realizing the goal of affordable and sustainable prices of basic foodstuffs for low-income groups.

## 6.3: Policy Suggestions

Over the past two years, the problem of rising food prices, particularly in the case of maize and other basic foods, has gotten increasing attention in the news and media of South Africa[1]. The basic stance is that despite freed control structures within the maize sub-sector, maize meal prices have continued to increase overtime. In general, three reasons are given as to why these high maize prices exist.

1. High producer prices based on unjustified import-parity pricing based in part on persistent official underestimates of crop yields (Dialogue, 2002). It has been shown that South Africans are paying 70% more for whole grain maize than if they used export-parity as a pricing mechanism (Liberty News, 2002). In fact, the prices paid currently for maize grain reflects the US price plus the shipping costs and South African import duties.
2. There is also the concern that the benefit of the VAT zero rating on basic foodstuffs is not being passed onto the consumers (Dialogue, 2002). This is assumed since surveys of certain retail stores have found that the cost of brown bread, which is tax exempt, is equivalent to or at times more than the cost of white bread. This suggests profiteering by the producers and retailers at the cost of the poor.
3. These high food prices have also been associated with the high level of concentration of ownership in production and processing, as well as in formal retailing (Dialogue, 2002).

A competitive market is not created by the absence of government regulations, rather it flourishes when the correct set of regulations is enforced by a public agency (Essinger,

2000). Due to high levels of concentration in both production and food processing stages of the maize sub-sector, it is important that the S.A. government establish clear policy guidelines that outline the government's objectives and policy instruments. The World Bank (1994) distinguishes three policy approaches that are available to the government:

1. Laissez-Faire: Government adopts a passive attitude towards concentration with the hope that the possible benefits of economies of scale and competitiveness within the international market to outweigh the potential costs from monopolistic pricing.
2. Active Anti-Trust Approach: Under this policy approach, the mandate and the power of the Competition Board would be increased in order to reduce the existing levels of concentration through forced divestment of holdings by major firms. Implementation of this policy approach would in practice be difficult to enforce. First, there is a lack of information to pursue legal action against monopolies. Second, forced sales of subsidiaries are likely to purchased by existing conglomerates instead of new entrants. Third, the unemployment implications of possible closures would be difficult to accept.
3. Indirect Approach through Deregulating the Economic Environment: Under this approach the government, rather than actively trying to disassemble large dominant firms, would through various policies aimed at changing the economic environment to remove the economic bias for concentration and reduce the barriers to entry for new entrants. The adoption of this approach would require the acknowledgement that the problem of concentration cannot be resolved in a

[1] See articles by Oxford Policy Management, 2000; and Dialogue, 2002.

short period and that the presence or threat of competition in the long-run is the most affective method of combating the adverse effect of concentration.

Based on the findings of this paper, it is proposed that the South African government adopt the third approach. There is a need for polices to be developed that are aimed specifically at reducing the barriers to entry for small-scale millers. These policies should include:

i. Regulations that ensure market information that is readily and equally available to all market participants. Information asymmetry can arises due to factors such as market concentration and/or imperfect competition and as a result, lead to higher consumer prices. In a recent study by William Kalaba, Lesiba Bopape, and Lilian Meyer, evidence was found to support the conclusion of information asymmetry in farm-retail price transmission in the wheat and maize sub-sectors of South Africa (2002). Government programs, for example, that invested in information systems would be effective in reducing information asymmetry within a market.

ii. Regulations that do not allow for the re-introduction of refined maize meal price controls. It is believed that since such subsidies would artificially lower refined maize meal prices. This would discourage consumers from moving towards a whole grain maize meal, which tends to be produced by small-scale millers and is cheaper and more nutritionally sound than refined meal.

iii. Regulations aimed at reducing barriers to entry into the maize milling/retail sector. With the advent of legislation mandating fortification

> of basic foodstuffs, the barrier to entry into the maize milling industry is likely to increase for potential entrants. In a study conducted by the South African Journal of Clinical Nutrition, 2001, it was found that the total cost of fortifying maize meal would be R23.2 million. These costs include the technology needed (dosifiers, mixers, scales) as well as the cost of micronutrients, equipment maintenance and additional personnel. It was found that within the entire industry, only six of the large-scale millers already had the necessary technology/equipment for the program, leaving approximately fifty or so small to medium sized millers with additional cost of acquiring the necessary technology in order to operate.

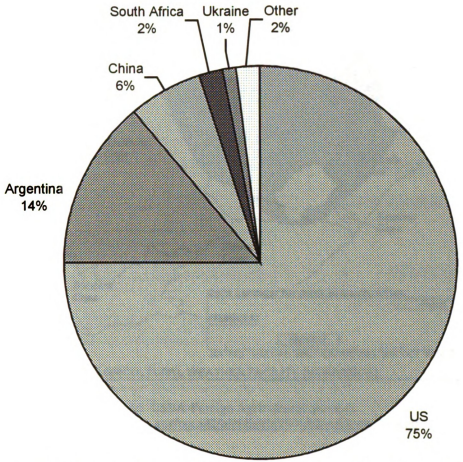
Food security is defined as "...the ability of a country or region to assure, on a long-term basis, that its food system provides the total population with access to a timely, reliable and nutritionally adequate supply of food" (van Rooyen, et al., 1997). This study has found that despite market liberalization, the maize milling/retail margin continues to grow in real terms within South Africa, threatening the level of food security within the nation. Although this study clearly shows the effect of market liberalization on milling/retail margins, it has not clearly identified the reasons behind these high margins and therefore the reasons why market liberalization has not been successful in decreasing real maize meal prices. According to Timmer, large marketing margins occur for two reasons: high real marketing costs and/or there is a monopolistic element in the marketing process that is earning excessive profits. The question that needs to be addressed is whether or not the retail price in the maize meal market accurately reflects the value of the traded commodity, i.e. is it a competitive pricing system? Future study, that looks at

the structure, conduct and performance of the maize sub-sector within South Africa would be able to adequately answer this question and thereby establish policy outlines aimed at ensuring access to low maize meal prices in real terms to consumers.

Furthermore, the evidence of an increasing growth rate in the milling/retail margin after market reform instead of a decline in real terms, suggests that unlike countries such as Zimbabwe, Mozambique and Kenya, the informal hammer-milling system has failed to successfully emerge within South Africa, thereby increasing competition among millers. There is a need for future research to establish why rapid investment in the informal hammer-milling system did not occur after market reform as other studies have shown in other countries. Such a study would be beneficial in gauging the level of competition within the maize sector, a necessary component to food security within South Africa.

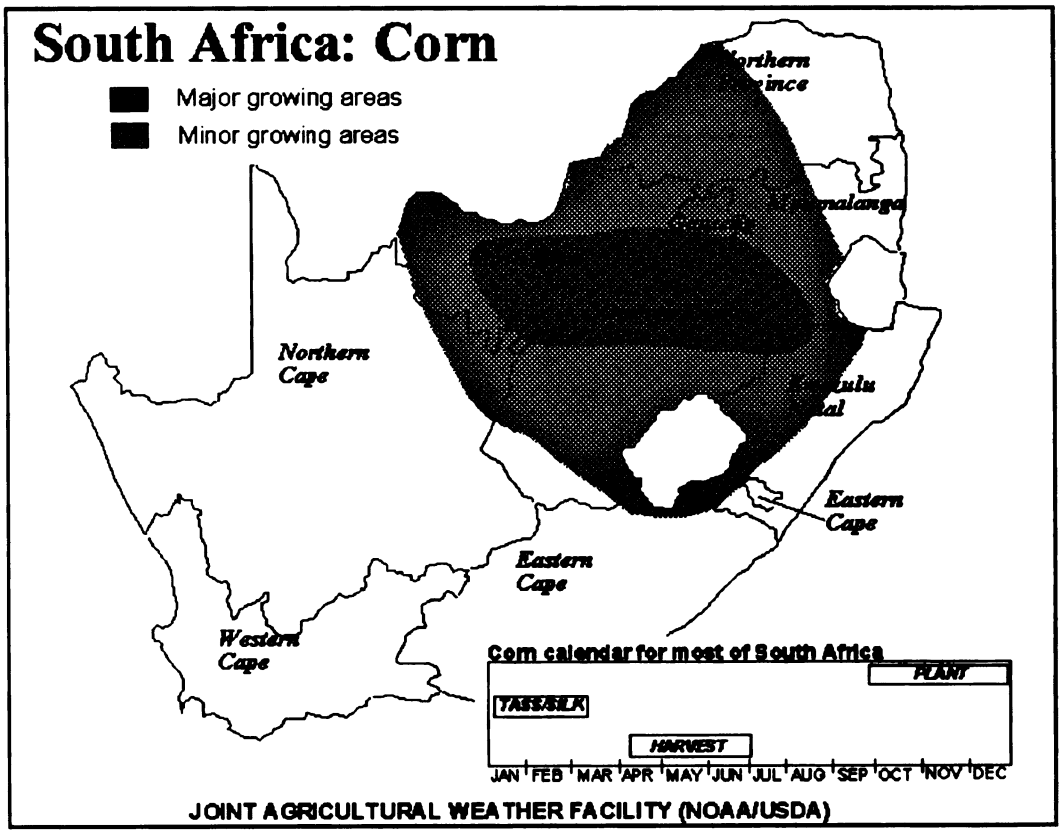
# APPENDIX A

**Appendix A.1:**
**Total World Maize Exports - 2000**



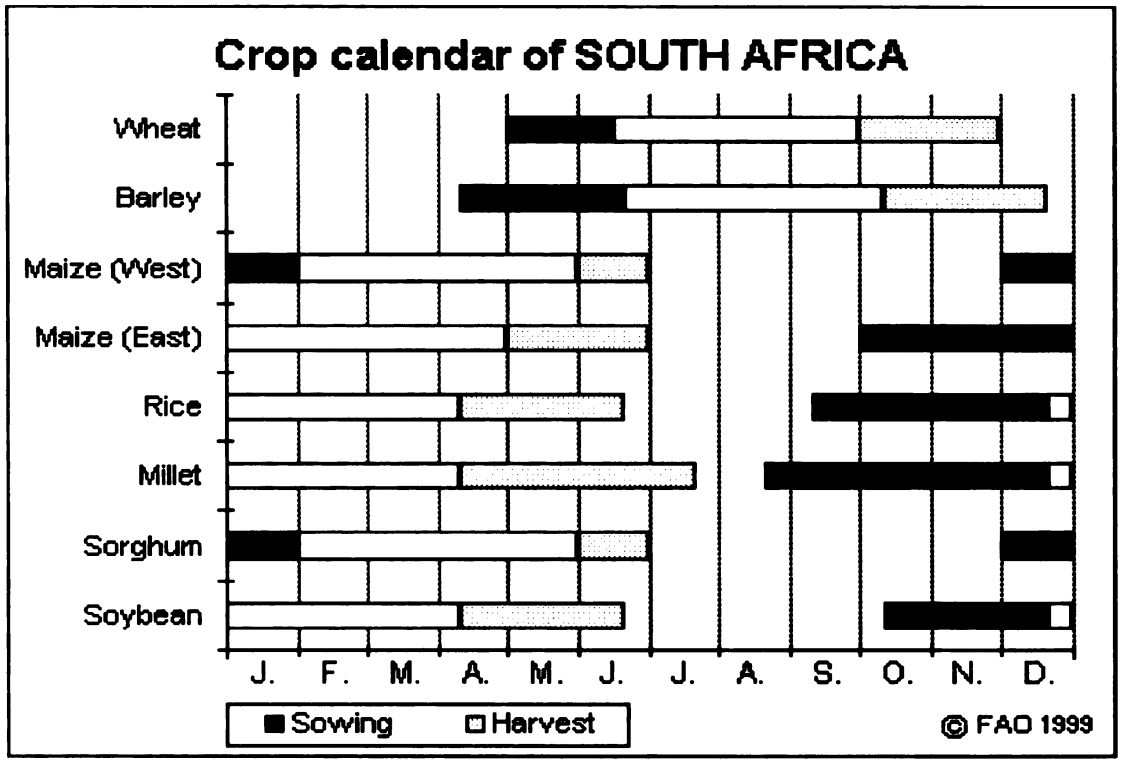

Source: USDA/Foreign Agriculture Service, Grain: World Markets and Trade, Jan 13, 2001

**Appendix A.2:**
**Major and Minor Maize Growing Areas**




**Source: USDA-Foreign Agricultural Services.**
**http://www.fas.usda.gov/pecad2/highlights/2001/02/safrica/safcrn.gif**

**Appendix A.3:**
**Crop Calendar of South Africa**

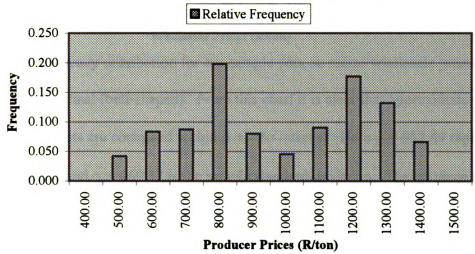



**Source: USDA-Foreign Agricultural Services.**
http://www.fas.usda.gov/pecad2/highlights/2001/02/safrica/safcal1e.gif

# APPENDIX B

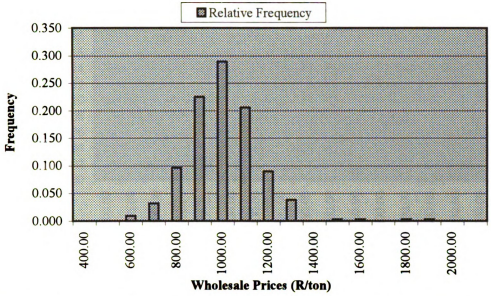
The objective of this study is to make an inference about the milling and marketing margin's population based on the data contained in our sample and to provide an associated measure of goodness for the inference. Accomplishing this objective requires a descriptive summary of the variables that are used in our margin models. Included in this appendix is a discussion of the various price variables used in the calculation of the margins and the methods of calculation for the Macro Risk and the Rainfall index variables.

**Appendix B.1: Producer Prices Histogram**



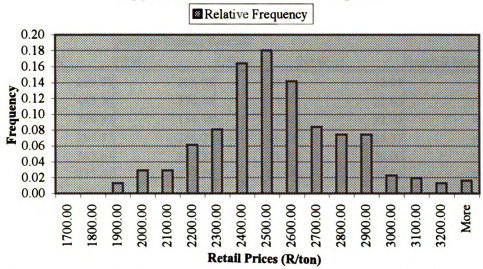

Based on the relative frequency distribution above, it is clear that our sample data on maize producer prices tends towards a normal distribution. From this chart it is clear that approximately 99% of all measurements are contained within $\mu$ +/- 2$\sigma$ interval. Here $\mu$ = 929.458 represents the sample mean and □ = 267.375 is the sample standard deviation. The variance ($\sigma^2$) in this sample is 71489.52, which is indicates great amount of variation within this sample set.

**Appendix B.2: Wholesale Prices Histogram**




The relative frequency distribution for our sample data on maize wholesale prices is approximately normal (bell-shaped). From this chart it is clear that approximately 95% of all measurements are contained within $\mu$ +/- $2\sigma$ interval. Here $\mu = 952.49$ represents the sample mean and $\sigma = 160.37$ is the sample standard deviation. The variance ($\sigma^2$) in this sample is 25718.32, which is indicates a smaller amount of variation within this sample set when compared to the producer price data set.

**Appendix B.3: Retail Price Histogram**




The relative frequency distribution for our sample data on maize-meal retail prices is approximately normal (bell-shaped). From this chart it is clear that approximately 96% of all measurements are contained within $\mu$ +/- $2\sigma$ interval. This then satisfies the empirical rule for a distribution of measurements to be normally distributed. Here $\mu$ = 2495.31 represents the sample mean and $\sigma$ = 278.47 is the sample standard deviation. The variance ($\sigma^2$) in this sample is 77545.57, which is indicates a greater amount of variation within this sample set when compared to the producer price and wholesale price data sets.

## Appendix B.4: Weighted Average Critical Rainfall

| | | Average Critical Rainfall | | | |
|---|---|---|---|---|---|
| Rain (mm) | T*W | F*W | C*W | N*W | Rainfall Index |
| 1970/71 | 299.97 | 203.05 | 14.31 | 32.01 | 549.34 |
| 1971/72 | 443.50 | 176.46 | 17.77 | 23.63 | 661.35 |
| 1972/73 | 229.87 | 134.38 | 7.02 | 32.91 | 404.17 |
| 1973/74 | 295.37 | 256.71 | 26.51 | 25.37 | 603.96 |
| 1974/75 | 363.61 | 241.22 | 17.75 | 26.06 | 648.65 |
| 1975/76 | 417.61 | 277.79 | 23.98 | 35.62 | 755.00 |
| 1976/77 | 330.30 | 223.67 | 20.22 | 36.26 | 610.45 |
| 1977/78 | 388.71 | 189.79 | 17.32 | 41.00 | 636.82 |
| 1978/79 | 248.83 | 119.75 | 11.86 | 39.08 | 419.51 |
| 1979/80 | 391.23 | 124.56 | 8.52 | 25.68 | 550.00 |
| 1980/81 | 394.57 | 231.61 | 29.34 | 27.78 | 683.30 |
| 1981/82 | 300.23 | 151.48 | 12.53 | 28.07 | 492.31 |
| 1982/83 | 263.40 | 115.65 | 5.74 | 29.36 | 414.15 |
| 1983/84 | 307.66 | 156.70 | 3.14 | 135.76 | 603.26 |
| 1984/85 | 314.77 | 160.61 | 23.78 | 35.24 | 534.41 |
| 1985/86 | 291.27 | 178.85 | 22.97 | 45.31 | 538.40 |
| 1986/87 | 373.44 | 166.62 | 19.26 | 26.22 | 585.53 |
| 1987/88 | 316.65 | 296.18 | 26.74 | 30.49 | 670.06 |
| 1988/89 | 310.64 | 209.81 | 25.01 | 24.61 | 570.07 |
| 1989/90 | 416.13 | 186.87 | 27.95 | 33.24 | 664.19 |
| 1990/91 | 376.94 | 139.63 | 17.11 | 40.59 | 574.27 |
| 1991/92 | 218.64 | 115.74 | 28.46 | 47.79 | 410.62 |
| 1992/93 | 201.86 | 177.25 | 20.71 | 17.16 | 416.99 |
| 1993/94 | 284.76 | 254.45 | 20.00 | 34.29 | 593.50 |
| 1994/95 | 368.47 | 89.26 | 29.32 | 46.68 | 533.74 |
| 1995/96 | 605.52 | 238.89 | 11.61 | 37.61 | 893.63 |
| 1996/97 | 373.27 | 219.97 | 12.08 | 32.15 | 637.48 |
| 1997/98 | 237.21 | 245.01 | 2.40 | 20.48 | 505.10 |
| 1998/99 | 326.78 | 196.80 | 2.39 | 18.72 | 544.69 |
| 1999/00 | 468.18 | 334.54 | 4.47 | 21.95 | 829.15 |
| 2000/01 | 263.18 | 189.48 | 2.26 | 11.06 | 465.98 |

Notes: T=Transvaal, C=Northern/Western/Eastern Cape, F=Orange Free State, N=Kwazulu Natal

W = weights= Provincial Production/Total National Production

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