PART 5

INVESTIGATING OTHER ASPECTS OF THE FOOD VALUE CHAINS

Investigating other aspects of the food value chains

Introduction

Part 5 of the Report continues with issues related to the core aspects of the Committee's Terms of Reference, namely, to understand the causes of food price increases. Chapter 1 considers the influence of price increases of farm requisites. Here the focus is on the broad trends in order to verify whether, during 2002, farmers were put under similar pressure as the consumers in that they had not yet received the benefit of a stronger Rand. In this context, also the effect of packaging costs on the cost of food at retail level is considered.

Chapter 2 considers the role played by other exogenous factors in the cost of basic food. Here transport costs are investigated, and the perceived collusive behaviour of silo owners. Much was said in the media and in labour union circles about the alleged collusive behaviour of silo-owners in that they should be held responsible for high producer prices by holding back grain stocks and not offering these for sale.

The Committee was of the opinion that certain practices and behaviour related to the relationships between food manufacturers and retail stores might have led to extra costs for the consumer. This aspect is investigated in Chapter 3.

In Chapter 4, aspects related to market structure and market power are considered, and how these influence the transmission of prices through the value chain.

Part 5

CHAPTER 1

TRENDS IN AGRICULTURAL INPUT PRICES

1.1 Introduction

It is often argued that rising farm input costs might contribute to higher food prices. This is not really possible since farmers in the free market dispensation of today are price takers (if they are not selling on contract). This means that they have to accept the price that is generated in the market through the interaction between domestic supply and demand factors, world commodity prices, exchange rates, and import tariffs. It is also true, however, that rising on-farm production costs do affect farmers' decisions to plant or invest in a particular farming activity. If costs and this is particularly true for marginal costs, increase above marginal revenue, farmers might decide to pull out of a particular industry, which then might reduce the domestic supply and so create a shortage thus leading to higher prices. This trend can, however, well be reversed in the next cycle as farmers respond to these higher prices.

It is, however, true that the 2002 food price crisis was not influenced by the high level of farm production costs. As farmers purchased inputs during the second half of 2002, they experienced higher prices for most agricultural inputs since the price of most of these inputs had been affected by the Rand exchange rate depreciation as is shown in a later section of this Chapter. When the exchange rate appreciated during late 2002 and continued in 2003, farmers – in the same manner as consumers – began to complain that the benefits of the appreciating exchange rate had not been passed through to them. Various farmer lobby groups then requested the FPMC to, also, monitor the price of farm inputs. The Committee agreed to add this to its activities as a service to the agricultural industry in the broader terms.

In this Chapter, we, therefore, provide a brief summary of the trends in the major farm inputs and we will analyse the effect of exchange rate movements on the price of these inputs.

1.2 Fertiliser Prices

The structure of the South African fertiliser industry

The South African fertiliser market is relatively small in world terms (2 million tonnes per year compared to, for instance, 20 million tonnes per year in Brazil). The market has been at roughly the same size for the past 20 years, and is not expected to grow significantly in the medium term. These factors, plus the high cost of capital have resulted in significant production capacity being permanently shut down over the last few years: Ammonia, Urea and limestone ammonium nitrate plants at Modderfontein in Gauteng; Ammonia, nitric acid and limestone ammonium nitrate plants at Milnerton in

the Cape. These closures have resulted in new demands on the distribution infrastructure of the country and are of a particularly seasonal nature. The fertiliser market is considered very competitive, but at the same time concentrated and because of the factors mentioned earlier, it could become even more concentrated.

The main players in the South African fertiliser market are:

- Kynoch: 100% owned by Norsk Hydro, the largest fertiliser company in the world, selling about 22 million tonnes of fertiliser globally
- Omnia: selling about 0.6 million tonnes of fertiliser in South Africa and about 0.2 million tonnes in the rest of Africa
- Sasol Nitro, part of the Sasol Group
- Various smaller players

The market is characterised by ad-hoc imports of standard commodities by independent players. This is possible since no import duties or tariffs are levied on fertiliser products.

Factors influencing fertiliser prices

Given the potential of fertiliser imports, the general price levels of fertiliser in South Africa are influenced by the landed price of international fertiliser commodities. This is mainly determined by:

1. The international FOB ("free on board") price. Of the three main plant nutrients (nitrogen, phosphorous and potassium), nitrogen represents about 60% of the value of the sales mix. International prices for nitrogen commodities are the most volatile of the major nutrients. For instance, the FOB cost of Black Sea Urea prill in September 2003 was $153/ton, compared to $90/ton a year ago (See Figure 1.1). Likewise, the Black Sea price of Ammonia (a major raw material for the fertiliser industry) was $205/ton, compared to $125/ton a year ago (See Figure 1.2).

2. Freight to a South African port. Maritime freight rates have increased dramatically over the last year. The benchmark JE Hyde Handimax shipping index has increased from around 900 (a year ago), to about 1400 (currently).

3. The Rand/US Dollar exchange rate has strengthened significantly since January 2002. This had a lowering effect on the fertiliser price levels, counteracting the increases in FOB values and maritime freight rates.

4. South African distribution costs from the port to the market. These costs have increased because of high domestic producer inflation, added to a deteriorating service from ports and railways.

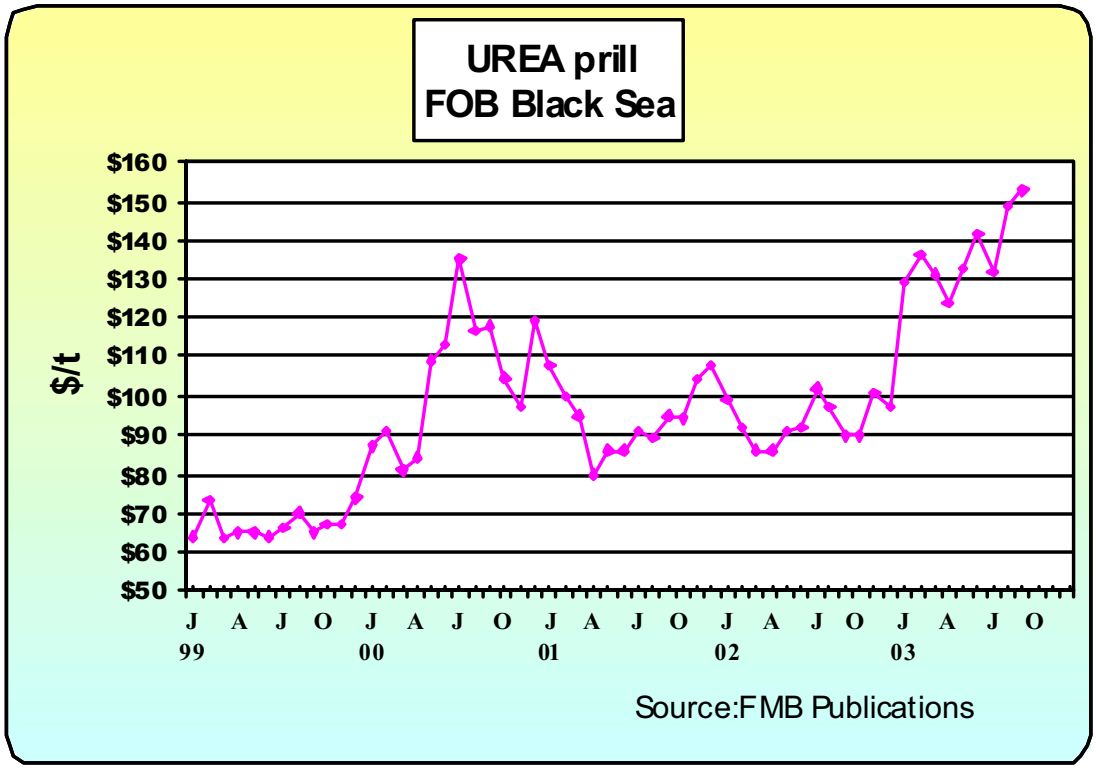

Figure 1.1: International Price trends for UREA prill, FOB Black Sea

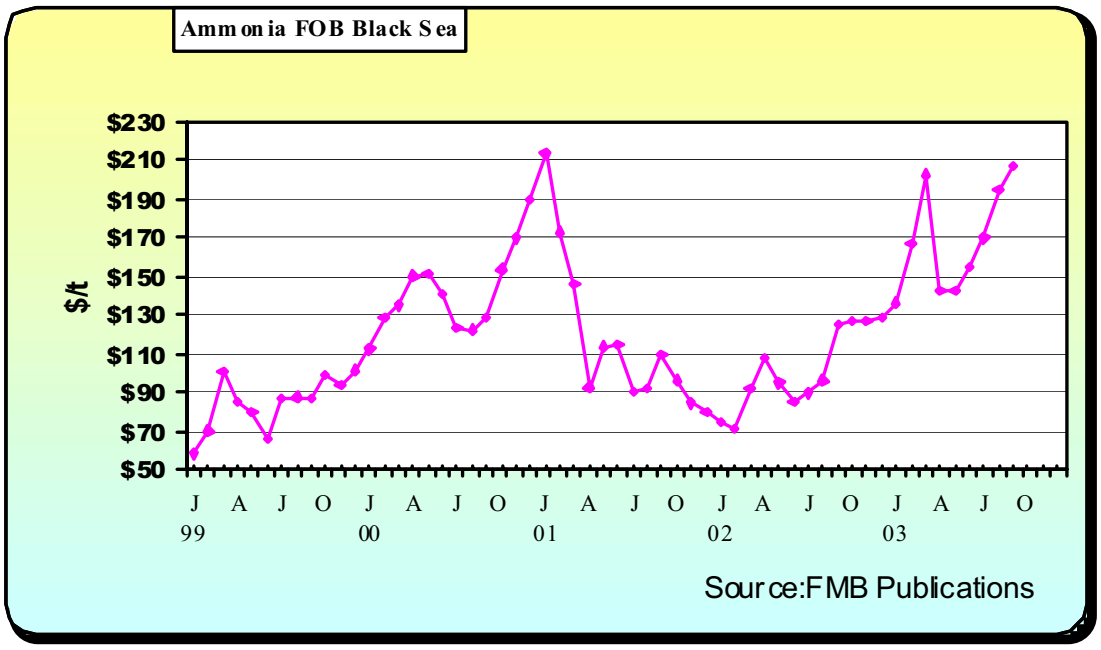

Figure 1.2: Black Sea price of Ammonia: July 1999 to October 2003

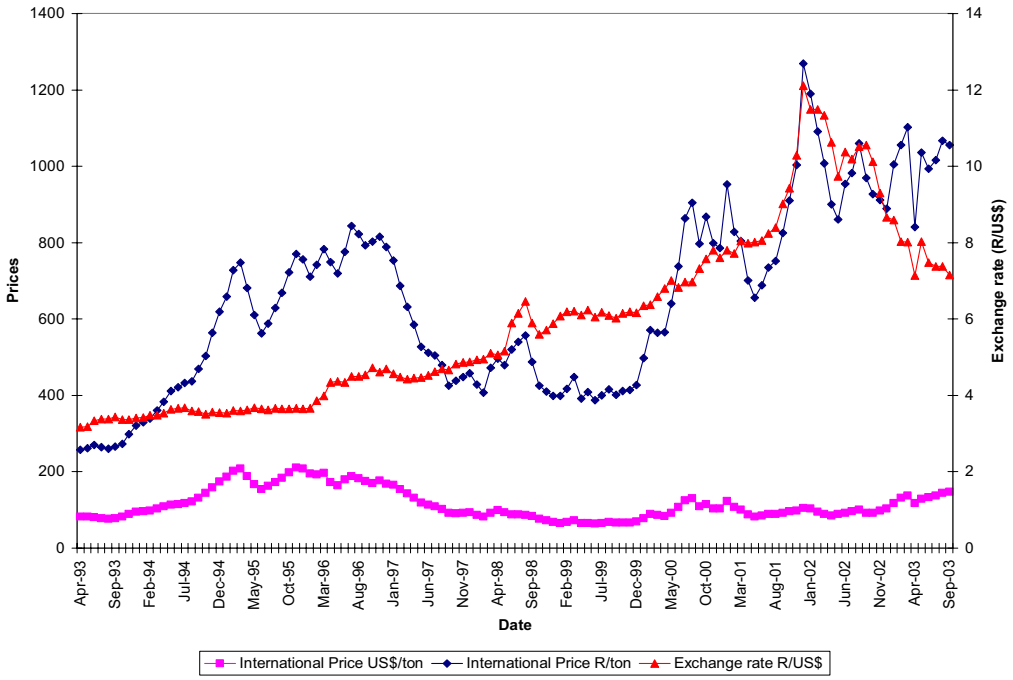

Figure 1.3: Monthly price of Urea and the Exchange Rate

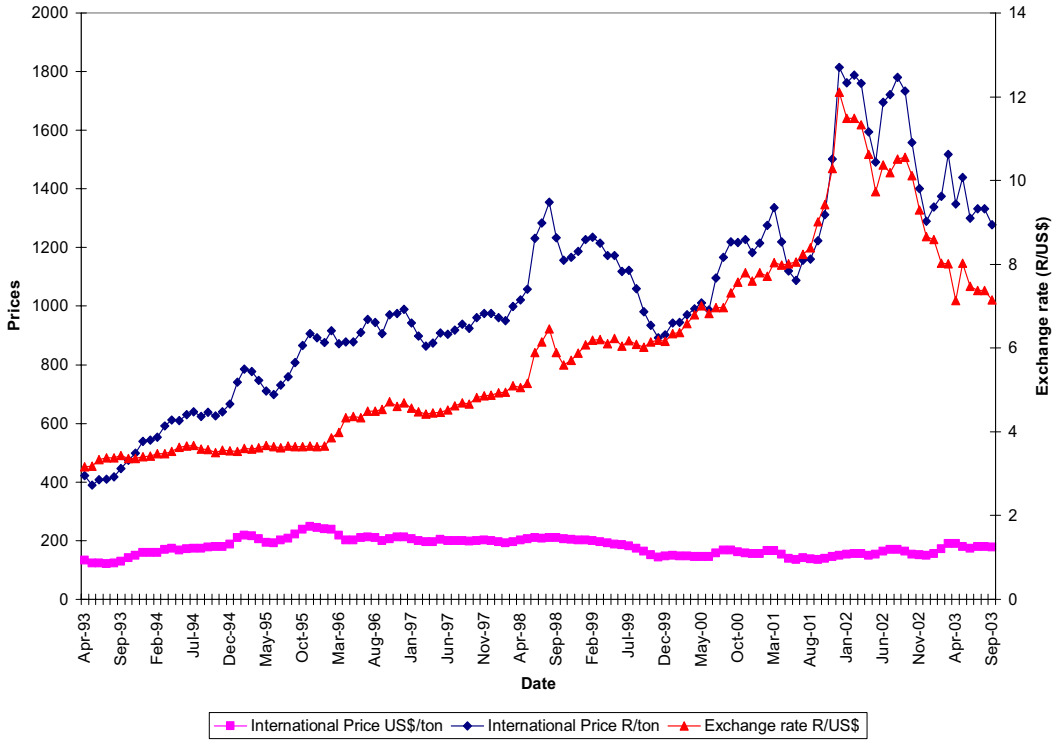

Figure 1.4: Monthly price of Dap and the Exchange Rate

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An attempt was also made, using monthly data, to study the relationships between fertiliser ingredients and the exchange rate as described above. According to the results, summarised in Table 1.1 below, the prices of Urea, Dap, and Ammonia increased between September 1994 and December 2001. The domestic prices of Urea, Dap, and Ammonia increased by 93%, 83% and 54%, respectively, between September 1994 and August 2000. Their rate of growth remained positive but slowed down to 41%, 55%, and 19% between August 2000 and December 2001.

As shown in Table 1.1, changes in the price of these inputs can be attributed entirely to the depreciation of the Rand from 3.56 per USD in September 1994 to 6.69 per USD in August 2000 and to 12.11 per USD in December 2001, but not to international prices. We propose this because, as can be seen from the same table, international prices of these inputs exhibited a downward trend between September 1994 and December 2001.

Table 1.1: Impact of a depreciation in the exchange rate on selected fertilisers

Month	$/ton	R/$-exchange rate	R/ton
International price of Urea, FOB, Eastern Europe			
September 1994	131.10	3.56	466.72
August 2000	129.90	6.96	900.21
December 2001	104.76	12.11	1268.64
September 2003	147.42	7.15	1054.03
International price of DAP, FOB, US-gulf harbour			
September 1994	178.4	3.56	637.69
August 2000	167.62	6.96	1167.26
December 2001	149.78	12.11	1813.84
September 2003	178.6	7.15	1277.67
International price of Ammonia, FOB, Middle-East			
September 1994	189	3.56	675.58
August 2000	150.1	6.96	1045.25
December 2001	102.56	12.11	1242.00
September 2003	211.19	7.15	1510.81

It is evident from Table 1.1 and Figures 1.3 and 1.4 that, except for Ammonia, the prices of Urea and Dap fell by 17% and 30%, respectively, following the appreciation of the Rand by 69% in September 2003. These prices are still higher than their September 2000 levels when the exchange rate was approximately equal to its September 2003 level. This implies that the appreciation of the Rand has not brought in a sizeable reduction in the domestic prices of Urea and Dap in recent months. This can be attributed to the increase in the international prices of these inputs, which increased by 29% and 16%, respectively (Table 1.1). Unlike the prices of Urea and Dap, the price of Ammonia increased in September 2003. This can again be attributed to the increase in the international price of Ammonia by 52% (Table 1.1).

Fertiliser price trends

Although the landed cost of the few standard international fertiliser commodities influences local price levels, it should be noted that many locally produced grades of fertiliser are not available internationally. Some large players hold more than 200 product registrations with the Registrar of Act 36 of 1947. These products have specifically been developed and optimised for local combinations of soil, climatic and crop specific requirements.

Fertiliser is not generally sold in South Africa on a list price basis but by individual negotiation with the end user. This happens because of several market factors, outlined below. List prices are therefore more of an internal guideline than a reflection of actual selling prices.

Selling prices are typically lower than list prices by varying percentages depending on factors such as competitive conditions in the market, the volume purchased and the level of value-added services used by the customer. The list prices also vary for different geographic areas and the sales mix differs from year to year and from season to season depending on the agricultural conditions, with the sales mix influencing the "average" list price. An indication of recommended retail selling prices of selected fertilisers is presented in Figure 1.5

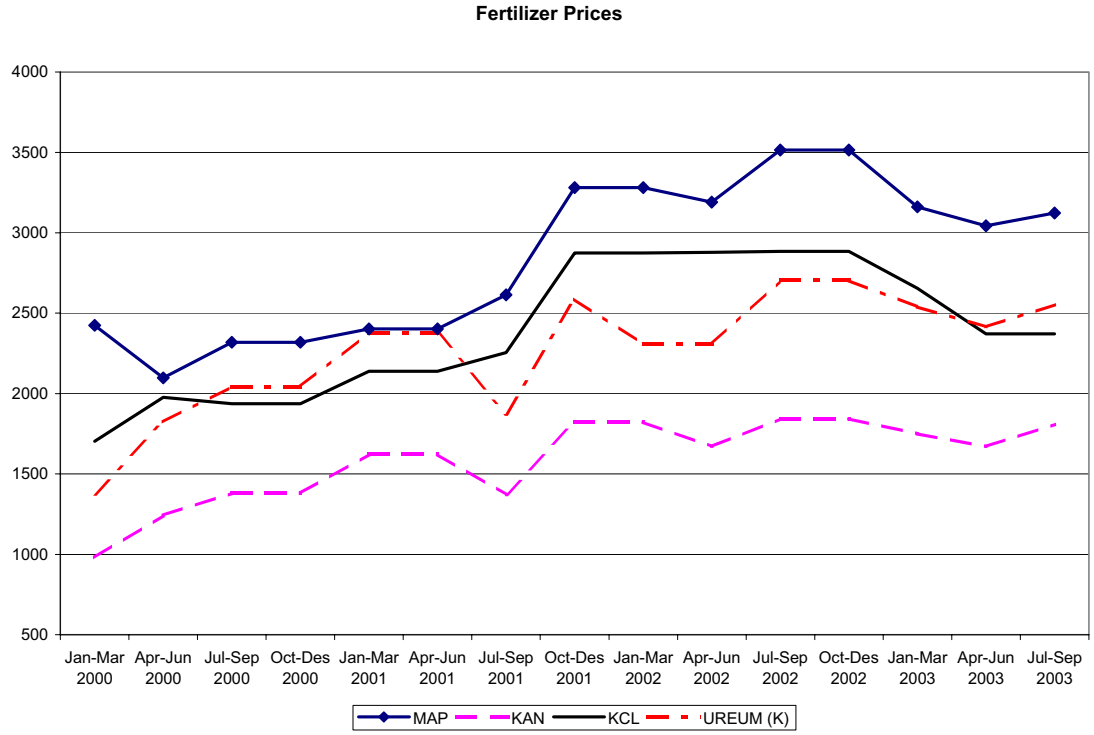

Figure 1.5: Selling prices for different fertilisers

Foskor is currently the sole supplier of phosphate rock, a key raw material for the production of phosphate fertilizers. Foskor indicated to the Committee the pricing process for phosphate rock (trends are reflected in Figure 1.6). In order to enhance the

production of fertilisers at low cost in South Africa, a unique pricing formula is applied for the domestic industry. The formula has allowed the local industry to purchase phosphate rock from Foskor at about 30% below that of imported phosphate rock. Figure 1.6 shows the monthly variations in the price. It must be mentioned here that the agreement to use this pricing formula, will expire in March 2004. The current pricing arrangement made sense as phosphate rock exports, which were priced at international market prices assist to sustain the viability of the local industry. Recent changes relating to Spoornet being required to charge market related rail tariffs have, however, made Foskor uncompetitive on the international market.

Foskor also produces diammonium phosphate (Dap) and monoammonium phosphate, which is adequate to meet the requirements of the domestic industry. Prices are at the ruling international price levels and any changes are due to both commodity and exchange rate movements.

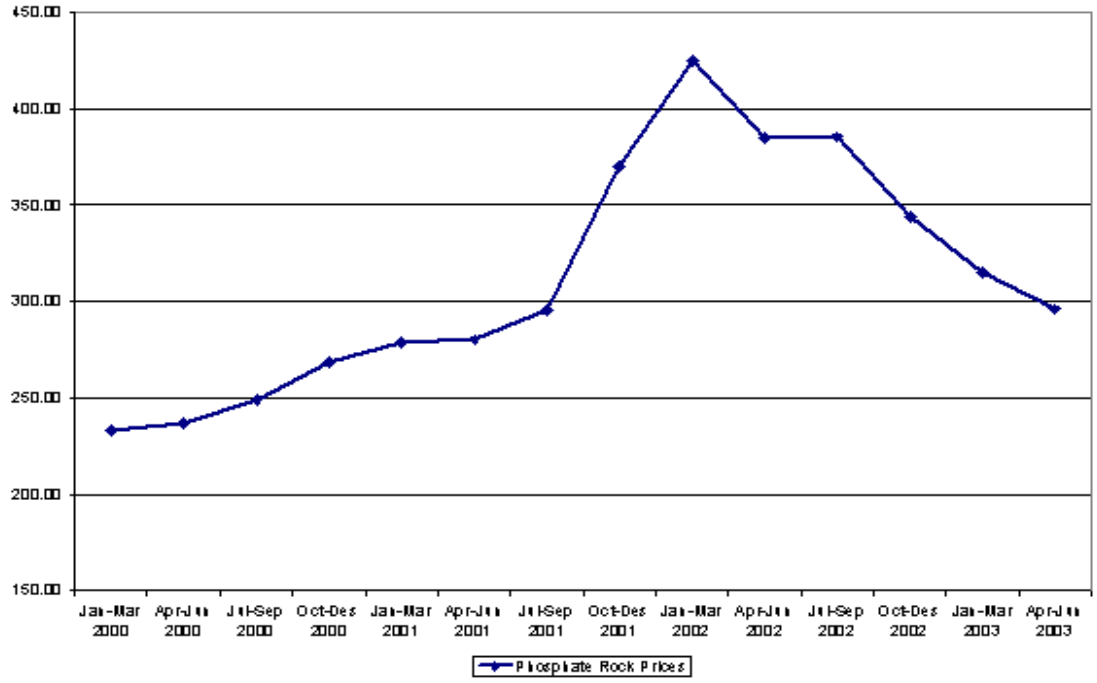

Figure 1.6: Monthly prices of phosphate rock: January 2000 – April 2003

1.3 Trends in Seed Prices

On request of the Committee, several seed suppliers provided information on seed price increases over the past few years. Most seed companies increased their prices in response to the changes in the exchange rate, but also because of an increased demand during the 2002 season.

Figure 1.7 gives an indication of the dramatic increase in maize seed prices since 1984/85. The prices of maize seeds increased exponentially with more than 950% in nominal terms over the last 20 years, which represents on average an increase of 47.6%

per annum The index shown is a combination of all the white and yellow maize cultivars from different seed companies.

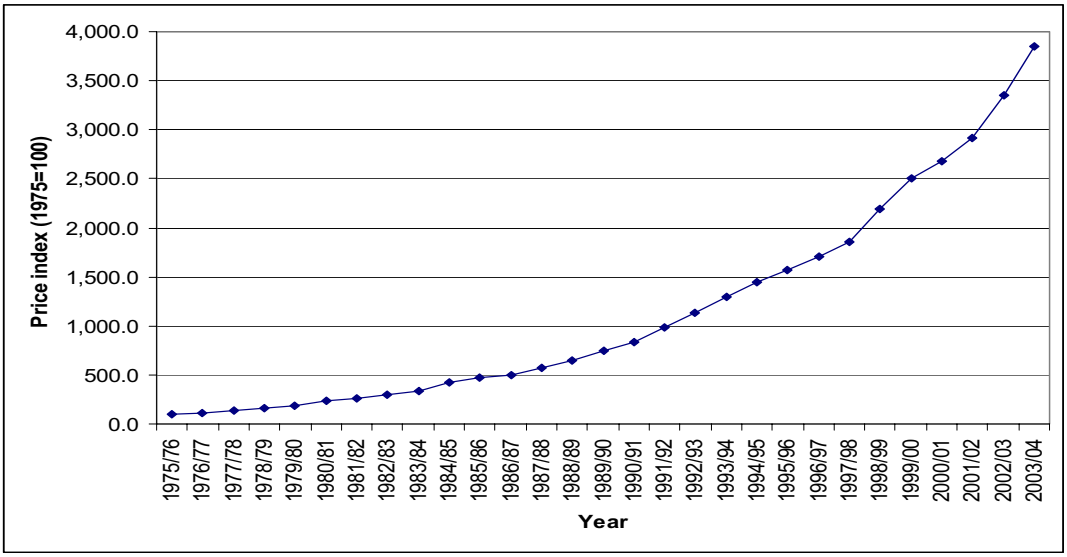

Figure 1.7: Annual combined maize seed (yellow and white) price index (1975/76 – 2003/04)
Source: Grain SA, 2003

Figure 1.8 shows the increase in seed prices of other summer grains (grain sorghum, sunflower seed and soy) over the last nine production seasons. During this period, the grain sorghum seed prices showed the largest increase (185.6%) followed by sunflower seed prices (167.1%), maize seed prices (144%) and soy beans seed prices (120.6%).

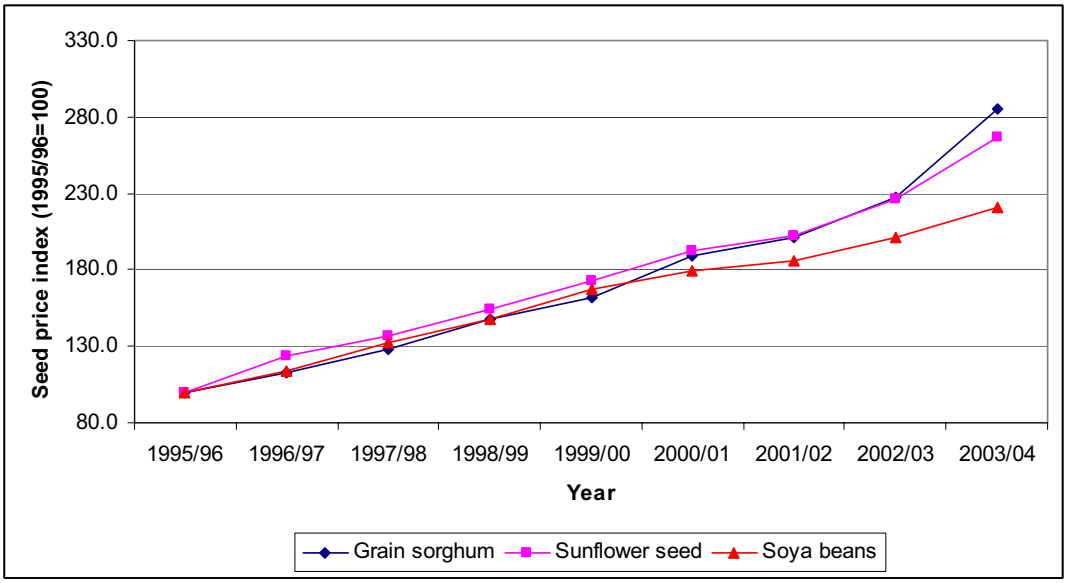

Figure 1.8: Annual price index for grain sorghum, sunflower seed and soy bean seeds (1995/96 – 2003/04)

Source: Grain SA, 2003

1.4 Trends in animal feed prices

Feed costs play an important role in the total input costs of the livestock sector. In the broiler and layer industries, for instance, the costs of feed constitute over 60% of the total input costs of these industries. This section analyses the recent trends in the costs of feed and will determine how closely the trends in feed costs have traced the trends in the prices of grains an oilseeds over the past three years. The Animal Feed Manufacturing Association (AFMA) provided data on the costs of feed and the inclusion rates of the various grains and oilcakes in specific feed rations. AFMA members produce 97% of the total broiler feed in South Africa, 89% of all layer feed, 47% of all dairy feed, 39% of all pig feed, and 25% of all beef and sheep feed.

It is a well-know fact that the inclusion rate of maize in the total production of feed is well over 50%. In fact, over the past three years maize products have made up more than 55% of the total feed produced by members of the AFMA (Table 1.2). This provides solid grounds to assume that feed costs will largely trace the price of maize. Mainly yellow maize is consumed in the livestock sector, and, therefore, the trends in yellow maize prices are compared to feed costs.

Table 1.2: Usage of Maize products by AFMA members, 1 April 1999 to 31 March 2002

Maize Products (Tonnes)	1999/2000	% Inc.	2000/2001	% Inc.	2001/2002	% Inc.
Maize/(Incl. Maize meal)	1,989,173	48.32%	1,986,530	50.43%	2,025,262	50.14%
Maize gluten meal/(20%)	35,567	0.86%	37,057	0.94%	41,811	1.04%
Maize gluten meal/(60%)	32,310	0.78%	28,266	0.72%	20,799	0.51%
Maize screenings	27,117	0.66%	19,578	0.50%	12,811	0.32%
Maize germ meal	60,582	1.47%	42,791	1.09%	30,526	0.76%
Defatted maize germ meal	5,081	0.12%	18,887	0.48%	19,224	0.48%
Maize germ oilcake	6,038	0.15%	2,974	0.08%	934	0.02%
Hominy chop/Germ meal	110,581	2.69%	102,471	2.60%	105,781	2.62%
TOTAL	**2,266,449**	**55.06%**	**2,238,554**	**56.82%**	**2,257,148**	**55.88%**
Total Feed Production	**4,116,266**		**3,939,506**		**4,039,058**	

Source: AFMA chairman's report, 2003

Table 1.3 presents the inclusion rates of various oilcakes in the total quantity of feed produced. From a total quantity of just over 4 million tonnes of feed produced, close to 500,000 tonnes of soybean oilcake were included in all the rations in 2001/02. A further 230 000 tonnes of sunflower cake were also added to the rations. In total, oilcakes make up 19.73% of the total feed produced by AFMA members.

In the following figures the costs of the feed rations for broilers, pigs, cattle and dairy are compared to the price of yellow maize, sunflower oilcake and soybean oilcake over time. Figure 1.9 graphically illustrates the relationship between the weighted average price of broiler growth mash and the SAFEX price of yellow maize. Similar to the methodology used in the analysis of the value chain of maize (Part 4, chapter 2), the SAFEX price of

yellow maize is lagged by three months. This implies that it takes three months from the moment the maize is bought by the feed manufacturers until the feed is sold.

Table 1.3: Oilcake usage by AFMA members, 1 April 1999 to 31 March 2002

OILCAKE (Tonnes)	1999/2000	% Inc	2000/2001	% Inc	2001/2002	% Inc
Soya	402,190	9.77%	406,677	10.32%	495,546	12.27%
Sunflower	304,970	7.41%	286,078	7.26%	232,460	5.76%
Cottonseed	54,165	1.32%	43,758	1.11%	53,741	1.33%
Groundnuts	5,699	0.14%	3,845	0.10%	5,164	0.13%
Canola	12,420	0.30%	8,683	0.22%	8,347	0.21%
Copra & Palm kernels					1719	0.04%
TOTAL	**779,444**	**18.94%**	**749,041**	**19.01%**	**796,977**	**19.73**
Fish meal	103,435	2.51%	115,990	2.94%	100,652	2.49%
Total Feed Production	**4,116,266**		**3,939,506**		**4,039,058**	

Source: AFMA chairman's report, 2003

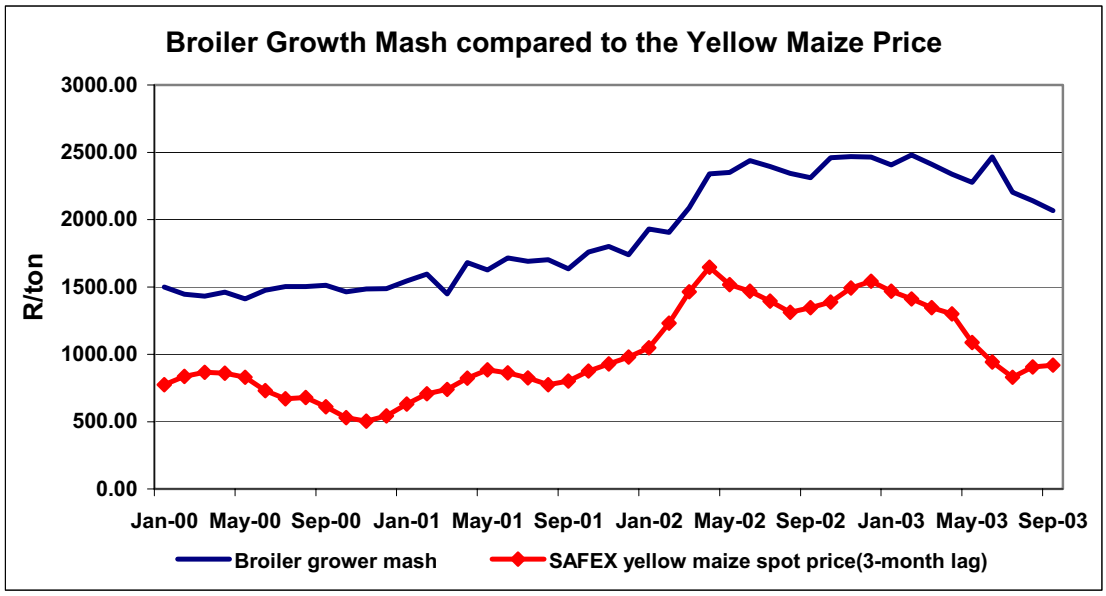

Figure 1.9: The average weighted price for broiler growth mash and the 3-month lagged yellow maize spot price

Source: SAFEX, AFMA, 2003

Figure 1.9 shows the trend in the margin between the price of yellow maize and the price of broiler mash over the past three years. It is evident from figure 1.9 and figure 1.10 that the margin between the price of broiler mash and the yellow maize has increased sharply over the past in the period April 2003 – September 2003.

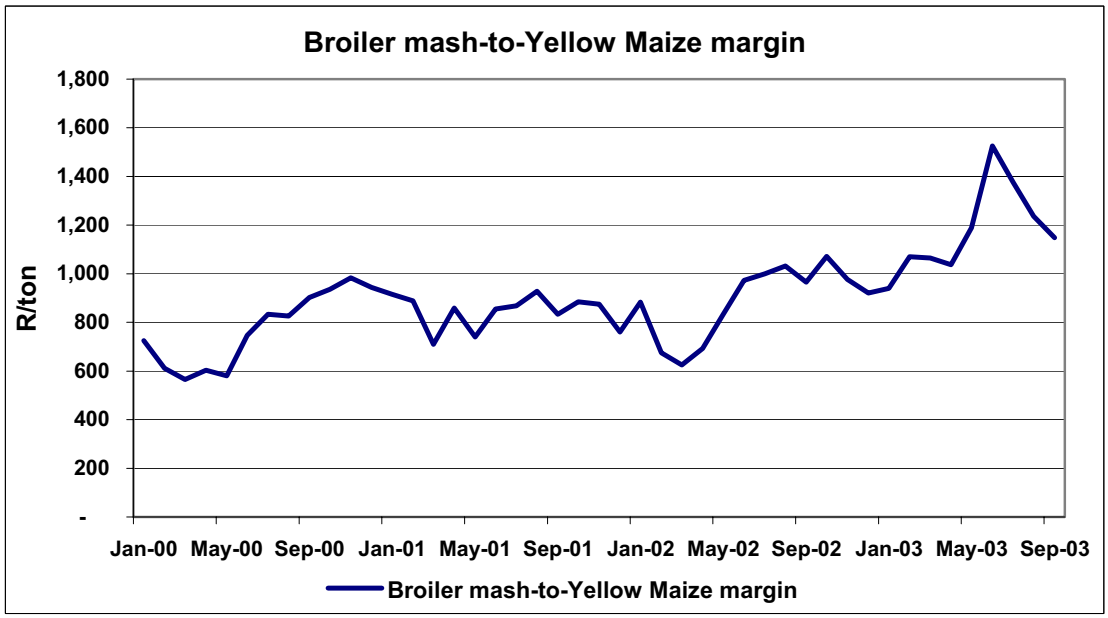

Figure 1.10: Broiler growth mash –to- yellow maize margin
Source: Own calculations

Broiler mash does not only consist of maize products but also of soybean cake and some sunflower cake. Figure 1.11 compares the trends in the price of broiler mash to the trends in the prices of sunflower cake and oil cake.

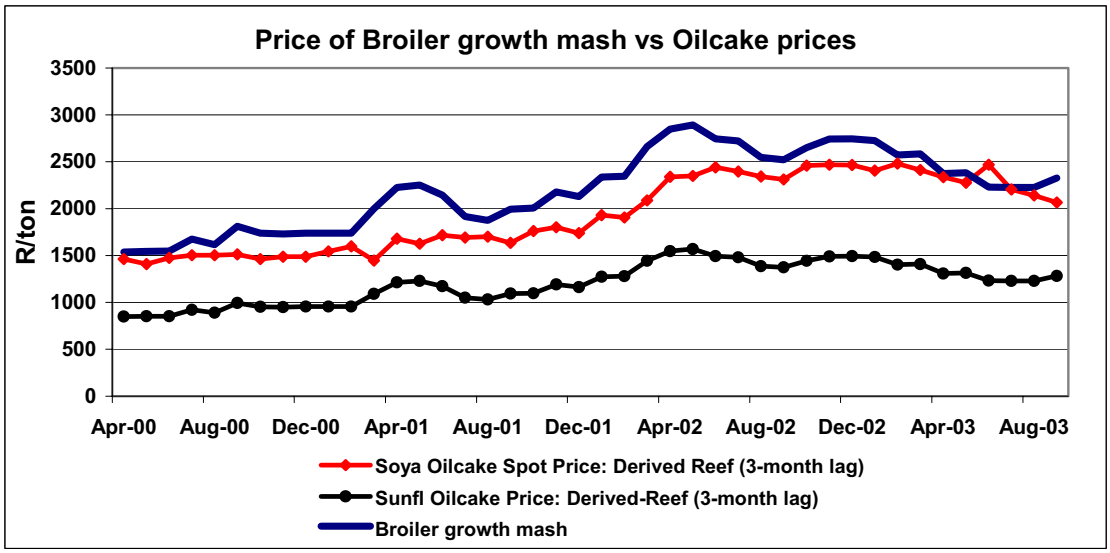

Figure 1.11: The average weighted price for broiler growth mash and the 3-month lagged prices of sunflower cake and soybean cake
Source: Reuters, Own calculations, AFMA, 2003

Similar figures can also be presented for layer mash, pig growth meal, dairy meal and cattle finisher. Figure 1.12 presents the 3-month moving average of the price of pig growth meal over the past three years. The Committee is concerned about the fact the there was no real declining trend in the moving average of the price of this specific feed.

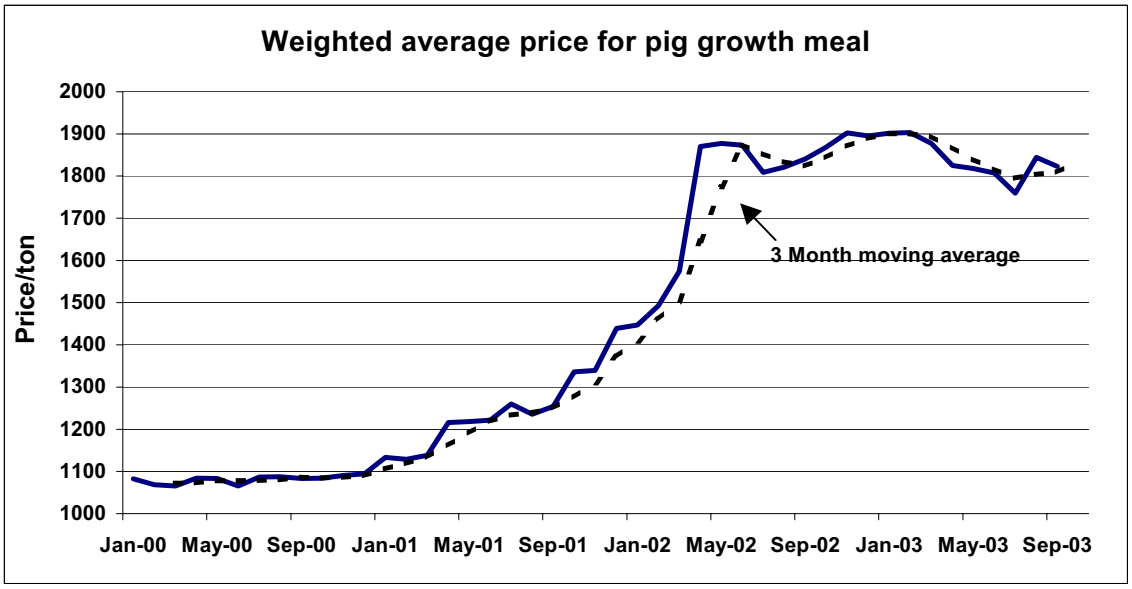

Figure 1.12: The average weighted price for pig growth meal (Source: AFMA, 2003)

Table 1.4 presents a short summary of the average percentage changes in the prices of the various animal feeds compared to the percentage changes in the prices of yellow maize and oilcakes for the period 2000 – 2003.

Table 1.4: Prices and average % changes for various animal feeds

	PRICES				% CHANGES		
R/ton	**2000 Jan-Dec**	**2001 Jan-Dec**	**2002 Jan-Dec**	**2003 Jan-Sep**	**00-01**	**01-02**	**02-03**
Broiler growth mash price	1473.56	1661.56	2291.38	2310.92	12.76	37.91	0.85
Layer mash price	1100.7	1233.04	1780	1717.64	12.02	44.36	-3.50
Dairy meal price	1025.33	1179.57	1704.27	1662.43	15.04	44.48	-2.46
Pig growth meal price	1081.38	1243.4	1772.9	1840.17	14.98	42.58	3.79
Cattle finisher price	1023.05	1176.7	1551.75	1590.92	15.02	31.87	2.52
Yellow maize price	668.83	911.57	1444.25	958.05	36.29	58.44	-33.66
Sunflower oilcake price	934.53	1186.57	1464.38	1230.26	26.97	23.41	-15.99
Soybean oilcake price	1701.52	2172.08	2691.67	2227.22	27.66	23.92	-17.26

Table 1.4 clearly shows that the prices of animal feeds have not responded to the lower grain and oilseed prices. In the case of broiler mash, pig meal and cattle finisher, prices have even increased over the past year despite the fact that the average prices of yellow maize, sunflower oilcake and soybean oilcake have decreased by 33%, 16% and 17%, respectively.

1.5 Packaging costs

The South African Packaging Industry grew by 3.2% during 2002 to a volume of 2.4 million tonnes. The market was worth an estimated R21.2 Billion, which is a 14.1% growth from the previous year. Growth was primarily attributed to the positive performance of exports during 2002, particularly in the fruit and wine markets. Paper still has the largest volume share of the packaging industry, with 37.6%. Plastic – due to its consistent positive performance over the last few years – surpassed paper in 2003 to constitute the largest value share of the packaging industry. Glass volumes grew well in the past year, largely due to the recovery of the malt beer market and the positive growth in wine exports.

Figures 1.13 – 1.16 report the actual prices of packaging in cents per item from January 2000 to January 2003, reported biannually. From the figures, it is clear that packaging costs have increased for all the four products. The packaging costs for a 10kg bag of maize meal increased by 60% from the 2000/01 average. The packaging costs for 1kg of rice increased by 41% in the same period, while the packaging costs for 750ml of cooking oil and 1 L sachets of milk increased by 31% and 39%, respectively.

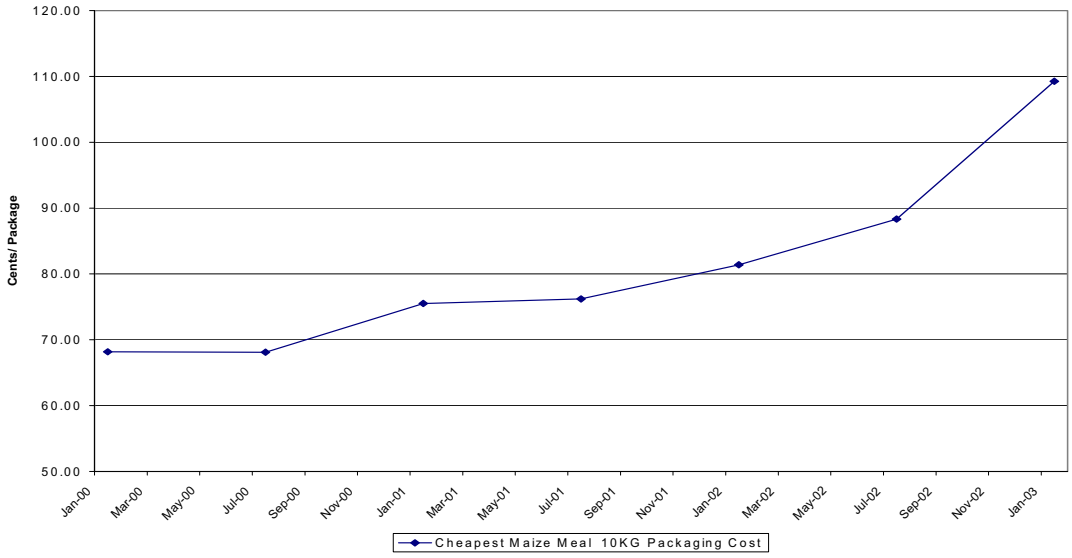

Figure 1.13: Packaging Costs of 10 Kg Maize Meal: January 2000- January 2003

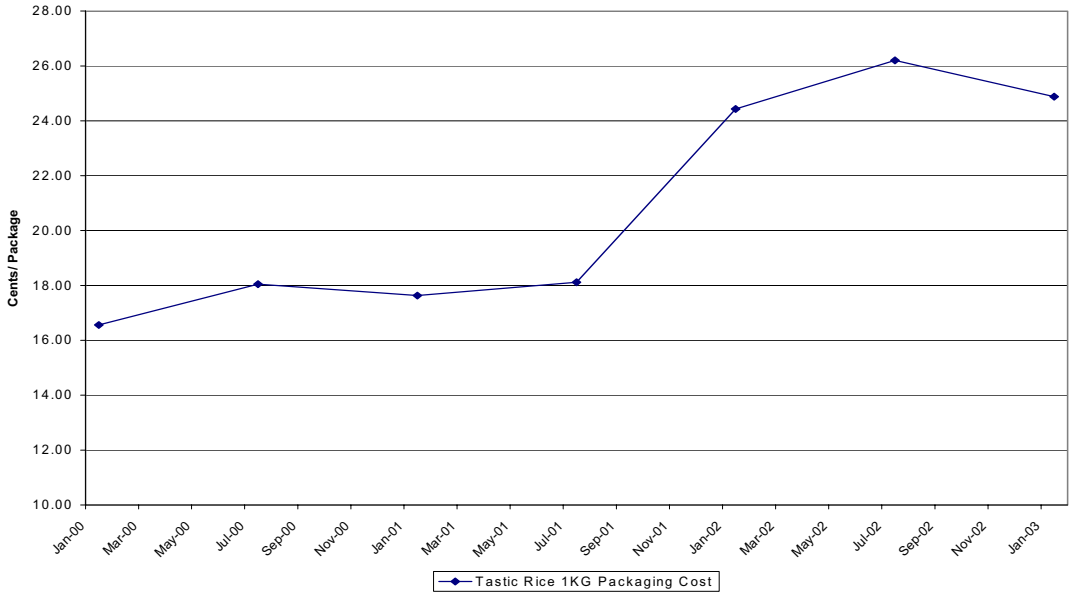

Figure 1.14: Packaging Costs of 1 kg Rice: January 2000- January 2003

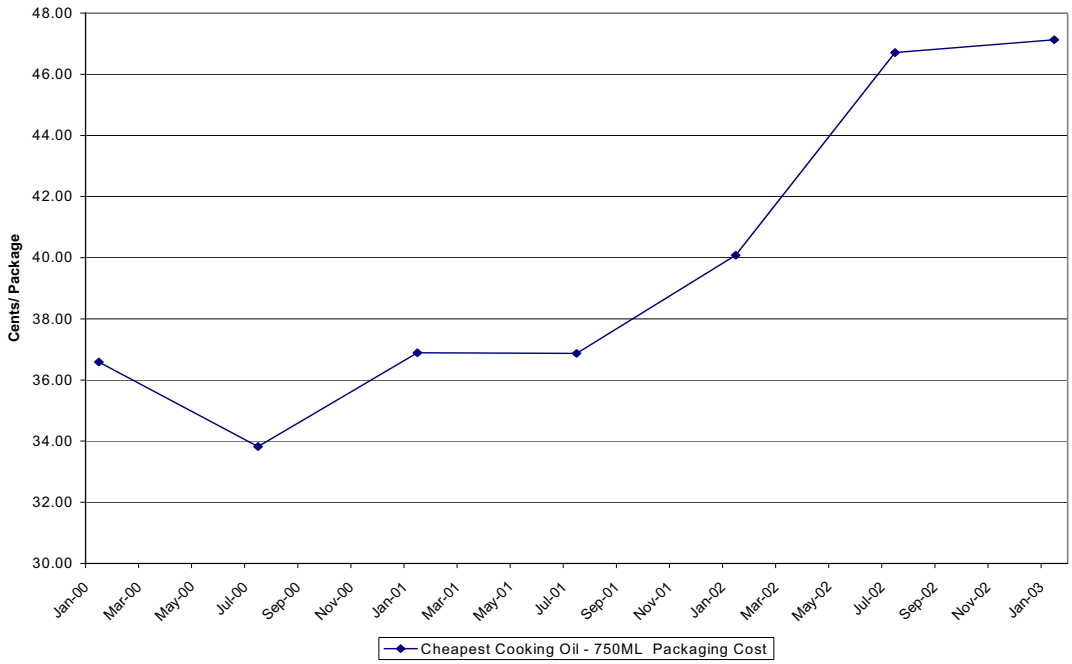

Figure 1.15: Packaging Costs of 750ml Cooking Oil: January 2000- January 2003

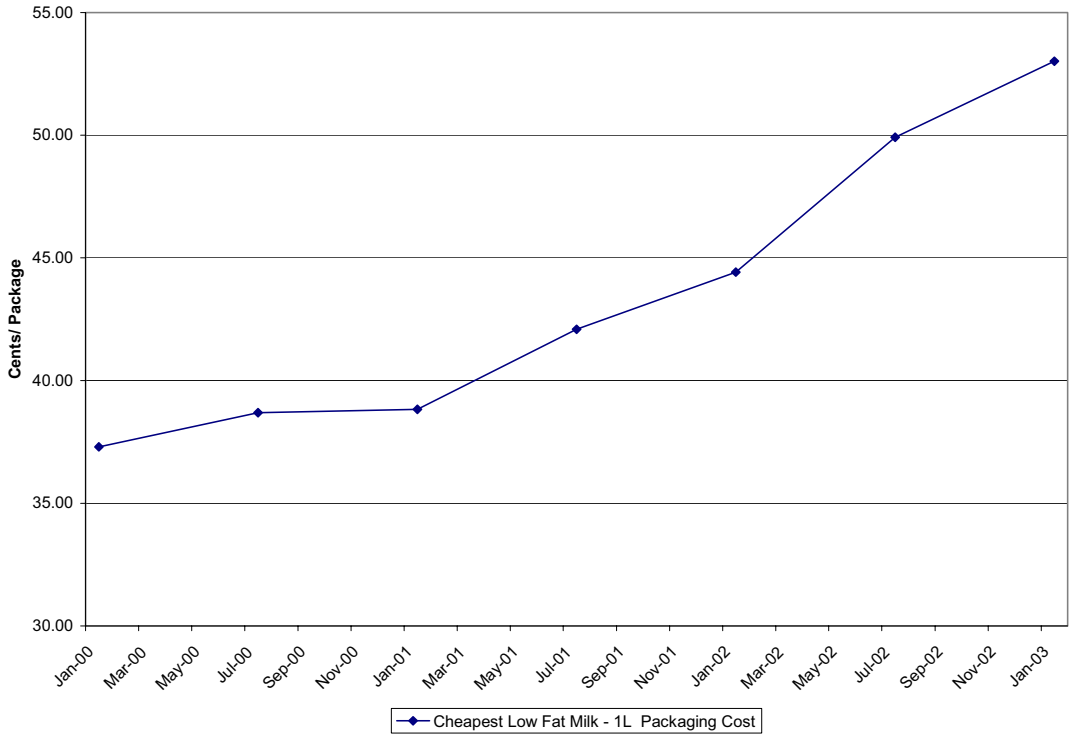

Figure 1.16: Packaging Costs of 1L sachet of Low Fat Milk: January 2000- January 2003

1.6 The agricultural chemical industry

The growth in the price of agricultural chemicals was constant in 1995/96 and in 1996/97 at 15%. The trend in growth rate was positive between 1997/98 and 2000/01. It increased by over 26% in 2000/01. From 2000/01 up to the present, the price has been registering a positive growth rate, although at a decreasing rate. This is evidenced by the negative trend in the growth of the price of agricultural chemicals since 2000/01 (Figure 1.17). The 26% growth in the price of chemicals in 2000/01 is attributable to the sudden growth of the exchange rate in the same year.

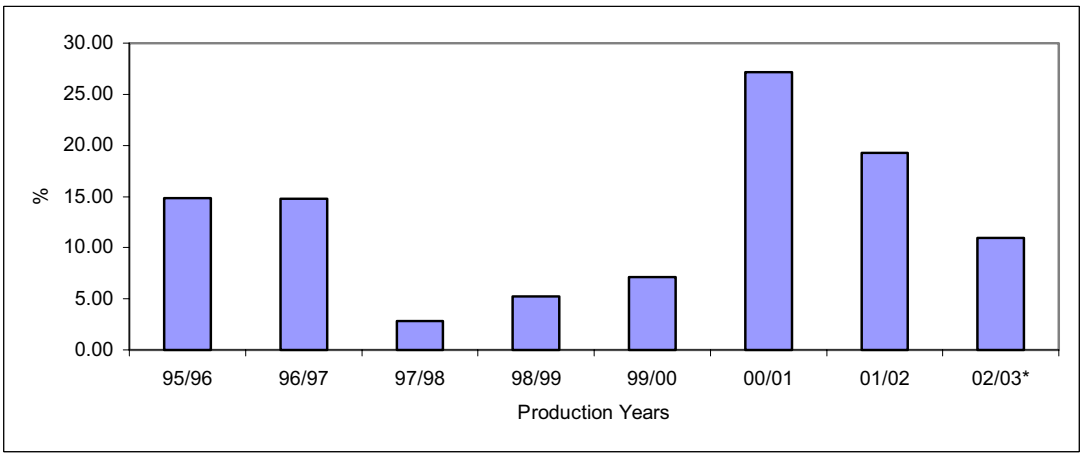

Figure 1.17: Annual Increases of Agricultural Chemicals, 1995/96-2002/03

The quarterly prices of agricultural chemicals (dips and sprays) at constant 1995 prices are shown in Figure 1.18 to 1.20. On average, the prices of agricultural chemicals increased with 111% in real terms since the beginning of 1995. Overall, agricultural chemicals can broadly be divided into livestock remedies and crop protection chemicals, (see Figure 1.18), the prices of which follow similar trends.

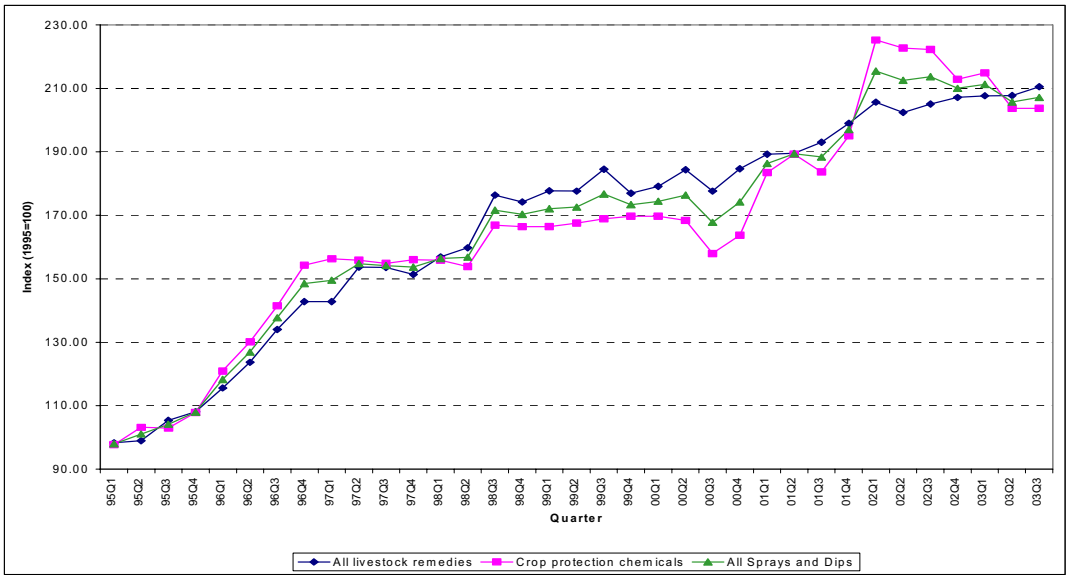

Figure 1.18: Quarterly price index of different animal remedies (1995Q1 – 2003Q3)

Crop protection chemicals are sub-divided into insecticides, herbicides, fungicides and plant growth adjusters. The real prices of these four sub-categories are shown in Figure 1.18. It is clear that over the past two years the prices of insecticides tend to be more volatile compared to other crop protection chemicals.

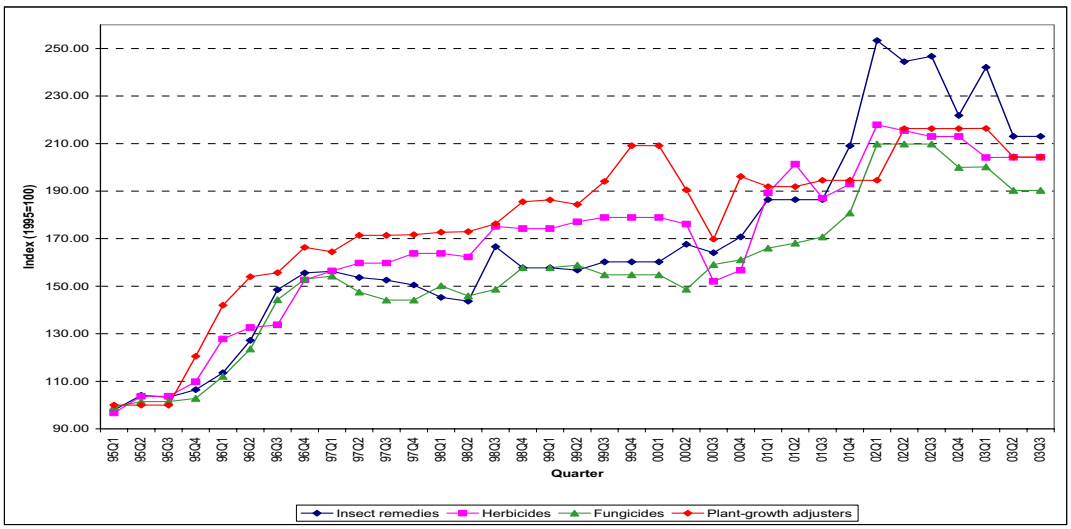

Figure 1.19: Quarterly price index of different crop protection chemicals (1995Q1 – 2003Q3)

The prices of sub-categories of livestock remedies can be sub-divided into dips, worm killers, vaccines and anti-microbial remedies (Figure 1.20). It is clear from Figure 1.20 that changes in the prices of vaccines and anti-microbial remedies are largely to blame for the sharp increases in the price of livestock remedies, especially over the last four years.

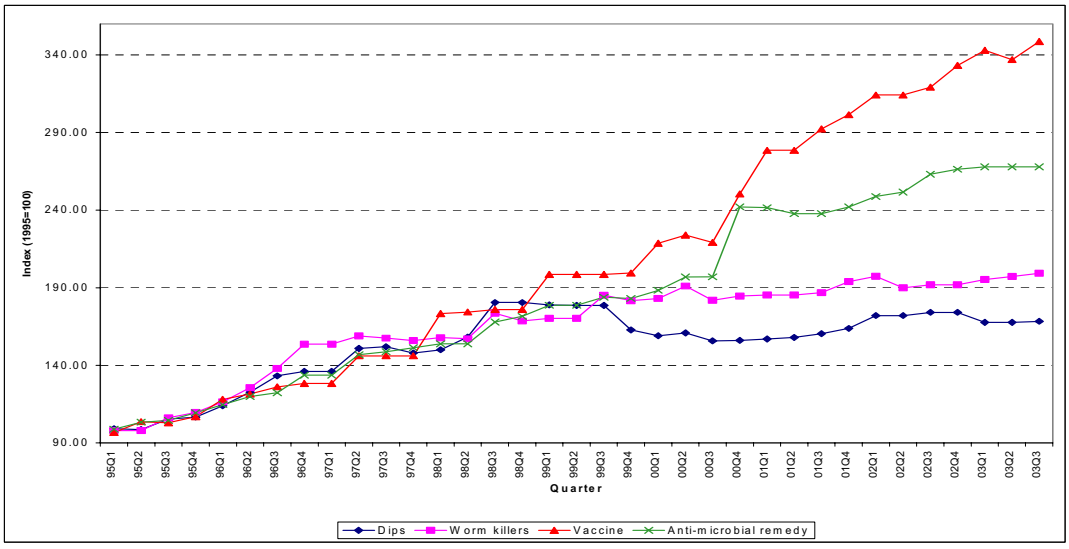

Figure 1.20: Combined quarterly price index of dips and sprays (1995Q1 – 2003Q3)

1.7 Agricultural machinery

Very little response was received from individual agricultural machinery companies on the Committee's request for information on price trends, The general feeling was that the information requested was of strategic and proprietary nature and could not be released. The South African Agricultural Machinery Association (SAAMA) however, provided a

submission to the Committee, which provides an overview of the multitude of factors affecting agricultural machinery prices. In the case of agricultural machinery the Rand/Euro exchange rate is clearly of more importance. With the weakening of the value of the Rand many machinery importers bought forward cover and were thus tied in to forward contracts at weak Rand rates. Price increases were thus inevitable. Many local companies also receive price instructions from parent companies in Europe and the US, which also makes it difficult for local companies not to pass on price increases.

The difficulty with price analysis in this market is that the prices that are available are only the recommended retail price or list price, which forms the starting point of price negotiations. The actual selling price is thus never known. Although Figure 1.21 reveals how fast tractor prices have increased since 2001/02 until present, SAAMA quotes the AGFACTS database that shows that the year-on-year tractor price change fell every month from March 2002 to October 2003.

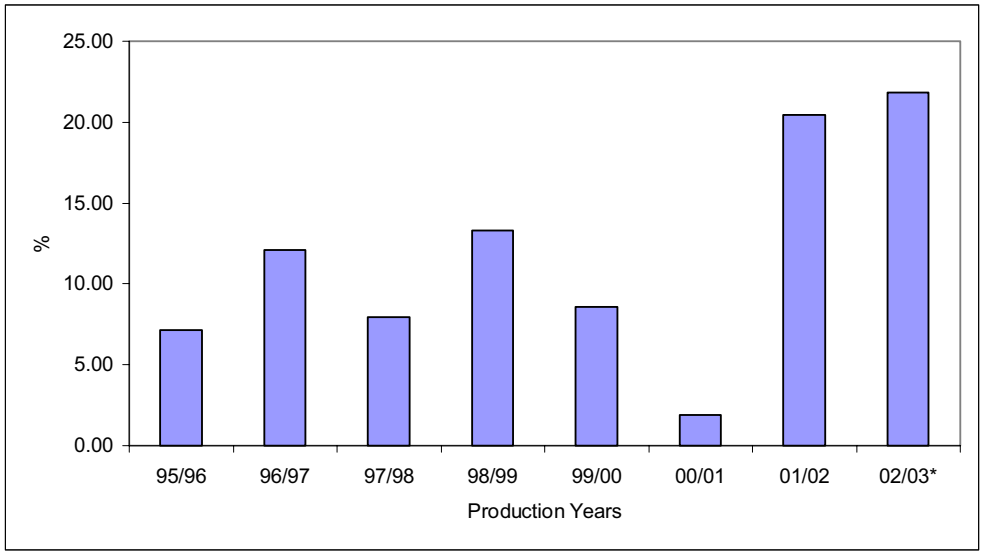

Figure 1.21: Annual increase in Tractor Prices (%), 1995/96 –2002/03

Prices of fertiliser, agricultural chemicals, and tractors have registered upward trends over the past many years. Compared with their pre 2000/01 levels, however, the rates at which these prices have increased since 2000/01 are high. For the most part this is attributed to the significant decrease in the Rand/USD exchange rate.

Based on the descriptive analysis presented, the following tentative conclusions can be made. Input prices increased following the weakening Rand in 2000/01. However, when the Rand started to pick up strength in recent years, it was not followed by a reduction in input prices. Questions that need answering are "Does it have something to do with volatility? If it does, can this be explained by volatility in the exchange rate?"

Attempts to answer these questions are useful because, in the literature, volatility and uncertainty are used in an interchangeable manner. In the next Section it is hypothesised

that increased uncertainty in the exchange rate induces increased uncertainty in the input prices. Increased uncertainty in input prices in turn induces increased instability in the input market, which generally results in higher prices. The recent upward trend in input prices, despite the relatively stronger Rand -which in itself is a product of uncertain foreign exchange market - can be explained by uncertainty in the inputs market, that is, provided that uncertainties in input prices can be proved and that uncertainties in input prices are increasing over time.

1.8 The effect of exchange rate volatility on input prices.

Exchange rates, wage rates, interest rates, land rental rates and food parity prices (or rural-urban terms of trade) are considered macro-prices. In this section, much of the discussion revolves around theoretical claims regarding the impact of the exchange rate volatility on the agricultural sector, in general, and on food prices in particular. The exchange rate is defined as the price of a nation's money in terms of other currencies. It represents the terms by which domestic prices, costs, and other values are translated from the domestic economy onto the international scene.

There are two arguments (i.e. macroeconomic and microeconomic) that explain sources of changes in major agricultural commodities and food prices. The macroeconomic argument considers exchange rate volatility as one of the major determinants of changes in commodity prices. The microeconomic argument takes large demand and supply mismatches and weather as causes of increased volatility in prices (Moledina, et al, 2003). The effect of the latter on commodity prices is alterable by government intervention, which targets the structure of the market. However, the application of target-oriented policies to alter the effect of exchange rate volatility on commodity prices is said to have a much less certainty of results (Houck, 1986).

Theoretical studies on the impact of exchange rate volatility in an economy give contradictory predictions (Yuan, et al, 2003; Barkoulas, et al., 2002). There is a standard hypothesis that exchange rate volatility increases risk and uncertainty and discourages domestic firms from engaging in international trade (Cushman, 1986; Peree and Steinherr, 1989). Others like Viaene and de Vries (1992) and Sercu and Vanhulle (1992) argue on the other hand that volatility in the exchange rate can have ambiguous or positive effects on trade volume. According to the latter group of researchers, the effect of exchange rate volatility on the volume of trade derives from the degree of risk aversion. Increased risk associated with volatility will induce risk-averse agents to direct their economic resources to less risky activities (See Yuan, et al., 2003 for a summary on these). The former group, on the contrary, believes that exchange rate volatility translates in an economy into the reduction of volumes of imports and exports. This would, then, result in the reduction of the surplus or deficit of the trade balance. The impact on volumes of trade arises from variability in the profit streams of international traders (Barkoulas, et al., 2002).

The effect of the exchange rate volatility is not limited to volume of trade alone. Its effect extends to investment and prices. Bleaney and Greenaway (2001), who conducted a study on the effect of real exchange rate volatility on investment and growth, found that real

exchange rate volatility has a significant negative impact on investment. The impact of exchange rate variability on the prices of agricultural commodities, in general, and those from the food sub-sector, in particular, extends through its impact on the costs of production if imported inputs enter into the calculation of costs of production.

The other channel through which the exchange rate can affect prices of agricultural inputs is through its impact on the transfer of resources from non-traded to traded sectors of the economy and vice versa, or through its direct impact on domestic product prices emanating from increased/decreased competitiveness of the domestic market that is made possible by its volatility. Mitchell (1987) has documented direct relationships between shocks to macroeconomic variables such as exchange rate and agricultural commodity prices. According to Aron et al. (2003), the exchange rate channel of transmission is important in the inflation process. It enters directly into the import price, producer price and consumer price index equation. The recent experience in South Africa provides some evidence to this effect.

Sudden Changes in the Variances of the Exchange Rate and Input Prices

Points of sudden discrete changes in the variances of exchange rate and input prices are detected by applying the Iterated Cumulated Sums of Squares (ICSS) method. The cumulative sum of squares is used to detect changes in variances and the time point of each variance shift. The information obtained regarding months of sudden variance changes can then be used to divide the data into different periods in order to determine the effect of exchange rate volatility on input prices at different time intervals.

Here we apply the ICSS methodology in order to tentatively identify cause and effect relationships between input prices and the exchange rate. This is done by comparing time points of sudden change in the input prices and the exchange rate. For exchange rates to be a cause for a sudden jump in the input prices, a sudden jump in the exchange rate is expected to precede a sudden jump in the input prices. The ICSS algorithm is considered useful for detecting the time lag required for an exchange rate shock (or sudden jump in the exchange rate) to be felt by input prices, and approximate the time that a shock in an input price, -whatever the source of the shock might be - to settle down to its pre-shock level. Attempts will be made to supplement findings from the ICSS algorithm by GARCH and regression models.

A relationship between the exchange rate and any one of the input prices is said to exist if the volatilities in the input prices and the exchange rate exhibit discrete spikes within similar time intervals and/or when, within similar time intervals, the volatility of the input price and exchange rate exhibit secular increase over time.

A GARCH/ARCH based measuring of volatility is applied to calculate time varying measures of volatility. This method is preferred to other methods because it has the potential to overstate the magnitude of volatility by taking into account the predictable and seasonal components as part of the volatility (Moledina, et al., 2003). The predictable component represents past values and trends of the price series. However, the

ARCH/GARCH method of measuring volatility considers only the unpredictable or stochastic component, which is believed to be a good measure of uncertainty. The unpredictable component is obtained after the predictable and seasonal components of the price process are removed from the price process. Volatility calculated this way is known as conditional volatility. It is called conditional because past values and trends of the series are considered as accumulated information or knowledge by agents.

Results on Sudden Changes in the Exchange Rate and Selected Input Prices

The time periods of a shift in volatility in selected variables as identified by the ICSS algorithm are shown in Figure 1.22 to Figure 1.27.

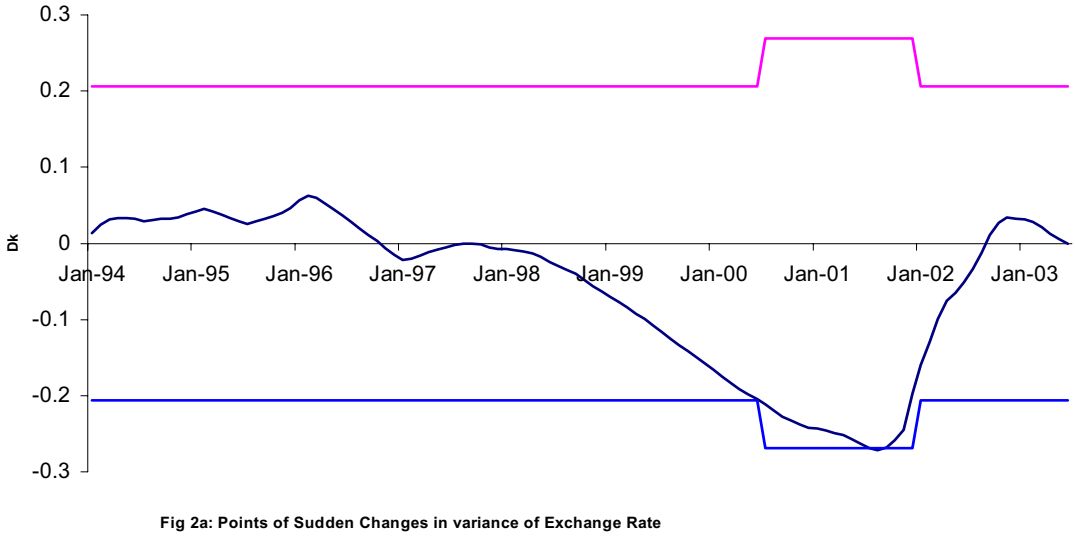

Figure 1.22: Points of sudden change in variance of exchange rate

As can be seen from Figures 1.22 (above) and 1.23) below, a sudden jump in variances of the exchange rate and in tractor prices of all models coincide. The jump in the exchange rate started in June 2000. Its variance attained its peak value in August 2001. The variance remained below the –3 standard deviation band (i.e. in the region where the null hypothesis of homogeneous variance is rejected) until December 2001. The sudden jump in tractor prices started late in March 2001, that is, eight to nine months after the sudden jump in the exchange rate occurred. The null hypothesis of homogeneous variance is accepted for the exchange rate starting January 2002 but for tractor prices this occurred after February 2002, that is a month after the variance in the exchange rate subsided to its pre-June 2000 level. Therefore, it can be concluded that the sudden jump in the tractor prices was preceded by a sudden jump in the exchange rate. In other words, we are suggesting that the sudden jump in the exchange rate was a cause for the sudden jump in the tractor prices.

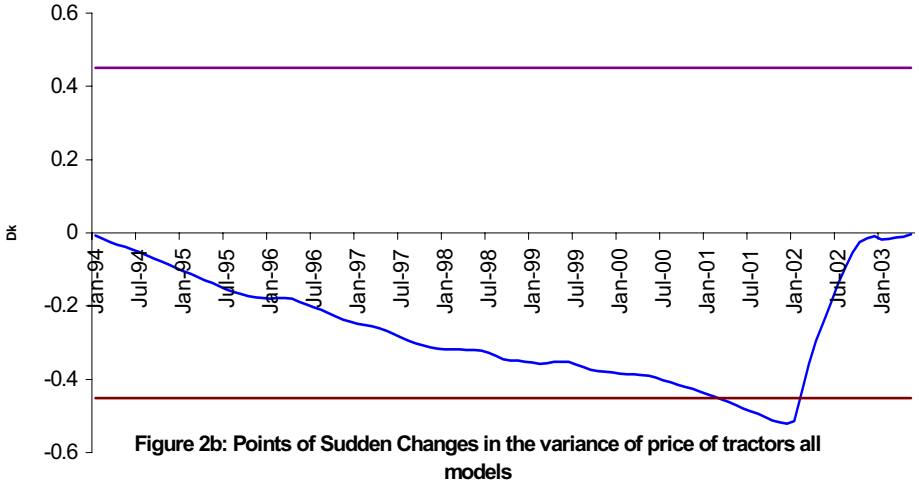

Figure 1.23: Points of sudden changes in the variance of price of tractors

To see the time points during which sudden jump in the fertiliser prices occurred, data on the prices of Ammonia, DAP, and Urea were subjected to a similar type of analysis. According to figure 1.24 below, a significant sudden change in the price of Ammonia occurred in September 2000, three months after a significant exchange rate variance was registered for the exchange rate in June 2000. The time it took for the variance in the Ammonia price to settle back to its September 2000 level was short. Therefore, according to these findings the sudden jump in Ammonia price was preceded by a sudden jump in the exchange rate.

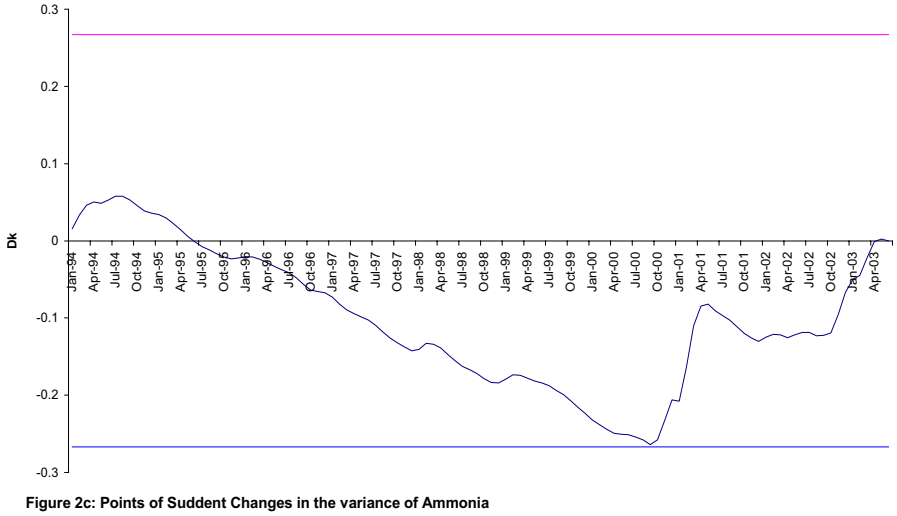

Figure 1.24: Points of sudden change in the variance of the price of Ammonia

A similar relationship between jumps in the exchange rate and the price of Urea was found, except that the time gap between the jump in the exchange rate and the Urea price was wide. A significant jump in the price of Urea was registered in August 2001, that is, ten months after the sudden jump in the exchange rate was realised. The time it took the volatilities in both cases to settle down to their pre-jump levels coincides, however. The urea price returned to its pre-August level in December 2001. Therefore, it can be concluded that the jump in the Ammonia prices was preceded by sudden jump in the price of Urea.

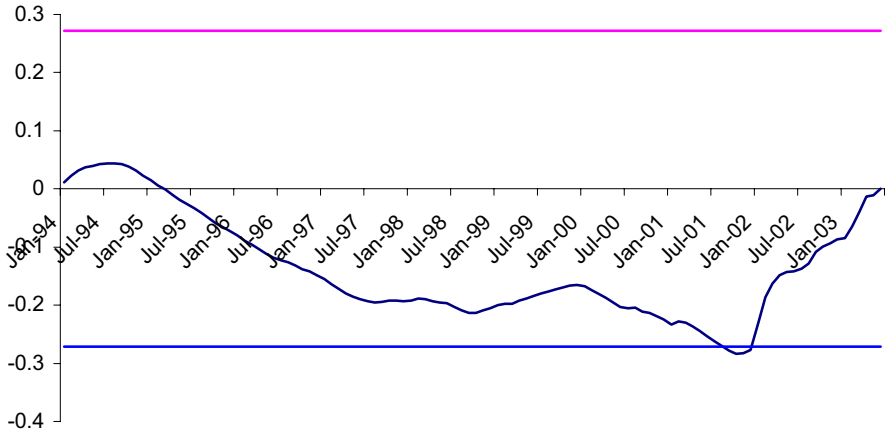

Figure 2d: Points of Sudden Change in the variance of Urea

Figure 1.25: Points of sudden change in the variance of the price of Urea

The effect of the exchange rate volatility on fertiliser prices was further investigated by looking at the relationship between Dap prices and the exchange rate. According to figure 1.26, a significant sudden change in the price of Dap occurred in February 2001, seven months after a significant jump in the variance of exchange rate was registered. The variance or volatility in the Dap price returned to its pre-February 2001 level a year later, that is, in February 2002. Considering the adjustment time that is required for a shock to take effect, we conclude, once again, that the sudden jump in the exchange rate occurred before the sudden jump in the Dap price was realised.

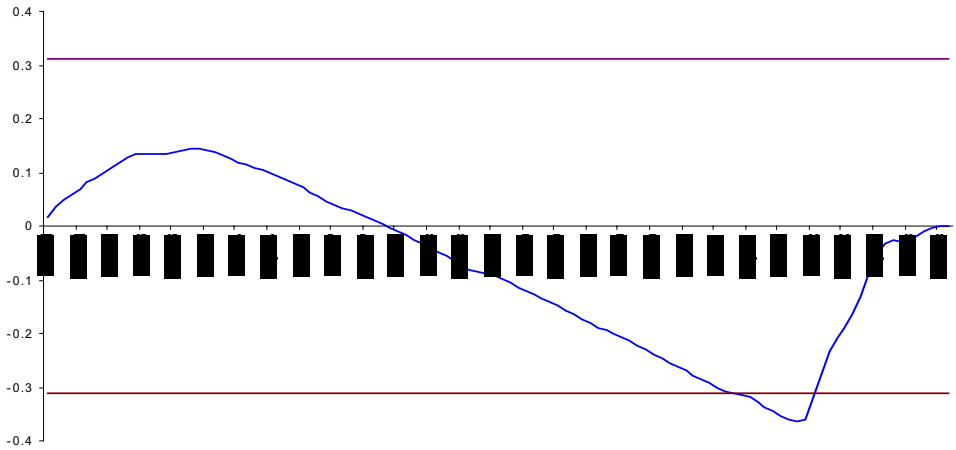

Figure 2e: Points of Sudden Change in the Variance of DAP

Figure 1.26: Points of sudden change in the variance of the price of Dap

In this section the results are discussed of calculating the measure of volatility for the following agricultural inputs: farm implements, tractors, trucks, irrigation equipment, building materials, fuel, fertiliser, feeds, etc.

Table 1.5: Measures of volatility of input prices and exchange rate

Series Name	Period	Process of series	Presence of non constant volatility indicator ã for yes and – for No
Exchange rate	1994:04-2003:01	ARIMA (1,1,0) GARCH (1,1)	ã
Farm implements	1994:04-2003:01	ARIMA (1,2,0)	–
Building materials	1994:04-2003:01	ARIMA (0,2,1)	–
Feeds	1994:04-2003:01	ARIMA (2,2,0)	–
Urea	1994:01-2003:06	ARIMA (1,1,0) GARCH (1,1)	ã
Dap	1994:01-2000:06	ARIMA (1,1,0) GARCH (1,1,0)	ã
Ammonia	1994:01-2000:06	ARIMA (1,1,0) GARCH (1,1)	ã
Tractors all models	1994:04-2003:01	ARIMA (1,1,0) GARCH (1,1)	ã

Source: Author's calculation

As shown in the first line of Table 1.5 above, the null hypothesis for no ARCH effect was rejected for the exchange rate. This means that the volatility in the exchange rate measured by the standard error of the GARCH regression has no constant variance during

the period under investigation. This is an important result because from here we will attempt to establish whether the input prices follow suite.

According to Table 1.5 (above), the null hypothesis of no ARCH effect was accepted for farm implements, building materials, and feeds. This means that farm implements, building materials, and feeds have a constant standard error (a measure of volatility) over the period under study. This entail that the volatility in these prices have been constant and cannot, thus, be related to the exchange rate whose volatility is varying over time. In this way, it can be established that the exchange rate volatility has had no effect on the prices of building materials, farm implements, and feeds. This can be attributed to the fact that most of these inputs are either manufactured locally, or to the fact that the imported components for manufacturing have a negligible share in the production cost of these inputs.

Table 1.5 further indicates that the no ARCH null was rejected for tractors of all models and for some of the major ingredients of fertiliser (i.e. Urea, Dap, and Ammonia). This means that the conditional standard errors of these input prices are not constant but vary over time. To see whether the volatilities in these prices and the exchange rate exhibit some form of relationship, the presence of common trends in these prices and the exchange rate were checked, firstly, by inspecting trends in their respective conditional standard plots and, secondly, by regressing the input prices (in first difference form) on a constant term, one month lag of the dependent variable, and a conditional standard error of exchange rate obtained from the GARCH regression. The exchange rate volatility is expected to have a positive and significant impact on the prices. This is discussed in the following paragraphs.

As shown in Table 1.5 above, only the exchange rate, the tractor and fertiliser prices (which include Ammonia, Dap and Urea) exhibited ARCH effects. The null hypotheses for no ARCH effects were accepted for the rest. Therefore, those aspects with ARCH effects were remodelled to calculate time varying measures of volatility. The results of this are shown in Figures 1.27 and 1.28.

According to Figure 1.27 (below), the volatility in the exchange rate exhibits discrete spikes in August 1998, January 2002, June 2002, and January 2003. Except for August 1998 and January 2002, they exhibited a relatively low rate of volatility. Volatility in the exchange rate has been on the increase since September 2001. This is demonstrated by the positive trend in the rate of volatility of the exchange rate after September 2001.

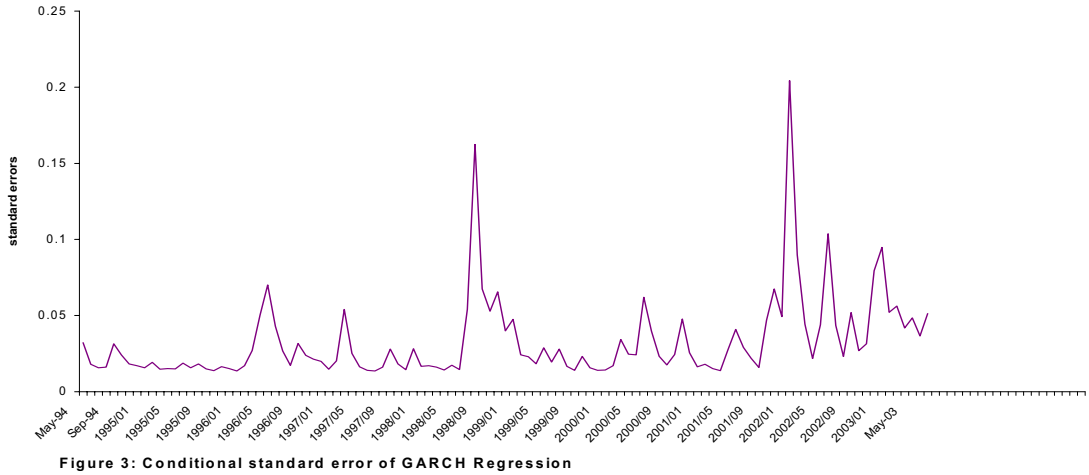

Figure 1.27: Conditional standard error of GARCH regression for the exchange rate

To determine whether similar spikes and trends in the volatility of input prices can be found, conditional standard errors of tractor prices were calculated using the GARCH method. These were then compared with the conditional standard errors of the exchange rate given in Figure 1.27 (above).

According to Figure 1.28, tractor prices showed discrete spikes in June 1996, June 1997, March 2002, and February 2003. The spikes in March 2002 and February 2003 are the highest. The spike in March 2002, the highest of all, can be correlated with the spike in the exchange rate that occurred in January 2002 with a time lag of three months, while the spike in February 2003 can be correlated with the spike in January 2003 with a time lag of one month.

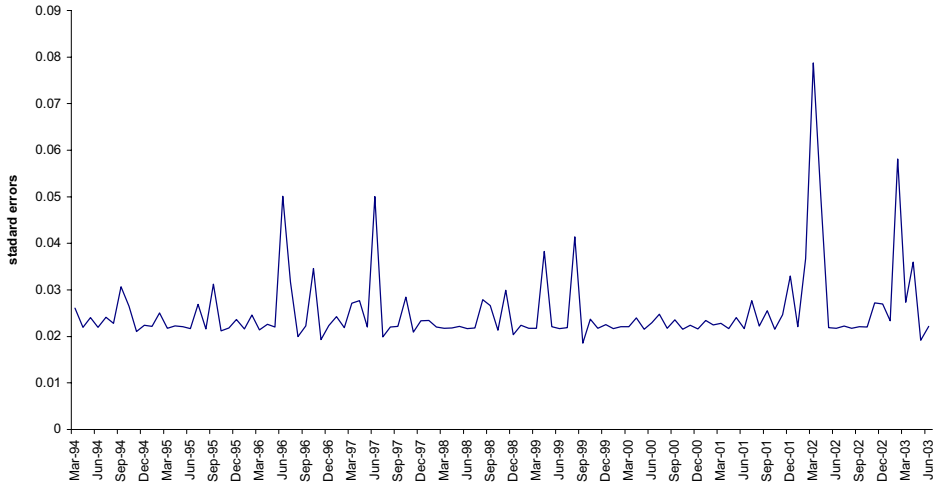

Figure 4: Conditional Standard Errors of GARCH Regression for tractors

Figure 1.28: Conditional standard error of GARCH regression for tractor prices

The above findings were confirmed by running a regression of tractor prices in first difference format on a constant term, one year lag of the dependent variable (tractor prices in differenced form) and volatility in exchange rate. The conditional standard error of the exchange rate was used as a measure of volatility in the exchange rate. According to the results obtained, the impact of the exchange rate volatility on the price of tractors is positive, and is highly significant at one percent level of significance.

The impact of the exchange rate volatility on fertiliser prices was determined in the same fashion. The paragraphs that follow discuss some of the major findings regarding the relationship between the volatility in the fertiliser prices and the volatility in the exchange rate for Ammonia, Urea, and Dap. As was done for tractors, here too, similarities in the time points of major spikes and overtime trends in the volatility of the exchange rate and prices of Ammonia were compared.

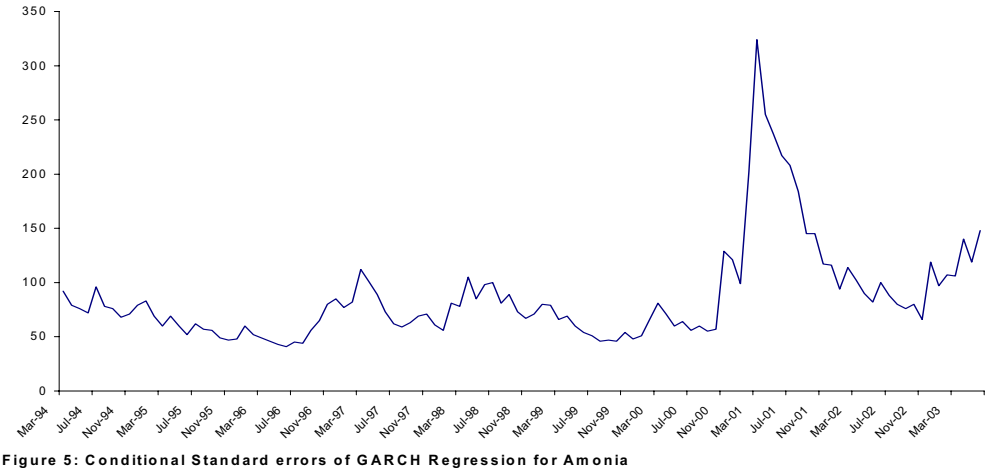

Figure 1:29: Conditional standard error of GARCH regression for Ammonia prices

As shown in figure 1.29 above, the volatility in the Ammonia price exhibited no discrete spikes other than the one that occurred in March 2001. Like the volatility in the exchange rate, the volatility in the price of Ammonia has been increasing over time since October 2000. Further attempts made to determine the effect of the exchange rate volatility on the price of Ammonia gave a positive but insignificant coefficient for the exchange rate volatility.

The same results were found for the analysis of Urea and Dap, thus supporting the earlier findings that fertiliser prices are positively affected by the volatility in the exchange rate.

Conclusions

This section focused on the investigation of the impact of the exchange rate volatility on input prices. To achieve this, trends in selected agricultural input prices that involved imported components in their cost of production, such as the prices of fertiliser, agricultural chemicals, and tractors, were analysed in relation to the exchange rate. According to the results, with the exception of tractor prices, which grew by less than 3%, these increased by more than 25% in 2000/01 alone. The tractor price did follow the price of other inputs in later years (2001/02 up to present) by growing on average by 23% annually. These changes in price coincided with the sudden fall in the value of the Rand in 2001, and with the subsequent fluctuation of the same to date.

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