CHAPTER 1

INTRODUCTION

1.1   Background

Agriculture plays a very important role in the South African economy. It contributes between 14% and 20% of the Gross Domestic Product (GDP) and provides significant employment and earns foreign exchange, as South Africa is a net exporter of agricultural products. In 2002, the total gross value of production of agricultural products was R70, 774 million but this decreased to R68, 867 million in 2003, as the result of a decrease in field crop production (National Department of Agriculture, 2003:3).

The value-added contribution of agriculture, fisheries and forestry represented 3.8% of the total value added in South Africa during 2003. This amounted to R41, 935 million, as indicated in table 1.1.

Table 1.1   Contribution of agriculture to the value added at basic prices

Year	Total value added	Contribution of agriculture to the value added	Contribution of agriculture as % of the total value added
	(R million)	(R million)	(%)
1998	673 860	20 285	3.0
1999	728 785	20 537	2.8
2000	808 461	21 032	2.6
2001	895 533	25 343	2.8
2002	1 021 685	35 383	3.5
2003*	1 100 925	41 935	3.8

*Figures for agriculture (including fisheries and forestry)

Source: National Department of Agriculture, 2003:10

In 2002, agricultural co-operatives, which form an integral part of agriculture in South Africa, had assets valued at R6, 7 billion and a net income after tax of R193 million.

In South Africa, co-operatives first came into existence in 1902, at the end of the Anglo-Boer war. During the war, agriculture in most provinces had come to a complete standstill as crops and cattle were almost completely destroyed. This gave rise to the need for economic reconstruction but capital for this development was unavailable. It became general practice for farmers to produce and sell their products directly to the nearest dealer at a fixed price in exchange for food, clothes and other necessities. Farmers wanted to improve their financial position by finding new ways to market their products at better prices. With the support of the government, farmers started co-operatives in all provinces of South Africa. These started gradually but played a significant role in changing agriculture into the successful enterprise it is today.

According to D'Haese (2000:33), in 1912 the South African government introduced legislation to establish the Land Bank in order to assist with the development of agriculture. The Land Bank provides financing to farmers and co-operatives. In 1922 the Co-operative Act no 28 was introduced in the then four provinces of the Transvaal, Free State, Cape Province and Natal. The Act provided guidelines for the registration, establishment and management of co-operatives. Co-operative Act no 38 was promulgated in 1925 and introduced the one-channel marketing system (see figure 1.1). The Marketing Act of 1937 provided directives for the functioning of this one-channel marketing system (D'Haese, 2000:33-34).

Figure 1.1   The one-channel marketing system for agricultural products in South Africa

Source: D'Haese, 2000:34

As indicated in figure 1.1, the government influenced the co-operatives through the control boards. These had to establish the maximum price of commodities as well as the gross profit of a co-operative, thus eliminating any price fluctuations between producer and consumer (D'Haese, 2000:34). The Marketing Act 59 of 1968 replaced the Marketing Act of 1937. It had as its primary objectives price stability, the decrease in marketing product cost, an increase of productivity as well as efficiency of the agricultural business (Marx, and Van der Walt, 1989:645-646). With this act the Minister of Agriculture had the power to appoint control boards for every agricultural product (Vink, Kirsten, and van Zyl, 1998:75). Agricultural products were sold domestically and internationally at a fixed price through the control boards. The agricultural co-operative was seen as the link between the control boards and the farmer (D'Haese, 2000:16).

Legislation pertaining to co-operatives was again changed with the introduction of the Co-operative Act 91 of 1981. This contains the new and modernized guidelines for the establishment, working and de-registration of co-operatives (D'Haese, 2000:35). This act remains the primary legislation governing co-operatives. It provides for three different kinds of co-operatives, namely the agricultural co-operative, special farmers' co-operatives and trading co-operatives. All these are administered by the National

Department of Agriculture and operate only in the agricultural sector.

During the latter half of the 1980s, deregulation and liberalisation became eminent in South Africa's agricultural sector (Van Zyl, Vink, Kirsten, 2000:1). Since1985 there has been a steady decline in government support for agriculture. After 1994, a new liberalisation policy followed, aimed at previously disadvantaged communities. D'Haese and Bostyn (2001:1) classify the main elements of the liberalisation policy as:

1   the overhaul of the regulated marketing system by deregulation of agriculture and liberalisation of prices;

2   change in the tax system; and

3   re-orientation of government spending with regard to agriculture.

According to Amin and Bernstein (1996:19), the most important changes to the legislation of co-operatives were enacted under Amendment Act 37 of 1993, which gave co-operatives an extended scope in their business activities, including:

1   extending business with non-members from 5% to 49% of total business;

2   converting themselves (transferring their assets) to companies or closed corporations;

3   trading in land; and

4   appointing non-members to their boards.

In addition to the changes in the Co-operative Act, the Marketing of Agricultural Products Act 47 of 1996 replaced the Marketing Act 59 of 1968. This Act provided for deregistration of the control boards before 5 January 1998 (GCIS, 1999:83-84). This legislation resulted in the total deregulation of agricultural product marketing.

With the absence of the control boards, the fixed price system was also deregulated and liberated. Prices are now determined by supply and demand and the control boards are no longer there to absorb losses in the industry (Spies, 1998:3-61).

In 1995 the futures market was introduced to ensure price stability for all agricultural

products (Ministry of Agriculture and Land Affairs, 1998:4). The deregulation of the agricultural sector to a free market economy in 1994 resulted in a dramatic change in the structure of the agricultural sector. The free market system orientation forced producers to adapt agricultural businesses to the changing circumstances. In many circumstances, it was regarded necessary to change the business form to public companies (Shone, 2003:4). D'Haese and Bostyn (2001:3) estimate that 70 of the 246 agricultural co-operatives registered with the Registrar of Co-operatives had transformed into companies by 2001, with some listed on the Johannesburg Securities Exchange (JSE). The largest of these transformed co-operatives are Eastern Transvaal Co-operative (OTK), an agricultural service group which in 2001 was rated 11th of the top 100 listed companies in South Africa.

The co-operative structure in South Africa can be divided into primary, central and federal co-operatives. At the end of 2003 there were more than 15 central co-operatives and almost 1000 primary agricultural co-operatives in South Africa (South African Yearbook, 2004:88). Where a primary co-operative provides its members with inputs such as seed, fertiliser and fuel, as well as providing credit and handling most of the members' produce, the central and federal co-operatives provide primary co-operatives with services in the processing and marketing of their agricultural products, as well as short term insurance for crops and farming requisites.

For farmers to share in the advantages of a co-operative they have to become members by buying shares in the co-operative. The National Department of Agriculture (2000:4) states that membership of a co-operative is on a voluntary basis and anyone who meets the requirements of membership and who can contribute to the co-operative must be included. No discrimination is allowed. It is also stated that members will not earn dividends on the basis of the number of shares they own, as in the case of a company or closed corporation, but rather on the value of their business with the co-operative (purchases and/or deliveries). This principle is also evident in the definition that Beierlein, Schneeberger and Osburn (1995) assign to a co-operative, namely, a free enterprise that is controlled and owned by a group of legal entities with the sole purpose of having mutual benefits on an equal basis, arising from their activities and not from

investing in the co-operative. At the end of each financial year the members can decide to divide the profits or to keep them for other purposes. If profits are divided between members this will be done according to the percentage of business a member has conducted with the co-operative (the greater the business, the higher the bonus) at the end of the year.

The fundamental differences between a co-operative and a company are indicated in table 1.2.

Table 1.2   Differences between co-operatives and companies

Difference	Co-operative	Company
Laws	Co-operative Act	Company Act
Purpose	To look after the interest of members	To create profits for its shareholders
Owner/client	Owners make up the majority of clients	Owners not necessarily the clients
Tax	Certain tax privileges	Company tax law applies
Share capital	Sale of shares – regain initial capital	Sale of shares - get present value of shares
Control	Voting rights through amount of member's contribution	Voting rights according to % of total shares
Profit/loss	Profits are distributed as bonuses to members – members carry no loss	Profits are distributed as dividends to shareholders – shareholders carry the loss
New members/shareholders	New members buy into the co-operative at a specified price and enjoy the full service package irrespective of the amount invested	New shareholders buy shares at market price
Management and control	Directors chosen by members	Directors chosen by the shareholders

Source: D'Haese, 2000:84-85

to provide its members (farmers) and other clients with world-class service and to create sustainable shareholders' wealth (Finance Week, 2002:38).

The functions of traditional agricultural co-operatives and those that transformed to companies, in essence therefore, remain very similar[1]. These functions include the following:

1 **Pooling resources of members and providing finance**

By pooling resources, the members of an agricultural co-operative firstly obtain the synergetic advantage of investing in a capital infrastructure that benefits all of them. Secondly, the pooling of resources establishes procurement and marketing benefits for all members. Thirdly, it helps to secure professional services, such as agricultural advice and research, to improve members' production capacity. With the pooling of resources, members share the risks but the return they get on their capital is based on a patronage allocation (Cobia, 1989:130). Agricultural co-operatives also provide their members with loans on which reasonable interest rates are payable. These loans are usually at better rates than those of other moneylenders and aimed at improving members' financial position (Thordarson, 1990:2).

2 **Providing members with access to domestic and international markets**

Co-operatives perform a two-sided function in this regard. Firstly, they procure all products and services required by their members, nationally and internationally, at better prices than individual members could obtain. Secondly, they buy products from members. Farmers find it more cost effective to sell their products to the co-operative than to market them on their own. This allows farmers to concentrate on their businesses safe in the knowledge that there is a market for their products (AgriTV). Co-operatives market the products locally and internationally. Co-operatives do, however, also add value to products produced by their members by undertaking manufacturing processes, producing

for instance sunflower oil, peanut butter, maize meal, flour, wine, meat products, dog food etc. These products are also marketed locally and internationally. Co-operatives have the knowledge and resources to provide this service to their members.

3   Providing services to members

Co-operatives perform functions that are costly and time-consuming for farmers, such as grain storage. They also offer production guidelines and risk management advice.

Shone (2003:4) supports the abovementioned functions of agricultural co-operatives by summarising their role in the international and domestic market place as:

1   matching supply and demand;
2   linking provision of credit for production opportunities;
3   providing guidelines for production; and
4   offering risk management advice.

In performing these functions, agricultural co-operatives are exposed to certain financial risks, which, according to Lombaard (2003:26) are:

1   commodity price risk;
2   yield risk;
3   interest rate risk; and
4   currency risk.

1.1.1   Commodity price risk

Commodity price risk can be defined as the probability that the price of a certain product will, in the future, differ from the price today. This may have a positive or a negative effect on the agricultural co-operative.

The volatility of commodity prices is best reflected by historical future price information from the South African Futures Exchange (SAFEX). Figures 1.2 to 1.5 are based on data that were obtained from the GrainSA website (2004). Figure 1.2 shows the changes in price of various agricultural products in South Africa over the period October 1997 to December 2003. Between September 2001 and January 2002 the price of yellow maize increased from R1 026 to R1 585 per ton. This, according to Van Rensburg and Ehlers (2002:6), was due to the variation in supply and demand, international grain prices, and fluctuations in the exchange rate. Other factors that played a role were the adverse weather conditions in South Africa and neighbouring countries. White and yellow maize contracts have been listed on SAFEX since 1996. As can be seen from figure 1.2, white maize prices stayed fairly constant during the period 1997 to the end of 2001, fluctuating between R500 and R1 000 per ton. At the end of 2001, prices of white maize increased dramatically to a high of almost R2 000 per ton, decreasing only at the end of 2002. In November 1997 wheat was introduced to the exchange at a price of R890 per ton and increased steadily, breaking the R2 000 per ton mark in September 2002, after which it declined but still traded closely around R1 500 per ton. Sunflower seed contracts only started trading at the beginning of 1999 and increased steadily. The greatest fluctuation occurred between 2001 and 2002 when prices of sunflower seeds increased to a high of R 3 026 per ton and dropped to R1 600 per ton in 2003, as indicated in figure 1.2. All these contracts have shown enormous growth in volume trades in order to hedge the price changes. For example in August 2003, the price of white maize futures rose with an unexpected change in the overnight electronic trading on the Chicago Board of Trade (Smith, 2003). This was after the United States of America (USA) Department of Agriculture revised the crop quality reports downwards due to the hot and dry weather in the maize belt. In this regard contract volumes rose from 2412 in September 2003 to 4350 in December 2003 (Smith, 2003).

Figure 1.2   South African commodity prices for maize, wheat and sunflower seeds as quoted by SAFEX – October 1997 to December 2003
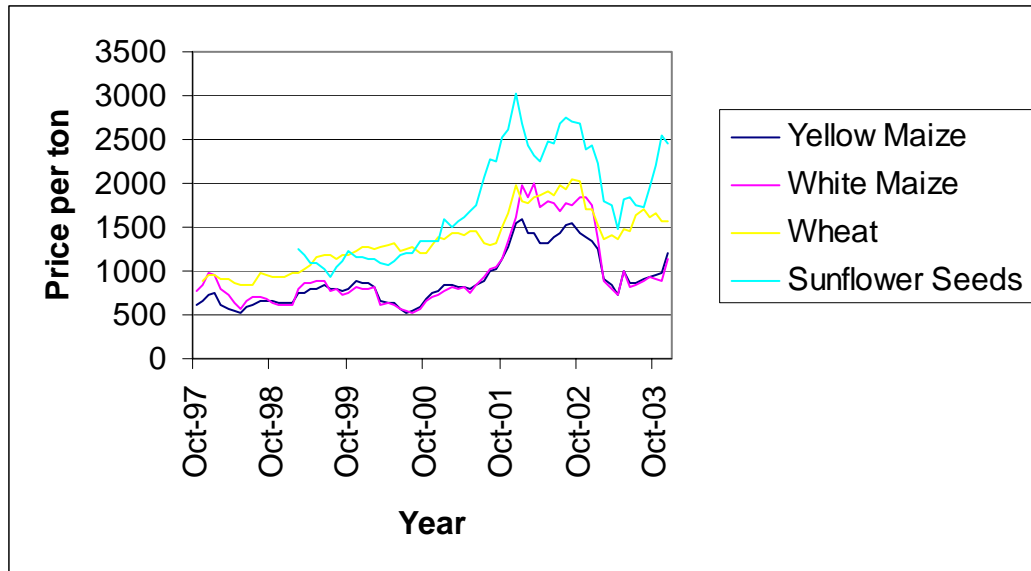
1.1.2 Yield risks

Yield risks affect agriculture mostly because of adverse events that cannot be controlled, such are weather and new technology. Weather risk includes too little or too much rainfall, hail, extreme changes in temperature and other factors such as insect plagues and diseases. Another form of yield risk stems from technology that is used to reduce production risks through the introduction of new varieties of crop and production techniques that improve the efficiency of the production process. Agricultural co-operatives are exposed to yield risk because, as marketing agents for their members, they enter into local and international forward contracts for selling their members' products. These forward contracts are based on the historical availability of products and members' intentions, communicated to the co-operative, regarding future production. Adverse weather conditions and the inclination of members to change to production of other crops based on their expectation of improved profitability, could affect the ability of the co-operative to fulfil its obligations in terms of the forward contracts. Thirteen percent of South Africa's surface can be used for crop production. Maize takes up the largest area of arable South African land (figure 1.3), followed by wheat, sugar cane and sunflower (South African Yearbook, 2004:71). The maize industry, which is the largest, has a very important role in the economy. The National Department of Agriculture stated

that during 2000, approximately 3, 7 million tons of maize were used for human consumption and 3,2 million were processed by the industry as farm feed. The remainder was exported to neighbouring countries.

Figures 1.3 to 1.5 provide the following yield related information regarding maize, wheat and sunflower over the period 1994 to 2003:

1   area planted with maize, wheat and sunflower (figure 1.3);

2   estimated production in tons for maize, wheat and sunflower (figure 1.4); and

3   yield per hectare for maize, wheat and sunflower (figure 1.5).

Figure 1.3   Area planted with maize, wheat and sunflower – 1994 to 2003
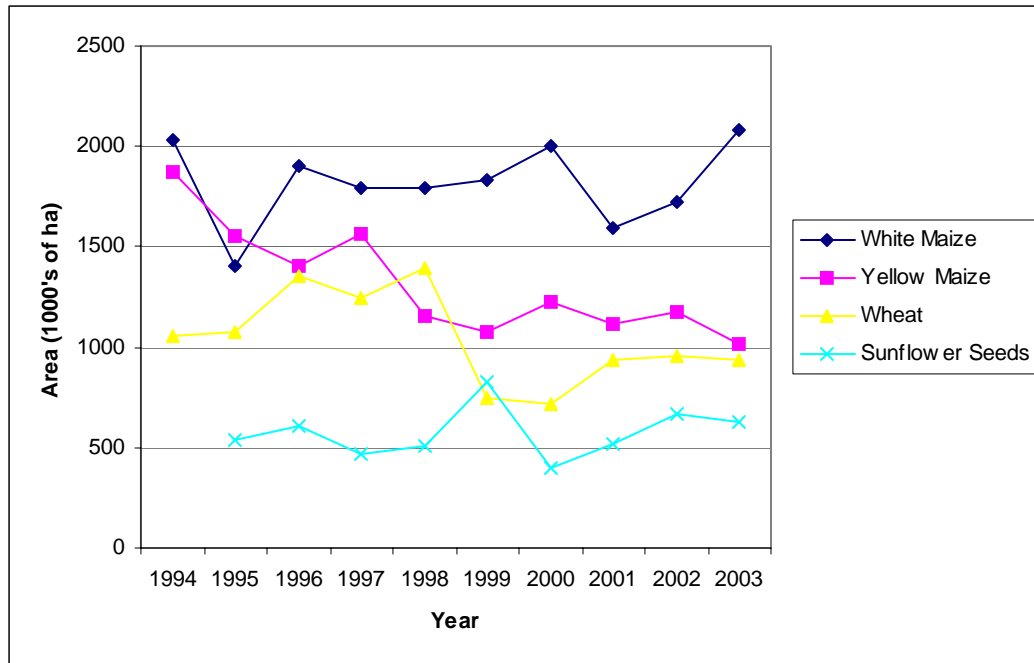
As indicated in figure 1.3, the largest area is used for white maize production, and this remained constant during the period 1995 to 2000, fluctuating around 1,8 million ha, except for the rather sharp decreases in 1994 and 2001 when 1,4 million ha and 1,6 million ha were planted. Yellow maize declined in area planted from 1,877 million ha in 1994 to only 1 million ha in 2003. The reason for this decline is not clear from the information at hand as the price of yellow maize is not very different from that of white maize, although white maize is normally used for both human consumption and animal feed, whilst yellow maize is usually used for the latter purpose only. White maize can therefore be regarded as a more multi-purpose crop. The wheat production area showed an increase from 1994 to a high in 1998 of 1, 4 million ha, followed by a sharp decline to

a low of 718 thousand ha in 2000. Since then the area under wheat has stabilised to around 900 thousand ha. It has not fully recovered to the area planted in the 1990s despite the fact that the yield per hectare has improved and prices did not fluctuate more than that of maize and sunflower. The price of maize, however, has been higher than that of wheat since the late 1990s. This could have contributed to a move away from the planting of wheat. Sunflower covers an area of between 400 thousand and 800 thousand ha, with a high of 830 thousand ha planted in 1999. This commodity has the lowest area fluctuation.

Figure 1.4   Estimated production in tons for maize, wheat and sunflower – 1994 to 2003
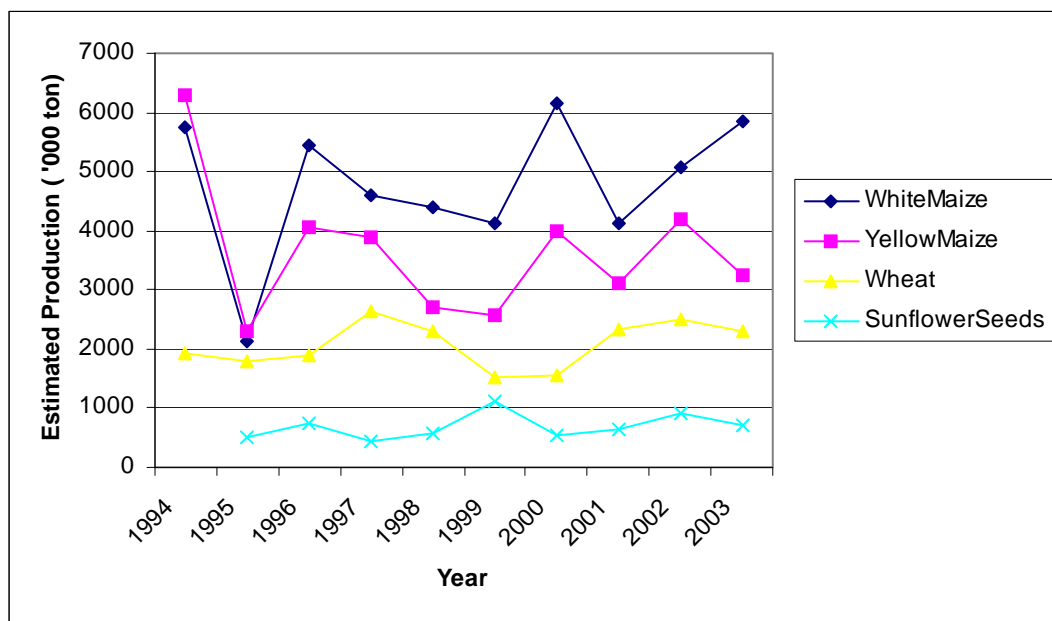
The estimated production of white and yellow maize fluctuated enormously through the period 1994 to 2003, with a 67% and 36% decrease respectively in 1995. After the decrease, white maize increased to 5, 44 million tons and then stabilised at around 4,5 million tons. The period 1999 to 2001 saw a fluctuation of 48% to a high of 6,155 million tons for white maize followed by a decrease and an upward slope thereafter. The estimated production for wheat shows less dramatic changes from 1994 to 2003, ranging

between 1, 5 million and 2, 6 million tons. These changes are still very high, however.
The estimated production of sunflower seeds varied around a mean of 6,863 million tons
with a maximum of 1,109 million tons and a minimum of 450 thousand tons during the
period under review. Although this is the least produced crop, the fluctuation remains
high.

Figure 1.5   Yield per hectare for maize, wheat and sunflower – 1994 to 2003
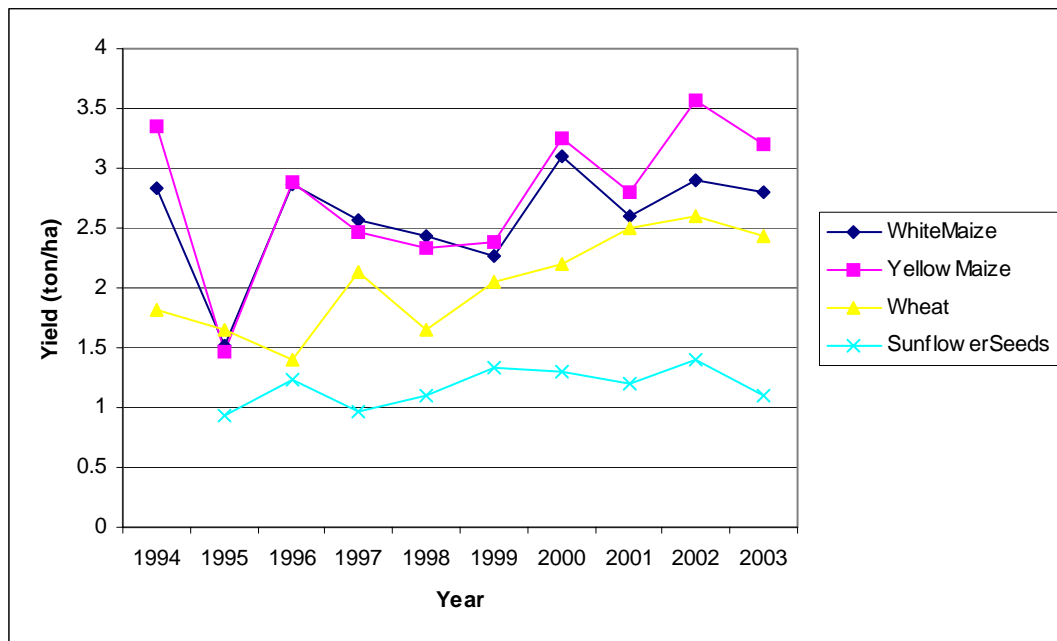
As noted in figure 1.5, the yield per hectare for white and yellow maize in 1995 was the

lowest at 1.5 ton/ha, and for sunflower at 0.93 ton/ha. After 1995, the yield of white and yellow maize increased, alternating between 2 and 3 ton/ha with a high in 2002 of 3.1 ton/ha for white maize and 3.57 ton/ha for yellow maize. The mean yield for sunflower seeds is 1.17 ton/ha with no major fluctuations for this commodity in the period 1994 to 2003. In 1997 the yield for wheat increased to 2.13 ton/ha but dropped sharply in 1998 to 1.65 ton/ha. After this period there was an increase to a maximum in 2002 of 2.6 ton/ha. These differences can be ascribed mainly to the erratic rainfall patterns experienced in South Africa. Farmers are continuously in collaboration with agricultural co-operatives to improve on cultivars that can withstand the extreme climatic conditions in South Africa.

1.1.3 Interest rate risk

Interest rate risk refers to the adverse effect that a change in the interest rates may have on agricultural co-operatives with a debt exposure. To date, the agricultural sector has been a net borrower. The total debt of South African farmers has grown by 10% each year since 1995. At the end of 2002 the total debt of farmers reached R28220 million, compared to R9 495 million in 1984. Agricultural co-operatives are also exposed to credit risk because they provide loans to their members: agricultural co-operatives provide 14 % of the total credit requirements of farmers and the Land Bank about 28% (South African Yearbook 2004:83). The credit exposure of members is considered a credit risk for co-operatives that will increase as interest rates increase. Agricultural co-operatives in turn receive loans from the Land Bank to buy property and erect infrastructure as well as short-term loans to enable them to grant farmers advances on the delivery of crops. These loans are usually repaid after crops have been sold. Agricultural co-operatives are therefore exposed as creditors to their members as well as debtors to the Land Bank and other financial institutions. Figure 1.6 indicates how the prime interest rate in South Africa changed over the period 1994 to 2003. It increased during June 1998, with a high in August and September 1998 of 25.50%, decreased slowly from October 1998 through 1999, and stabilized in 2000 and 2001, fluctuating between 13.00% and 14.50%. Thereafter it increased to 17.00% in 2002. In 2003 interest rates decreased by 550 basis points, the lowest since March 1998, ending at 11.5% during

2003.

**Figure 1.6   Prime interest rates – January 1994 to December 2003**
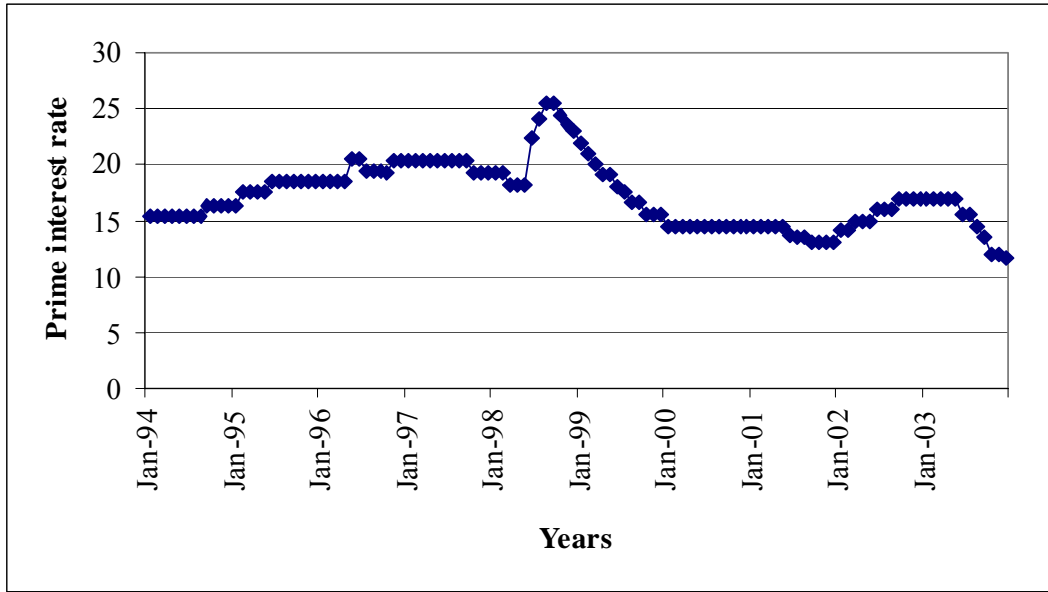
Source: Cronje, 2004

1.1.4   Currency risk

The Market Traders Institute defines currency risk as the risk of incurring losses resulting from an adverse change in the exchange rates. Van Rensburg and Ehlers (2002:6) state in an article on high maize prices that the exchange rate has an effect on the input cost as well as on agricultural commodity prices. This statement is confirmed by the fact that maize prices reached record highs after September 2001 when the rand/dollar exchange rate deteriorated rapidly. The exchange rate, has, however, improved dramatically since then with a concurrent decline in local commodity prices.

Figure 1.7   Currency: USD/ZAR – January 1994 to December 2003
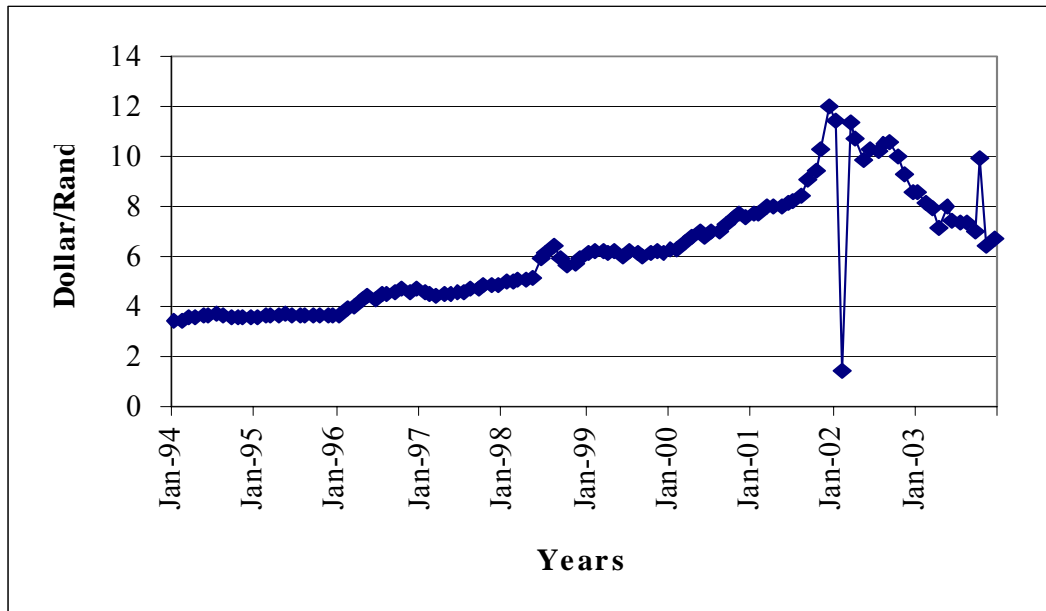
Source: Cronje, 2004

In 2003 the South African Rand (ZAR) strengthened against the US dollar (USD) by 39 %. According to Brouwer and Van Wyk (2004:6), this strengthening was due to:

1   the weakness of the dollar on international markets;
2   the differential between South African interest rates and those of emerging

markets; and

3 improved sentiment towards the emerging markets.

Figure 1.7 summarizes the USD/ZAR exchange rate for the period 1994 to 2003. It shows a constant exchange rate during 1994 and 1995 of between R3.40 and R3.60 per dollar, after which it began depreciating against the US dollar. In 2000, the rand went from R6/$ in January to R8/$ in December. The rand continued to depreciate until it reached a high of R13.85 to the US dollar in December 2001. It strengthened again at the start of 2002 to just above R6.50 to the US dollar in December 2003.

1.2   Problem Statement

It is evident from the preceding discussion that agricultural co-operatives are exposed to various financial risks. It is therefore necessary to determine how these co-operatives manage and mitigate these risks. No scientific research has been conducted to date on how agricultural co-operatives hedge the financial risks they are exposed to.

1.3   Purpose of the Research

The purpose of this research is to determine to what extent agricultural co-operatives hedge their financial risks by using derivative instruments. In order to attain this purpose:

1 The different types of derivative instruments readily available in the market will be identified and their applicability to mitigate various financial risks of agricultural co-operatives will be described.

2 Secondly, the extent to which these derivative instruments are utilized by agricultural co-operatives will be investigated.

1.4 Approach

The research is divided into three parts:

1 Part 1 - an extensive literature review

2 Part 2 - planning and conducting the empirical research

3 Part 3 - interpretation and integration of the literature and empirical research results

Part 1 - An extensive literature review, regarding the different derivative instruments used to mitigate financial risks.

Part 2 - Conducting empirical research on the use of derivatives by South African agricultural co-operatives. The empirical information will be obtained through a structured questionnaire that will be sent to a representative sample of agricultural co-operatives in South Africa.

Part 3 - Interpretation and integration of the literature and empirical research results to see how efficiently (if at all) co-operatives use derivatives to hedge their financial risks. Realistic conclusions will be reached and recommendations made for future research.

1.5 Presentation Structure of the Study

Chapter 2 provides a comprehensive literature review of different derivative instruments available in the South African market. This chapter provides an overview of how the market works and how these instruments can be applied by agricultural co-operatives to hedge their risk exposures.

Chapter 3 deals with the research methodology as well as with the design of the questionnaires that were formulated and distributed to a selected group of agricultural co-operatives.

Chapter 4 provides the findings of the empirical study with specific reference to the existing utilization of derivatives by agricultural co-operatives to hedge their financial risks.

Chapter 5 provides a summary of the research and conclusions on the use of derivative instruments by co-operatives. Recommendations for future research are also made.

CHAPTER 2

DERIVATIVE INSTRUMENTS THAT MAY BE USED BY AGRICULTURAL CO-OPERATIVES TO HEDGE FINANCIAL RISKS

2.1   Introduction

The Group of Thirty (1993) defines a derivative as "… a contract whose value depends on (or derives from) the value of an underlying asset, reference rate or index."

The global derivative market has increased substantially over the past decades due to certain factors, for example:

1   globalisation and liberalisation of world trade;
2   relaxation of capital controls;
3   technology and communication revolution; and
4   development of risk management strategies.

Derivative instruments exist in most financial and commodity markets, bringing alternative risk profiles and new participants to the markets. They also provide greater dimension and flexibility to the markets (Skerritt, 2002:16).

Derivative instruments can trade on formal markets, such as the JSE, or on Over-the-Counter (OTC) markets. The exchange-traded derivatives are more standardised and more liquid than those on the OTC markets, which are customised to give participants greater flexibility and innovation than the exchange traded derivatives. The OTC market is the larger of the two and consists mostly of banks and market makers that quote customised derivatives to each other and their clients. Derivatives on an exchange comprise mainly options and futures. Swaps are sometimes quoted but with limited success (Skerritt, 2002:18).

According to Skerritt (2002:10), there is real significance in the classification of derivative instruments for legal as well as economic purposes. He provides the following reasons:

1. Some derivative contracts are off-balance sheet transactions and only appear in the footnotes to financial statements, giving the organisation the opportunity to improve financial ratios such as return on assets (ROA).
2. Using derivatives in the corporate world attracts different regulatory requirements.
3. Risk committees of organisations will sometimes restrict the use of certain derivatives by their personnel.
4. Derivatives can sometimes have more favourable tax treatments than non-derivative instruments, which have significant economic benefits.
5. Derivative instruments have lower capital requirements than cash instruments.

In this chapter the derivative instruments that agricultural co-operatives can use to manage their financial risks will be discussed.

2.2   Users of Derivatives

Traders in the market can be classified into three broad categories, namely (Hull, 2002:7):

1   arbitrageurs;

2   speculators; and

3   hedgers.

2.2.1   Arbitrageurs

Hull (2002:12) states that arbitrageurs use derivative instruments to lock in a risk free profit by simultaneously buying different instruments in two or more markets. The arbitrageur identifies and takes advantage of small market price imperfections, usually between the cash and futures markets. When the future and spot price of a certain instrument differ in the short term the arbitrageur will buy the lower price market instrument and simultaneously sell the higher price market instrument to generate a risk free profit. As the financial markets become more sophisticated and developed both in South Africa and internationally, the real opportunities for making a risk free profit through arbitrage have decreased substantially (Skerritt, 2002:85).

2.2.2   Speculators

Speculators enter the market with the hope that the price will either increase or decrease, depending on the position they took to make a profit on the transaction. Capital leverage principles make derivative transactions attractive investment opportunities for speculators because they benefit from favourable price movements with only a small capital outlay. The investment may end in either a profit or loss; usually these profits or losses are in line with the risk associated with the particular investment (Grönum, 2001). Speculators play a vital role in derivative markets because they provide liquidity to the markets through buying and selling contracts on a regular basis. They also help to keep transaction costs low (Kurten, 2002:5).

2.2.3   Hedgers

Hedging can be defined as the process of establishing or offsetting long and short positions to decrease the risk exposure that could result from unfavourable price movements. The long position involves the buying of an asset and the short position the selling of an asset.

The perfect hedge is graphically depicted in figure 2.1. The profit and loss of the two positions (line A represents the long position and line B the short position) are offset against each other. The breakeven point which equals the purchase price or point where no profit or loss is made is represented by P_0. P_1 represents the price of the asset above the breakeven point. As indicated in figure 2.1, the profit from the long position will be $P_1 - P_0$ while the loss from the short position will be $P_1 - P_0,$ exactly offsetting each other.

Figure 2.1   The perfect hedge

Source: Cronje et al., 2004:159

Hull (2002:7) states that hedgers make use of derivative instruments to protect themselves against an adverse movement in the market. Hedgers in agricultural product markets are usually producers or users of commodities. Through hedging, they can protect themselves against surprises such as an increase in the commodity price (Hull, 2002:77). The more participants in the derivative market the better (Grönum, 2001). The best time for any participant to hedge his/her underlying commodity risk is when the risk occurs. Most hedgers do not have the skills or expertise needed to predict certain variables such as interest rates, exchange rates or commodity prices. For this reason it is best for them to hedge against these risks as they occur in order to focus on the core business activities for which they have the necessary skills.

2.3   Different Derivatives

2.3.1   Forward and Futures contracts

According to Skerritt (2002:30), the fundamental mathematics and economics of futures and forwards are the same, with only the form and terminology differing.

a.   Forward contracts

Forward contracts can be regarded as the oldest and most straightforward derivative instrument in the market. They are customised to the needs of the transacting parties and trade on the OTC market. Smithson (1998:29) defines a forward contract as an obligation by a party to buy or sell a specific asset on a specified date, at a contract or forward price that was specified when the contract was entered into. The absence of a clearinghouse from the OTC market to guarantee transactions increases the amount of credit risk the transacting parties have to bear. Because of this credit risk, counter parties are required to supply sufficient collateral on all forward and other OTC contracts (Ryan, 2002:224). According to Skerritt (2002:31), the majority of forward contracts will end in

the physical delivery of the underlying commodity. The party with the long position will make a profit if the actual price is higher than the exercise price, and a loss if it is lower than the exercise price (refer to figure 2.2). The party with the short position will, however, make a profit if the actual price is lower than the exercise price and a loss if it is higher. Forward contracts are used extensively in many of the underlying markets; for example, there are more currency forward contracts in the market than listed currency futures (Skerritt, 2002:31).

Figure 2.2   The payoff diagram when buying a forward contract

Source: Ryan, 2002:224

b. Futures contracts

Commodity futures contracts have been traded on formal exchanges since the early 1860s, whereas financial futures only started in 1972. Futures contracts work according to the same basic principles as forward contracts, except that they trade on formal exchanges. The payoff diagram for futures contracts will be the same as that for forward contracts illustrated in figure 2.2. Smithson (1998:29) defines a futures contract as an agreement to buy or sell a standardised quantity and quality of a commodity at a specified exercise price on a specified future maturity date under terms and conditions of the exchange. The only characteristic of a futures contract that may change is the price. The grade, tonnage and exercise date are all standardised by the exchange (Grönum, 2001). Owing to the standardised nature of futures, they often only allow for imperfect risk management despite the low transaction cost and credit risk (Ryan, 2002:223).

2.3.1.1 Trading of forward and futures contracts

The forward and futures market is seen as a very useful part of the economic system. Farmers, financial institutions, businesses and individuals use forwards and futures to decrease the risk of loss which could be incurred as a result of the uncertain future prices of commodities or other underlying instruments. The two most prominent participants in this market are speculators and hedgers, with the latter transferring some of the price risk to the former (Strong, 2001:191).

Rand Merchant Bank (RMB) started the informal futures exchange in South Africa in April 1987. RMB represented the exchange, the clearinghouse and the only market maker, trading in relatively thin volumes. In September 1988 RMB decided to expand this futures market by forming SAFEX and the SAFEX Clearing Company (Pty) Limited (SAFCOM). The reason for this was to increase participants' confidence in the independence of the exchange and clearinghouse. In April 1990, SAFCOM took over all management functions of the informal futures market from RMB and the new entity was officially licensed after the promulgation of the Financial Markets Control Act in August 1990 (Watt, 2001:2).

With the incorporation of SAFEX by the JSE in May 2001, by means of a buy-out agreement, the branding of SAFEX remained unchanged with two primary business areas, namely the SAFEX Financial Derivatives Division and the SAFEX Agricultural Products Division (Watt, 2001). These separate divisions are fully automated and trading members can transact by means of telephone or Automated Trading Systems (ATS). The ATS consists of a wide area network (WAN) of computers situated in different locations. Members gain access by logging in at their respective premises and trading according to their clients' wishes.

Figure 2.3 illustrates SAFEX's risk management structure. An individual or company must utilise the services of a broker to trade on SAFEX: no individual or company is allowed to trade directly on SAFEX but must trade through brokers employed by registered broking members. These brokers are required to keep up with changing market conditions, such as local supply and demand, weather, import and export parity values, and the international market and prices, in order to make sound financial decisions for their clients (Watt, 2003). Through this risk management structure, SAFEX bears only the risk that its clearing members will default; this is limited as the clearing members comprise major banking institutions in South Africa.

Figure 2.3   The risk management structure of SAFEX

Source: SAFEX website

2.3.1.1.1 Margins

Margins provide a safeguard for clearing members and the exchange against members or clients defaulting. Skerritt (2002:19) defines two types of margin payments, namely the initial margin, which is set by the governing body of the relevant exchange, and the variation margin, which is set by the clearing member and based on the credit worthiness of the client. All new members of the exchange must supply sufficient cash or excess funds to the broking member as an initial margin and must have sufficient funds left to cover the variation margin when it occurs.

a. Initial margin

The initial margin is seen as a good faith deposit when taking a position in the market and ranges between 5% and 8% of the full purchase price. It is kept in the client's margin account for as long as the client has an open position on the market. It can be in the form of cash, shares or government bonds, but in South Africa the JSE only accepts cash as an initial margin (Skerritt, 2002:19). The initial margin required by the exchange is constant between participants. There is, however, an offset between calendar spread type transactions and commodity spreads which are traded with highly correlated commodities such as white and yellow maize.

b. Variation margin

The initial margin is generally very low because the exchange protects itself from defaulting clients through other safeguarding methods such as marking-to-market and

margin calls, either by requiring daily settlement or settlement when a maintenance margin is reached. In the case of daily settlement, the exchange values each derivative contract against the current market price of that specific contract on a daily basis. If the daily price movement shows a loss, the client must pay the additional or variation margin or the exchange will terminate the position (Skerritt, 2002:20). If there is a profit, the exchange will pay the amount in cash to the client. In the case of maintenance margins being applied, the exchange requires that when the balance of funds in the initial margin falls below a certain point known as the maintenance margin the client must replenish the margin to the original level. In both methods, the payment to replenish the initial margin is called a variation margin (Kolb, 2001:18).

The mechanisms applied by the exchange are designed to transfer the daily profit and loss for transactions between different parties without having to call the parties for these amounts (Stacey, 1988:18).

2.3.1.2 Types of futures contracts

The types of futures contracts and the asset categories on which futures are based are important, as they will determine how the contracts are priced. The uses of the different types of futures contracts from a hedger's perspective are summarised in table 2.1.

Table 2.1   Uses of futures contracts by hedgers

Type of futures contract	Reason for taking a long position	Reason for taking a short position
Equity index futures	Covering a short selling exposure*	Hedge total portfolio against downward prices
Individual equity share futures	Covering a short selling exposure*	Hedge individual shares against downward prices
Interest rate futures	Hedge a floating rate loan against an increase in interest rates	Hedge a floating rate loan against a decrease in interest rates
Currency futures	Hedge against an	Hedge against a

Bond index futures	Buyer of bond portfolio hedges against an increase in interest rates	An issuer (seller) of bond portfolio hedges against a decrease in interest rates
Commodity/agricultural futures	Buyer of commodities hedges against price increases	Producer/seller of commodities hedges against a decrease in prices

*   Short selling involves selling securities or underlying assets that are not owned

Agricultural co-operatives may, by the nature of their business activities, use commodity futures, interest rate futures and currency futures to hedge their risk exposure. Each of these is discussed in more detail in the ensuing section.

**a. Commodity futures contracts**

Futures on commodities such as maize and wheat are classified as non-financial futures and trade on the SAFEX Agricultural Products Division of the JSE. They are quoted in such a way that the delivery month is in line with that of the physical crop cycle. Currently available on the SAFEX Agricultural Products Division of the JSE are contracts for each of the months in a year. Contracts trade in different tonnage depending on the particular commodity, as indicated in table 2.2 (Skerritt, 2002:33). Contracts must be exercised through physical delivery in the month that they expire. For each futures contract there is also an underlying physical or cash market. As indicated in table 2.2, one futures contract in wheat is equal to 50 tons. If a producer wishes to hedge 1000 tons of wheat he must enter into 20 futures contracts, at the prevailing futures price (Grönum, 2001).

Table 2.2   Contract sizes of agricultural futures on the JSE

COMMODITY	TONNES PER FUTURES CONTRACT
White and Yellow Maize	100
Wheat	50
Sunflower Seeds	50
Soya Beans	25

Source: Skerritt, 2002:37

Volumes traded are a measure of how many trades have occurred (Strong, 2001:20). When one trader buys a futures contract and another sells one, it is said that the transaction has generated one contract of trading volumes (Kolb, 2001:13). The settlement of derivative contracts on agricultural products is through physical delivery at the date of expiration. When the contract is first listed there has been no trading. After the first trade, one trader is left with a long position in the underlying market and another with a short position. The seller, or short position holder, is obliged to deliver the underlying commodity to the buyer, or long position holder, at expiration of the contract (Kolb, 2001:13). Because futures contracts trade many times before expiration date, the underlying commodities are turned over at least eight times on a mature agricultural futures market and only a very small percentage is taken as physical deliveries (Agritv). As illustrated in figure 2.4, 30% to 40% of volumes traded for white and yellow maize in the period March 1997 to March 1998 were actually taken in physical deliveries. In March 2003 the percentage tonnage of white and yellow maize physically delivered on SAFEX decreased to far below 3% per annum.

**Figure 2.4   Average percentage white and yellow maize physically delivered from
            March 1997 to March 2003 on SAFEX**
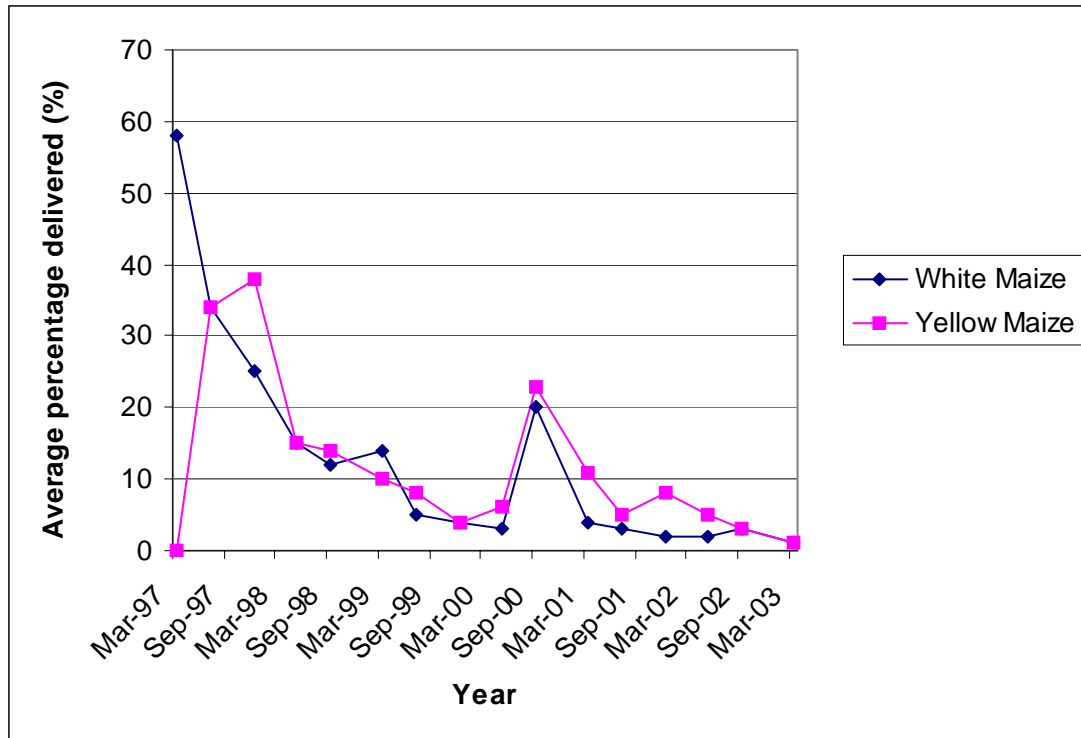
Source: Agritv – SAFEX series

Figure 2.5 indicates the dramatic increase in the total volumes traded on SAFEX for futures and options since 1999. In 2003 the total volumes traded equalled almost 2, 5 million contracts, over 200 million tons of crop and twenty times more than actual crop production in South Africa (especially for white and yellow maize) indicating ample liquidity in the market (Watt, 2003).

Figure 2.5   Total futures and option contracts traded – 1998 to 2003
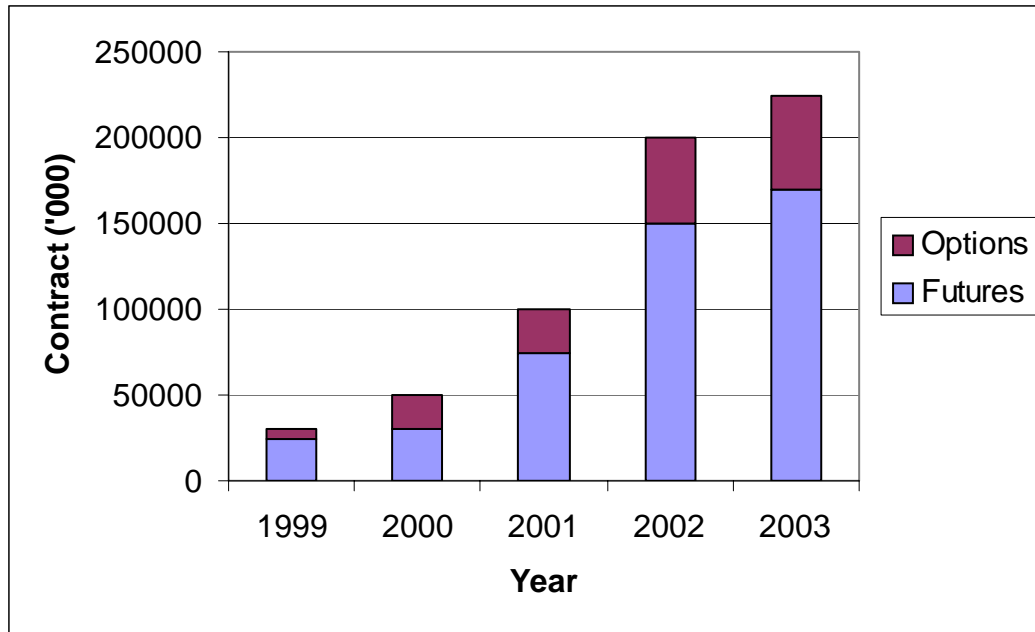
Source: Agritv –SAFEX series

b.   Interest rate futures contracts

The best-known international interest rate futures contract is the Eurodollar (ED), which is simply American dollars that are deposited in a bank outside the USA. In South Africa the only interest rate futures contract trading on SAFEX is the 3-month JIBAR contract, which was introduced as a replacement for the 91-day Bankers' Acceptance futures. The contract specifications for the 3-month JIBAR futures are stated in table 2.3. The OTC interest rate contracts dominate the market in South Africa. The existing exchange traded interest rate futures contract is very illiquid due to the fact that there are very few participants in the market with open positions in the futures (Kurten, 2002:86). The volumes traded in interest rate futures were 23 175 in 1999 but decreased to zero in 2003.

Table 2.3   Specifications for JIBAR futures contracts

Futures underlying instruments	3-month JIBAR
Contract size	R1, 000,000 notional
Contract months	March, June, September, December, AND other months according to demand
Expiry	3rd Wednesday of the month
Settlement method	Cash

Source: Skerritt, 2002:32-33

c.   Currency futures

Potgeiter (1999:37) defines a currency futures contract as a legally binding agreement between two parties to take or make delivery of a specified quantity of currency at a specified future date at an agreed rate on a regulated exchange.

In May 1997 SAFEX, the New York Cotton Exchange (FINEX) and the Chicago Mercantile Exchange (CME) launched the first USD/ZAR futures contract once they had received approval from the South African Reserve Bank (SARB). These contracts have a notional value of $100,000 and are traded on the automated trading system of SAFEX (Skerritt, 2002:36). In table 2.4 the contract specifications for a currency futures contract are stated.

Table 2.4   Specifications for currency futures contracts

Futures underlying instrument	Rand/dollar
Contract size	$100,000
Contract months	March, June, September, December
Expiry	The Monday preceding the 3rd Wednesday
Settlement method	Cash

Source: Skerritt, 2002:32-33

The market for currency futures and the trading volumes of these futures have shown substantial increase globally over the past few years and, with increasing growth in international transactions, the market should grow further (Madura, 2000:121). These contracts are, however, restricted in the South African market due to the exchange control regulations imposed by the South African government.

2.3.1.3 Pricing of forward and futures contracts

Forward and futures pricing is important and has to be considered before entering into a contract. Both parties must understand their future commitments and the implications of the transaction. The cost of carry calculation allows for the computation of the fair value of futures or forward contracts. The "fair value" represents the price that will prevent arbitrage between the cash and the futures market (Skerritt, 2002:37).

a.   **Calculation of commodity futures and forward prices**

The calculation of commodity futures and forwards prices is relatively simple in theory. It is based on the underlying asset price (spot price) and with the addition of the cost of carrying or carrying charge, which is the total cost to hold/own the commodity until a specific future time. The carry cost represents the total financing cost and holding (storage, insurance and transportation) costs of a commodity, less the income it generates, which is not always certain (Skerritt, 2002:37). For example, wheat on hand in July can be carried forward or stored until December, requiring a carrying cost from the holder (Kolb, 2001:53). The decision whether to hold the wheat will depend on the perception of the holder of future demand and supply in the market.

If the market participants believe that the futures price of a certain commodity will increase, the demand for long futures positions on that commodity will be far greater than the supply of short futures positions. The futures will trade at a price far higher than the theoretical price, which can be calculated as follows (Stacey, 1988:13-14):

$$\text{Futures or Forward Price} = \text{Spot Price adjusted by the Carry cost}$$

$$F_0 = S_0(1 + C)$$

The prices of different commodities on the agricultural division of SAFEX are based on prices from the Randfontein silo, which is used to establish a basis from which all prices can be calculated. A producer delivering to any of the other accredited silos (Kroonstad, Bothaville, Pietersburg, Pietermaritzburg etc.) will have to subtract the transport and brokerage costs from the price quoted on SAFEX in order to work out the nett futures price (Grönum, 2001).

b.   Calculation of interest rate futures prices

The interest rate futures contract is a standardised contract, the price of which is quoted as 100 minus the forward JIBAR, quoted to three decimal places. For example, if the three-month JIBAR rate for the June contract is expected to be 11.5%, the JIBAR contract will be quoted as follows:

$$100 - \text{forward rate} = \text{JIBAR futures contact}$$

$$100 - 11.5 = 88.500$$

On expiry of the contract, the futures price will be 100 minus three-month JIBAR as set by SAFEX on that day.

c.   Calculation of currency futures prices

Currency futures are closely priced in relation to the cash market prices and any differences between the two markets can result in an arbitrage transaction. The fair value of a currency futures contract can be calculated by using the following formula (Falkena and Kok, 1999):

$$X_f = [\, 1 + (\, r_{fo} \times t/365)\,] \,/\, [\, 1 + (r_{do} \times t/365)\,] \times X_o$$

Where X_f = forward exchange rate in foreign currency units

X_o = current spot exchange rate in foreign currency units

R_{fo} = current foreign interest rate

R_{do} = current domestic interest rate

T = number of days between futures trading date and futures.

For example, a South African co-operative that exports goods denominated in a foreign currency expects an increase in the $/ZAR exchange rate. On 5 January 2004 the broker buys one Dollar/ZAR currency futures contract on SAFEX, using the March contract. The following information is provided:

$/ZAR spot exchange rate	=	6,205
Contract size	=	US$ 100 000
Call rate ($)	=	7, 56%
Call rate (ZAR)	=	15, 50%
Futures trading date	=	5 January 2004
Futures expiry date	=	16 March 2004

The forward $/ZAR exchange rate is calculated as follows using the above-mentioned formula:

X_f = [1+ (0,155 x 70/365)] / [1 + (0, 0756 x 70/365)] x 6,205

= 6, 2980

The fair value of the currency futures contract (FVF) is accordingly:

FVF = 100 000 x 6, 2980

= R 629 800

2.3.1.4 Application of forward and futures contracts in agricultural co-operatives

With agricultural futures contracts, the buyer of a commodity with a bullish outlook on the market will hedge against the price of the commodity increasing over a certain period. By entering into this contract and taking a fixed price in advance, a profit may be realised when the contract expires. The buyer of the futures contract will take delivery of

the underlying commodity at expiration date, with the possibility of selling the commodity in the market for a higher price (Skerritt, 2002:33-34).

The producers of a commodity will only enter into futures contracts when they expect the price of the commodity to decrease, and will thus hedge against such decrease. For example, the prices for white maize contracts for delivery in July 2005 are trading at R1058/t (Randfontein). An agricultural co-operative delivering to the Kroonstad silo expects the price of white maize to decrease in the future and enters into a futures contract to sell white maize at R1058/t in July 2005.   In July 2005 the futures contract expires and the agricultural co-operative has to deliver the white maize to the Kroonstad silo. If the price of white maize decreased to R920/t in July 2005 the agricultural co-operative will still receive a gross price of R1058/t, and would have hedged its position successfully. On the other hand, if the price of white maize increases to R1200/t the co-operative will only receive R1058/t, losing the benefit of the price increase.

2.3.2   Options

Hull (2002:160) states that options are fundamentally different from forward and futures contracts. This is due to the fact that an option gives the holder the right to exercise the option if he wants to or if it is profitable to do so. This is in contrast with forward and futures contracts where two parties enter into a commitment to fulfil some action.

Options are usually classified as the most complex and least understood category of derivatives. The increased leverage or gearing that option-based financial instruments offer has given rise to several derivative disasters through speculative selling of options, for example, the case of Barings Bank (Kurten, 2002:95).

American stockbrokers started trading options in the early eighteenth century after they featured significantly in the infamous "Dutch Tulip Bubble" (an early version of the NASDAQ bubble) in the seventeenth century. The cornerstone of option pricing and hedging, the Black and Scholes model, was accepted in 1973 as the universal mathematical solution for option pricing. This was a result of the hard work of Fisher

Black, Myron Scholes and Robert Merton (Skerritt, 2002:60). This pricing model was developed on the assumption that asset prices adjust themselves to prevent arbitrage, that stock prices are continuously changing and that the returns on stock follow a log-normal distribution (Kolb, 2001:396). Unlike other derivative instruments, the buyer or holder of options has a choice of whether to exercise the right to buy or sell. Distinguishing between the different types of derivatives is very important to the option contract holder as it gives him an advantage over the futures contract holder, the forward contract holder and even the option writer/seller, for the option holder will only exercise the option if it is profitable.

2.3.2.1 Trading of options

The complex financial world we live in today gives rise to many sources of risk which did not exist previously (Strong, 2001:21). Option contracts can be used to hedge against interest rate risks, currency risks, price risks and yield risks exposures. Participants in the market, however, use options for many reasons, including to transfer risk, provide financial leverage, and generate additional income (Strong, 2001:22-23).

Options can be traded on a formal exchange such as SAFEX or on the OTC market. The JSE usually makes use of market makers to facilitate these trades. A market maker quotes both bid (price at which he is prepared to buy) and offer prices (price he is prepared to sell) on an option. The quoted offer price is always higher than the bid price and the difference between the two prices is known as the bid-offer spread (Hull, 2002:171).

The OTC market in South Africa has expanded substantially since the 1980s and is now larger than the exchange traded market. The JSE launched an exchange-traded option in early 1997 but the product never really took off. However, the options on futures trading on SAFEX have been far more successful. The most popular options trading on the OTC market are foreign exchange and interest rate options. As with forward contracts, the OTC option contracts increase the credit risk exposure of counter parties and are less liquid than exchange traded options because they are tailor made to suit the needs of the

counter parties (Hull, 2002:178). Figure 2.6 illustrates the different types of underlying instruments to which options can be applied, for example equity, interest rates, currencies and commodities.

Figure 2.6   Instruments on which options can be traded
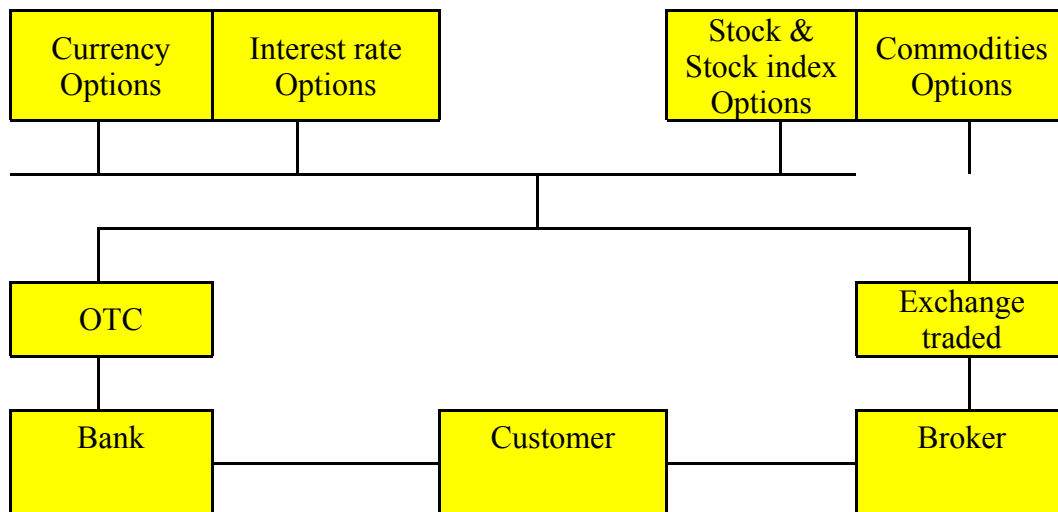
Source: SARB, 2000:96

2.3.2.2 Types of options

There are four types of participants in the option market, namely buyers of calls, sellers of calls, buyers of puts and sellers of puts. Buyers have long positions in the market and sellers have short positions. Selling options is also known as writing the options (Hull, 2002:6). In the ensuing sections the different types of options will be discussed.

2.3.2.2.1   Call option

According to Kolb (2001:3), a call option gives the holder the right but not the obligation to buy the underlying asset for a specific price at a specified date. The call option buyer hopes that the price of the underlying instrument will increase, therefore such a buyer is said to have a bullish outlook on the market.

Consider a three-month European call option on an underlying asset with a price of c, a strike price of X and risk-free interest rate of 6%. If the share price is greater than the

strike price at expiration, the owner (buyer) of the option is in the money (S > X) and will exercise the option. For S > X at expiration date, the owner of the call option can buy the share at the strike price of X and sell it in the cash market at S, realizing a profit of S – X. The value of an in-the-money call option is equal to the difference between the share price and the strike price (c = S – X). If the share price is lower than the strike price at expiration the owner of the option is out of the money (S < X) and the option to buy this asset at the strike price expires worthless (c = 0). When buying a call option the maximum loss is the premium, whilst the maximum profit is unlimited, depending on favourable market conditions (Johnson, 1999:6). In summary the value of the call option is expressed as:

$$c = \text{Max } [0, (S - X)]$$

Figure 2.7 illustrates the value at expiration for the buyer of a European call option. The dotted line represents the profit profile and the solid line represents the payoff profile of the call option. The payoff for the buyer of a European call option is:

$$c = \max (S - X, 0)$$

The payoff for the seller of a European call option is illustrated in figure 2.8 and is:

$$c = -\max (S - X, 0) = \min (X - S, 0)$$

Figure 2.7   Value for a call buyer of European call option at expiration

Source: Smithson, 1998:193

Figure 2.8   Value for a call seller of European call option at expiration

2.3.2.2.2   Put option

A put option gives the buyer the right to sell the underlying asset at a specific price on a specific date. In the previous section it was indicated that the purchaser of a call option anticipates that the share price will increase. The purchaser of a put option, however, believes that the price will decrease and therefore has a bearish outlook. For example, a co-operative buys a put option, with a price of p, to sell 1 000 tons of white maize at a price of X. The current market price is S. If the price of the underlying instrument decreases, the value of the put option will increase. This will enable the buyer of a put option to sell it in the secondary market at a profit, at expiration. If the share price is lower than the strike price ($S < X$), the option will be in the money and a profit will be realised by exercising the option. The value of the option will be the difference between the strike price and the share price ($p = X - S$). If, however, the share price in the market is greater than the strike price ($S > X$), the option will be worthless ($p = 0$). In summary, the value of the put option is:

$$p = \max [0, (X - S)]$$

Figure 2.9 represents the value for the buyer of a European put option at expiration. The dotted line represents the profit profile and the solid line represents the payoff profile of the put option. The payoff for the holder of a long position in the European put option (buyer) is:

$$p = \max (X - S, 0)$$

The payoff for the holder of the short position in a European put option is illustrated in figure 2.10 and is:

$$p = - \max (X - S, 0) = \min (S - X, 0)$$

Figure 2.9   Value for a put buyer of European put option at expiration

Source: Smithson, 1998:194

Figure 2.10   Value for a put seller of European put option at expiration

Source: Smithson, 1998:194

2.3.2.2.3   Option combinations

When combining long and short puts and calls a user can create a strategy that will make the risk and return characteristics of the option position more precise (Kolb, 2001:316). Some of these strategies are bull and bear spreads, straddles, strangles and butterfly spreads. These option combinations allow participants to profit when prices have large fluctuations and when they remain constant (Kolb, 2001:316).   Other strategies include box spreads, condors, strips and straps.

a. Bull and bear spreads

A bull spread in the option market is an option strategy using a combination of puts or calls to profit when the price of the underlying asset increases.   In contrast to the bull spread, a bear spread uses puts or calls to provide a profit should the underlying asset or commodity price decrease (Schwartz, 1997:632). With a bull spread using calls, the investor buys a call with a certain strike price and sells a call on the same asset with a higher strike price; both options expire on the same date. Figure 2.11 illustrates the strategy. The dashed lines represent the two separate calls and the solid line represents the profit from the combined strategy or bull spread. A bull spread that is created by using call options requires an initial investment. The reason for this is that the call price always decreases as the strike price increases; this will make the value (premium) of the bought call option higher than that of the option sold (Hull, 2002:204).

Figure 2.11   Profit and loss at expiration for a bull spread with calls

Source: Hull, 2002:208

Table 2.5 illustrates the payoff from the bull spread using call options.

Table 2.5   Payoff from a bull spread using call options

Share price range	Payoff from long call	Payoff from short call	Total payoff
$S_t \geq X_2$	$S_t - X_1$	$X_2 - S_t$	$X_2 - X_1$
$X_1 < S_t < X_2$	$S_t - X_1$	0	$S_t - X_1$

$S_t \leq X_1$	0	0	0

Source: Hull, 2002:205

When creating a bull spread using puts, an investor will buy at the low strike price and sell at the high strike price, in contrast to a bull spread using calls. When puts are used the investor receives a positive cash flow at the beginning of the transaction (ignoring margin requirements) and a negative or zero payoff (Hull, 2002:205).

In contrast to a bull spread, where the investor expects that the share price will increase, in a bear spread, the investor expects that the price will decrease. When creating a bear spread with calls, the investor will buy a call with a high strike price and sell a call on the same underlying instrument at a lower strike price, as indicated in figure 2.12. The dashed lines represent the two separate calls and the solid line represents the profit from the combined strategy or bear spread. A bear spread using calls creates an initial cash inflow (ignoring margin requirements) because the price of the call bought is less than that of the call sold (Hull, 2002:206). In table 2.6 the payoff for the bear spread is indicated.

Table 2.6   Payoff from a bear spread using call options

Share price range	Payoff from long calls	Payoff from short calls	Total payoff
$S_t \geq X_2$	$S_t - X_2$	$X_1 - S_t$	$-(X_2 - X_1)$
$X_1 < S_t < X_2$	0	$X_1 - S_t$	$-(S_t - X_1)$
$S_t \leq X_1$	0	0	0

Source: Hull, 2002:207

A bear spread created with puts will require an initial margin. Investors buy a put with a high strike price and sell a put with a low strike price. In both bear and bull spreads the strategies limit the investor's upside profit potential but also limits the downside risk (Hull, 2002:207).

Figure 2.12   Profit and loss at expiration for a bear spread with calls

Source: Hull, 2002:206

b. Straddles

A straddle is the best-known option combination. A long straddle consists of a call and a put option with the same strike price and expiration date, based on the same underlying instrument. An investor who is short in a put or a call option is said to have written a straddle (Strong, 2001:67). Investors who expect a large movement in the market but

who are uncertain of the direction of the movement will mostly use straddles. When the underlying price is close to the strike price the investor will make a loss, as indicated in figure 2.13. However, if the underlying prices show large movements the investor will make a significant profit (Hull, 2002:211). The dashed lines represent the put and call options and the solid line the profit from the combined strategy. The payoff from the straddle purchase is illustrated in table 2.7.

Table 2.7   Payoff from a straddle using call options

Share price range	Payoff from call option	Payoff from put option	Total payoff
$S_t \leq X$	0	$X - S_t$	$X - S_t$
$S_t > X$	$S_t - X$	0	S_t - X

Source: Hull, 2002:212

Figure 2.13   Profit and loss at expiration for a straddle with calls

The straddle in figure 2.13 is sometimes referred to as a bottom straddle or straddle purchase. The reverse position is known as a top straddle or straddle write, and occurs when an investor sells a call and put option with the same strike price and expiration date and on the same underlying instrument (Hull, 2002:212).

c. Strangles

Professional option traders mostly use strangles. This option strategy is similar to a straddle; the only difference is that the puts and calls have different strike prices (Strong, 2001:69).

In a strangle, also known as a bottom vertical combination, an investor buys a put and call on the same underlying instrument, with the same expiration date but different strike prices. The payoff function for the strangle strategy is shown in table 2.8 and is based on investor expectations that there will be a very large movement in the market, although it is uncertain whether this will be an increase or a decrease. The profit pattern an investor receives depends on how close the strike price of the put and call options are. The greater the difference between the strike prices of the two options, the lower the downside risk; the underlying prices will, however, have to move further in either direction to generate a profit from this strategy. Figure 2.14 depicts this strategy. The dashed lines represent the long put and call option and the solid line the profit from the combined strategy (Hull, 2002:213).

Table 2.8   Payoff from a strangle using call options

Share price range	Payoff from call	Payoff from put	Total payoff
$S_t \leq X_1$	0	$X_1 - S_t$	$X_1 - S_t$

$X_1 < S_t < X_2$	0	0	0
$S_t \geq X_2$	$S_t - X_2$	0	$S_t - X_2$

Source: Hull, 2002:214

Figure 2.14   Profit and loss at expiration for a strangle with calls

Source: Hull, 2002:214

d. Butterfly spreads

Butterfly spreads appeal to most people for they can be constructed with very little cost apart from commission (Strong, 2001:79). This spread is one of the few that can be constructed either by using calls or puts or by using a combination of the two and having

three different strike prices.

To create a butterfly spread one buys one call with a relatively low strike price (X_1), and another with a relatively high strike price (X_3) and sells two call options with a strike price of somewhere in between (X_2). Figure 2.15 illustrates this strategy. The dashed lines represent the calls and the solid line the payoff of a butterfly spread. Table 2.9 shows different combinations of calls and puts that may be used to create butterfly spreads.

Table 2.9   Constructing a butterfly spread

Long call (X_1)	Two short calls (X_2)	Long call (X_3)
Long put (X_1)	Two short puts (X_2)	Long put (X_3)
Long put (X_1)	Short put (X_2), short call (X_2)	Long call (X_3)
Long call (X_1)	Short call (X_2), short put (X_2)	Long put (X_3)

Source: Strong, 2001:79

Figure 2.15   Profit and loss at expiration for butterfly spreads with calls

Source: Hull, 2002:209

Figure 2.16 shows the payoff of a butterfly spread (solid line) created by making use of put options (dashed lines).

Figure 2.16   Profit and loss at expiration for butterfly spreads with puts

Source: Hull, 2002:209

e. Other option strategies

Other combinations of option strategies include box spreads, condors, strips and straps. Box spreads consist of a bull spread with calls and a bear spread with puts. The two spreads have the same pair of exercise prices. Condors constitute a very specialized strategy involving a combination of four options on the same underlying instrument with the same expiration date but with different strike prices (Kolb, 2001:329). Other strategies include strips and straps. A strip is a long position in one call option and two put options with the same strike price and expiration date. A strap comprises a long position in two call options and one put option with the same strike price and expiration date.

2.3.2.3 Pricing and valuing of options

The option price or premium is defined as being the amount the purchaser of an option has to pay the seller (option writer) when entering into a contract (Ryan, 2002:225). The premium is calculated using very complex mathematical models such as the Black and Scholes model and the Binomial model (Skerritt, 2002:61). These models together with models derived by Garman and Kohlhager, Cox, Ross and Ruberstein and Merton are used today to derive a fair value for the various types of options (SARB, 2000:106). The discoveries made about option pricing are the single most important development in the finance world during the past 30 years.

a. Binomial option pricing model

Constructing binomial trees is a very useful and popular technique for pricing an option contract. A binomial tree is a diagram that represents the different values that the share price can take on before expiration (Hull, 2002:218). This model assumes that the price

of an option can only move up or down by a certain amount in any specific time period. It furthermore allows for interest rate and volatility to be included in the pricing model whereas the Black and Scholes model assumes these values to be constant (Falkena and Kok, 1999).

b. Black and Scholes option pricing model

The Black and Scholes model is one of the models most commonly used to price options contracts. As the periods in the binomial model increase and become too large, this model will merge into the famous Black and Scholes model. The Black and Scholes model was developed on the assumption that the asset price always adjusts to prevent arbitrage; the underlying asset price changes continuously; and the returns from the underlying asset price follow a log normal distribution (Kolb, 2001:396). The Black and Scholes formula for call options is set out on the next page:

$$C = S_t\, N\,(d_1) - Xe^{-r\,(T-t)}\, N\,(d_2)$$

$N\,(.) =$ cumulative normal distribution function

$$d_1 = \frac{\ln\,(S/\,X) \;+\;(r + \tfrac{1}{2}\,\sigma^2)\,(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\,\sqrt{T-t}$$

where:
C = call price
S = share price
X = strike price
T = Time to expiration

2.3.2.3.1   Factors that affect option prices

According to Hull (2002:182), the factors that affect option prices are the current underlying asset price, the strike price, time to expiration, volatility of the underlying asset price, the risk free interest rate, and the expected dividends during the life of the option. These factors are summarized in table 2.11. In the ensuing section the various factors are described to indicate their influence on the option prices when all other factors are kept constant.

a. **Underlying asset price and strike price**

Options are referred to as being either in the money, at the money or out of the money, as illustrated in table 2.10. The intrinsic value of an option contract is the difference between the strike price and the current market price of the underlying. If the option has an intrinsic value it is said to be in the money. In the case of call options, this is when the strike price is lower than the current market price; in the case of put options it is when the strike price is higher than the current market price of the underlying. When the option is in the money the holder or seller will exercise the option and receive a profit or positive cash flow. An option is out of the money when the strike price is higher than the market price of the underlying for a call option, and for a put option when the strike price is lower than the market price of the underlying. The option then has a negative intrinsic value and will not be exercised; the only cash flow will be the premium paid for the option (SARB, 2000:107). The owner of a call option benefits from increasing prices and has limited downside risk when prices decrease; the most the owner can lose is the premium paid. The owner of a put option will benefit from a price decrease with limited downside risk when prices increase (Hull, 2002:183).

Table 2.10   **Conditions for puts and calls to meet moneyness conditions at any time**

	Call Option	Put Option
In the money	$S > X$	$S < X$
At the money	$S = X$	$S = X$
Out of the money	$S < X$	$S > X$

Source: Kolb, 2001:316

b. Time to maturity

An American option gives its holder the same rights as a European option, but with the added advantage of being allowed to exercise the option at any time before maturity. Therefore the value of the American option will be the same as that of the European option, unless the holder of the American option decides to exercise the option before expiration, which will make it more valuable (Smithson, 1998:214).

The longer the time to expiration, the greater the effect on the premium of the option. However, time value does not erode in a straight line but decreases faster in the last few weeks of the option contract (SARB, 2000:108). The time to expiration will influence the premium differently at various periods. At the beginning of the long-term option contract the effect of time to maturity has a minimal effect but during the last few weeks is becomes precipitous. The question marks in table 2.11 at time to maturity of European options indicate an uncertain relationship. It is evident that options do become more valuable as time to maturity increases but the effect of dividends on the options can produce different results to those expected (Hull, 2002:183).

c. Volatility

Volatility is a key input factor in the pricing of options. The premium will be much higher in a volatile market than in a stable market. The risk to the writer of an option and the benefits to the holder of an option in a volatile market are usually higher than in a stable/flat market. The market usually makes use of historic price volatility. Historic volatility is described as the past variance of the price of an instrument and helps in estimating the future volatility in the absence of other data. The standard deviation of daily price changes over a period of time is normally used to calculate volatility. Implied volatility is defined as an estimate of volatility implied by the market prices of an option. To determine whether an option is fairly priced, one can compare the historic volatility

with the implied volatility of the option. When historic volatility is lower than implied
volatility it is said that the option is over valued, and vice versa (SARB, 2000:109).

d. Risk free rate of interest

Interest rate is an important input factor for any derivative price since it allows the
calculation of the future price of the underlying asset. This makes interest rates
important in option pricing (Skerritt, 2002:65). Interest rates do not affect option prices
in a very clear-cut way. While the interest rate increases the growth rate of the
underlying asset price will increase but the present value of that future cash flow will
decrease. Both these factors will have a negative effect on a put option, which means
that the value of a put option will decrease when the interest rate increases. The increase
in the growth rate of underlying asset prices will increase the call price, whereas the
change in the future cash flow will have a negative effect on the option price. However,
the first effect will always dominate the second: an increase in the interest rate will have
a positive effect on the value of the call option (Hull, 2002:184).

e. Dividends

Dividends have the effect of reducing the share price at the ex-dividend date. Table 2.11
illustrates that dividends negatively affect the value of a call option and positively affect
the value of a put option when there is an increase in the anticipated dividends (Hull,
2002:185).

Table 2.11 provides a summary of the changes in option prices when a certain variable is
increased and all the other variables remain constant.

Table 2.11   Influences of variables on option prices

Variable	European call option	European put option	American call option	American put option
Share price	+	-	+	-
Strike price	-	+	-	+

Time to expiry	?	?	+	+
Implied volatility	+	+	+	+
Risk-free interest rate	+	-	+	-
Dividends	-	+	-	+

Source: Hull, 2002:183

+   Indicates an increase in the price of the option due to an increase in the variable.

2   Indicates a decrease in the price of the option due to and increase in the variable.

?   Indicates an uncertain relationship.

2.3.2.4 Application of option contracts in agricultural co-operatives

Let us assume that long-term crop production forecasts indicate that the prices quoted on SAFEX may decrease, due to an expected increase in the rainfall and a larger maize supply. An agricultural co-operative can then buy a put option on futures, locking in a price for delivery of crops in the future. The following serves as an example of such a transaction.

Step 1:   **November 2003 (Wmaz Jul-04-futures contract R970/t).**

Buy a Wmaz Jul-04 put option with a strike price of R1000/t and a premium of R80/t.

Step 2:25 June 2004 (Wmaz Jul-04-futures contracts decreased to R850/t).

The put option expires and the co-operative receives R1000/t from SAFEX for the futures contract sold. The agricultural co-operative pays the initial margin of R100/t (R10 000 for one contract of 100 t) and receives the variation margin of R150/t (R1000 – R850/t). The co-operative buys back the futures contract at R850/t, cancelling the previous transaction. It then delivers the maize in the cash market and receives a gross price of R850/t. This R850/t plus the profit from the futures transaction (R150/t) minus the R80/t premium gives the co-operative a gross price of R920/t for its maize. Alternatively, it

could let the futures contract expire and deliver the maize to the nearest SAFEX-silo. As seen in this example, the co-operative can hedge against a suspected decrease in the price of maize by buying put options. Call options may also be used when the co-operative suspects that the price of maize will increase and wants to fix a price now for buying in the future (Grönum, 2001).

2.3.3 Swaps

Ryan (2002:227) defines a swap as an exchange of recurring payments between two parties. Although futures and options have been known for centuries, swaps only became known in the 1980s. They are usually facilitated by the banking sector and are not traded on a formal exchange like futures and options (Johnson, 1999:10). The most commonly used swap is the plain vanilla interest rate swap, where one party agrees to exchange fixed interest payments for floating rate payments with a counter party. Swaps are seen as private agreements between two parties. There is no clearinghouse to carry the default risk and for this reason the creditworthiness of the counter party is an important aspect to be considered.

Most institutions make use of swap transactions for the following purposes:

1. To hedge an existing asset or liability;
2. To adjust their existing cash flow to a desired structure;
3. To capture value in the market;
4. To artificially access markets which are normally not easily accessible ; and
5. To improve the cosmetics of the transaction by employing optional characteristics which may be adjusted with the swap.

2.3.3.1 Types of swaps

Most swaps are seen as hypothetical transactions as they are simply agreements between two parties that pretend that an exchange has occurred and pay accordingly. Swaps

originated from interest rates but are not limited to these.

It is very important to establish whether there is an exchange of the principle between the counter parties. With the exchange of the principle, credit risk associated with the transaction increases and the transaction becomes far more risky than just an agreement to pay the net cash difference on the notional amount. This occurs mostly in currency swaps and cross-currency swaps (Skerritt, 2002:49). The United States uses either LIBOR for constant maturity swaps or the U.S. Treasury rate for constant maturity treasury swaps (Ryan, 2002:227).   In South Africa, JIBAR is used as the floating reference rate. This is a daily-determined average rate calculated from the rates submitted by fourteen leading banks in the South African debt market.

The International Swap and Derivatives Association, Inc. (ISDA) is an organisation that provides standard documentation for swaps and keeps records of the various swap activities (Kolb, 2001:10).

2.3.3.1.1   Plain vanilla interest rate swap

The interest rate swap is a fairly recent development in the hedging market but has become a very popular tool for investors who want to manage their interest rate exposure. Swaps usually occur between two unrelated borrowers who independently borrow identical principal amounts for the same period. One borrower pays a fixed rate that remains unchanged while the other borrower pays a floating rate that varies according to the particular benchmark. The parties then agree to swap interest payments. South Africa makes use of the JIBAR as the benchmark rate for floating interest rates (Strong, 2001:317). There are, however, two limitations to interest rate swap agreements. Firstly, there is the cost of time and resources associated with the search for a suitable swap candidate and negotiation of the swap terms. Secondly, there is the risk taken by each swap participant that the counter participant will default on the payment (Madura, 2000:509). For these reasons, swap participants make use of financial intermediaries. These financial intermediaries charge a fee for their role and this fee reduces the estimated benefit for the participants. This involvement is, however, critical to

effectively matching up swap participants and reducing counter party risk.

Interest rate swaps are normally based on scenarios in which one borrower who wishes to borrow at a fixed rate but for different reasons can obtain more favourable rates in the floating market, whilst a second borrower wishes to borrow at a floating rate but can obtain more favourable rates in the fixed rate market. These two borrowers then enter into a transaction to exchange the payment to each other's interest cost. By doing so the borrowers obtain the type of interest rate payment acceptable to them. The basic structure for an interest rate swap is depicted in figure 2.17.

Figure 2.17   The basic structure of an interest rate swap

Source: Cronje et al, 2004:163

The following serves as an example of how agricultural co-operatives may apply swaps:

Assume Co-operative AA and Co-operative BB wish to borrow R10 million for six years from the Land Bank. Co-operative AA wants a floating rate loan, which is linked to the six-month JIBAR rate, and Co-operative BB seeks a fixed-rate loan. They are offered the following rates by the Land Bank, which will also transact as the financial intermediary in the swap transaction:

	Fixed	**Floating**
Co-operative AA	11.0%	6-month JIBAR + 1.3%
Co-operative BB	12.2%	6-month JIBAR + 1.6%

The strategy:

1. Co-operative AA borrows funds at a fixed rate of 11% per annum.
2. Co-operative BB borrows funds at a floating rate of JIBAR+ 1.6% per annum.
3. They enter into a swap agreement.

Figure 2.18   Diagram of interest rate swap agreement

In this swap agreement, Co-operative AA borrows at a floating rate of JIBAR + 0.9% per annum, and Co-operative BB ends up borrowing at a fixed rate of 11.8%. The Land Bank net 0.1% on the transaction and both co-operatives gain a 0.4% advantage. This swap transaction is illustrated in figure 2.18.

2.3.3.1.2   Currency swap

Currency swaps originally emanated as short-term transactions between central banks. For example: one bank finds itself short of US dollars and borrows from another country using its own currency as collateral. The borrower then returns the dollars and receives its collateral back. Foreign exchange risk came into being when the Bretton Woods agreement was abolished in August 1971. Before the suspension, exchange rates were fixed and pegged to the gold price, priced in US dollars. With the suspension of the agreement currencies were free to float until they found an equilibrium price in the market. Floating exchange rates means volatility and volatility means risk that needs to be measured and managed (Strong, 2001:325-326).

A currency swap can be defined as an exchange of the principal and interest rate payment in one currency for the principal and interest rate payment in another. In a currency swap, the principal amount must be specified in both currencies and is exchanged at the beginning of the transaction and then again at the end of the swap (Hull, 2002:148).

There are two types of currency swaps, the foreign exchange swap and the cross-currency swap. These differ only in the timing and nature of the cash flows. In foreign currency swaps there is no periodical exchange of interest payments during the life of the swap. The payments are fixed rate for fixed rate and are included in the re-exchange of the principal at the end of the transaction. The fact that there is no provisional cash flow

makes this swap ideal for managing the timing of currency receivables and payments (Skerritt, 2002:56). In a cross-currency swap, participants exchange interest rate payments during the life of the swap and the re-exchange of the principal is calculated at the same exchange rate as at the beginning of the transaction.

2.3.3.1.3   Commodity swap

Participants in a commodity swap want to hedge themselves against the fluctuation of prices in the market. The counter parties make payments that are based on the price of a specified quantity of the commodity. One party will pay a fixed price for the commodity while the other agrees to pay a fluctuating price. There is usually no physical exchange of the commodity, merely an exchange of the net payments between the parties (Kolb, 2001:637).   For example, a farmer is concerned that the price of white maize will decrease, while the co-operative is concerned that the price will increase. They enter into a commodity swap where the co-operative agrees to pay a fixed price to the farmer and the farmer will pay the prevailing market price at the payment date. If the price that the co-operative has to pay the farmer is set at R900/t, it will profit if the price of maize increases to above this set price. The farmer will profit if the price of maize decreases to below R900/t.

2.3.3.1.4   Other examples of swaps

Other examples of swaps include the circus swap, which is a combination of the interest rate and currency swap. In a circus swap you are a party to both an interest rate swap and a foreign currency swap. These swaps may be with the same counter party or others. Other swap variations include deferred swaps, floating for floating swaps, amortising swaps and accreting swaps (Strong, 2001:330).

2.3.3.2 Pricing and valuing of swaps

In South Africa most interest rate swaps are reset every three months in order to be in line with the rollover/repricing of the underlying loan. For this reason interest rate swaps

are usually quoted as a Nominal Annual Compounded Quarterly (NACQ) rate, which means that the swap rate is an annualised rate that is compounded quarterly (Skerritt, 2002:54).

The relevant yield curve, which consists of the most liquid benchmark interest rate instruments, is used to price interest rate swaps. The yield curve is based on a combination of short-term money market instruments and long-term capital market instruments and is seen as a reflection of the expected future floating interest rates, which provide information of the fixed rate to be agreed upon on a specific date for payments in the future. The calculations behind the pricing of a plain vanilla swap are very straightforward although extra caution must be taken in the different compounding methods used for interest-bearing instruments (Skerritt, 2002:55).

The value of a swap to an investor who pays a fixed rate (B_{fix}) and receives a floating rate (B_{fl}) will be as follows:

$$V_{swap} = B_{fl} - B_{fix}$$

The value of an interest rate swap is zero or very close to zero when the swap is initiated and after a period of existence the value can become either positive or negative. With the absence of default risk, the currency risk of a currency swap may be separated into two bonds, as is the case with interest rate swaps. The value of a swap in South African Rand (V_{swap}) where the investor receives rands (B_D) and pays in a foreign currency (B_F) is as follows:

$$V_{swap} = B_D - S_0 B_F$$

S_0 represents the spot exchange rate expressed as the number of units of domestic currency per unit of foreign currency (Hull, 2002:151-152).

2.3.4   Forward rate agreements (FRAs)

A forward rate agreement, or FRA as it is commonly known, is a contract in which the

borrower and lender lock in an interest rate for a certain period of time in the future. An FRA is a contract of difference, meaning it is cash settled (Skerritt, 2002:44).

The use of FRAs has become a very popular method of hedging short-term interest rates in South Africa and around the world. As in the case of other debt derivatives in South Africa, it is settled against JIBAR on a discounted basis. The FRA market uses very specific terminology, for example one talks of a "three by six" FRA or "six by twelve" FRA etc. These terms are references to the starting and ending dates of the agreement. For example, "6 v 12" means that you lock in an interest rate today for a period that will start in six months' time and end in twelve months' time (Skerritt, 2002:45).

An FRA usually trades for short periods of time, between three months and two years, on the OTC market. This gives it additional flexibility and makes it a liquid instrument in the South African market. FRAs are quoted in yield terms like bonds, and differ from futures, which are quoted in price terms. The buyer, usually the borrower of money, will make a profit when the market interest rates increase and the seller, usually an investor with money to lend, will make a profit when the interest rates decrease (Skerritt, 2002:44).

FRAs trade on the OTC market and may be customised to suit the needs of the participants. They can be structured for any future period. FRAs are bought or sold depending on the investor's perspective of the market (Kurten, 2002:143).

2.3.4.1 Pricing and valuing of FRAs

The value of an FRA is always zero when $R_K = R_F$. This is because large financial institutions are unable to lock in the forward rate for a future time period. Consider an FRA in which the investor will earn an interest rate (R_K) for the period between T_1 and T_2 on a principal amount of L. The forward JIBAR rate for the specified period is R_F and the actual JIBAR at T_1 for a maturity of T_2 is R. The FRA has two agreed cash flows:

T_1:   *-L*

T_2: $+L [1 + R_K (T_2 - T_1)]$

The value of an FRA promising R_K is as follows:

$$V = L (R_K - R_F) (T_2 - T_1) e^{-R2T2}$$

(Hull, 2001:106).

2.3.4.2   Application of FRAs in agricultural co-operatives

Agricultural co-operatives perform the functions of both lender and borrower. The Land
bank and other financial institutions they borrow from see them as debtors.   They are
also exposed to their members as creditors, for providing them with funds. They can
therefore apply FRAs as lenders or borrowers. The following example illustrates the use
of an FRA by an agricultural co-operative as a borrower:

Assume that Co-operative XYZ secured a three-year facility for the borrowing of R50
million from Bank ABC, at an interest rate calculated at Bank ABC's Negotiable
Certificate of Deposit (NCD) rate. Every three months the loan is rolled over in the
prevailing NCD market and the co-operative has to pay that rate for the next three-month
period. The co-operative is concerned that the up-coming elections in a neighbouring
country will negatively affect its short-term interest rate three months from now. The co-
operative decides to lock in an interest rate of 11.5% for the three month period starting
in three months' time, by taking a "three sixes" FRA. If Bank ABC's NCD rate is higher
than the FRA after three months, Bank ABC will pay the co-operative the difference
between the two rates. If by then, however, the NCD rate has decreased to below 11.5%,
the co-operative has to pay the bank the difference.

By entering into this FRA contract the co-operative hedges itself against the interest rate
risk.

2.4   Summary

This chapter focused on the derivative market and the major instruments it comprises. The users of derivatives were discussed as well as the purposes for which they participate in the derivative market. Furthermore, the different instruments that are available to these participants in the market and how these instruments can be used to hedge price risk, interest rate risk, currency risk and yield risk respectively, were discussed. The instruments are futures, forwards, options, swaps and FRAs. Focus was placed on a description of these instruments, the trading of these instruments, their pricing and valuing, and some practical examples of how they could be applied by co-operatives. In chapter 3 the methodology applied to conduct the empirical research is discussed.

CHAPTER 3

RESEARCH METHODOLOGY

3.1   Introduction

Chapter 1 provided a background to the financial risks that agricultural co-operatives are exposed to whilst chapter 2 focussed on different derivative instruments available in the market for hedging against these financial risks.

The purpose of chapter 3 is to describe the research methodology that was used to gather the data for this research. Firstly, the sampling methodology is discussed and secondly, focus is placed on the research design that was used. Finally, the statistical analysis that was used to analyse the data gathered during the study is described.

3.1.1 Target population

According to Zikmund (1997:417), a target population can be described as a complete group of specific population elements that is relevant to the research project. For the purpose of this research, the target population comprises all agricultural co-operatives in South Africa.

3.2 Sampling methodology

According to Neethling (2001:1), the main purpose of empirical research is to obtain information with regards to the characteristics of a target population. To include the total population in the study may be very time consuming and expensive and for this reason researchers resort in practice to sample surveys. A perfect scale, which is defined as a scaled-down version of the population mirroring all its characteristics, is not possible in a complicated population. For this reason a representative sample is usually taken, which mirrors the characteristics of the population as closely as possible.

3.3 Sampling design

According to Sekaran (2003:269), there are two types of sampling design, namely probability and non-probability sampling.

a. Probability sampling

In probability sampling all the elements of the population have some known chance/probability of being part of the sample. Probability sampling can be unrestricted or restricted in nature (Sekaran, 2003:270).

i. Unrestricted sampling
Unrestricted sampling is commonly known as simple random sampling and

involves the assumption that every element has a known and equal chance of being selected in the sample. This design provides the least biased results and offers the most generalization of results (Sekaran, 2003:270).

ii. Restricted sampling

Restricted or complex probability sampling offers a viable alternative to unrestricted designs and improves the efficiency in that more information can be obtained than from simple random sampling designs. The five most common complex probability sampling designs are as follows (Sekaran, 2003:271):

- Systematic sampling – this involves the selection of every nth element of the population, starting with a randomly chosen element between 1 and n.
- Stratified random sampling – this involves dividing the population into two or more relevant and significant groups based on certain attributes and determining the representation (number) of each of these groups in the sample. Elements of these groups are then selected randomly for inclusion in the sample.
- Cluster sampling – groups of elements that would provide heterogeneity among members within each group are chosen. This is similar to a stratified sample except for the fact that the criteria for the representation of a group differ.
- Area sampling – this involves geographical clusters.
- Double sampling – this involves gathering further information when needed from a subset of the group from which the information was gathered.

b. Non-probability sampling

Non-probability sampling designs do not attach any probability to elements being chosen. For this reason, the findings from this form of sampling cannot confidently be

generalized to the population. Non-probability sampling is classified into two broad categories, namely convenience sampling and purposive sampling (Sekaran, 2003:276).

i. Convenience sampling

Convenience sampling concerns the collection of information from members of the population that are conveniently available. This type of sampling is most often used during the exploratory phase of the research and is seen as one of the best ways to get basic information quickly and efficiently (Sekaran, 2003:277).

ii. Purposive sampling

This sampling method involves getting information from a specified target group. The group is usually confined to specific types of people who will be able to supply the necessary information. The two major types of purposive sampling are (Sekaran, 2003:277):

1 Judgement sampling –choosing respondents who are most advantageously placed to provide the information needed.
2 Quota sampling – ensuring that certain groups are adequately represented in the study.

1.3.1   Sampling methodology applied in this study

A non-probability sampling technique was used in this study. Information provided by the registrar of co-operatives indicates that more than 1000 co-operatives are registered in the Republic of South Africa. Restructuring in the agricultural sector, combined with the transformation of traditional agricultural co-operatives to companies resulted in the absence of one comprehensive source of information about economically significant agricultural co-operatives in South Africa. Therefore, the sample of agricultural co-operatives for this study was chosen from a list of co-operatives identified in a previous study by Liebenberg (2004:53-83). Liebenberg listed sixty agricultural co-operatives. This list was augmented by adding major transformed companies that still fulfil the role of agricultural co-operatives to their shareholders, as mentioned in par 1.1 (page 7). The

sample can therefore be regarded as representative of all significant co-operatives in South Africa and excludes all small and inoperative co-operatives. The information regarding transformed agricultural companies was obtained from the Agricultural Business Chamber (ABC). The co-operatives identified for inclusion in the sample population are reflected in table 3.1.

Table 3.1   Sampling population for the study

Wine	Grain and oilseeds
Aan-de-Doorns Co-operative wine makers Ltd	Langkloof farmers co-operative Ltd
Agterkliphoogte Wine cellar (co-operative) Ltd	MGK Operating company (Pty) Ltd
Badsberg Co-operative wine cellar Ltd	Senwes Ltd
Barrydale Co-operative winery and distillery Ltd	WPK Group
Bonnievale Co-operative wine cellar Ltd	NWK Ltd
Botha Co-operative wine cellar Ltd	Suidwes Co-operative (SWK)
Brandvlei Co-operative wine cellar Ltd	Northern Transvaal Co-operative (NTK)
Breeriviervallei Bottelerings Co-operative Ltd	Afgri Limited
Citrusdal Co-operative wine cellar Ltd	Natal agricultural co-operative Ltd
De Wet Co-operative wine cellar Ltd	Sentraal-suid Co-operative (SSK)
Du Toitskloof Co-operative wine cellar Ltd	Vrystaat Co-operative Ltd
Goudini Co-operative wine cellar Ltd	**Meat**
Groot Eiland	KLK Agriculture Ltd
Ladismith Co-operative winery and distillery Ltd	Klein Karoo Co-operative Ltd
Langeverwacht Co-operative winery Ltd	Vleissentraal Ltd
McGregor Co-operative winery Ltd	Taurus veeverbeteringskooperasie Bpk.
Merwespont Co-operative winery Ltd	Williston meat co-operative Ltd
Merwida Co-operative	**Tobacco**
Montagu Co-operative winery Ltd	Gamtoos Tobacco co-operative Ltd

Perdeberg wine farmers (co-operative) Ltd	Magaliesberg citrus Co-operative Ltd
Robertson co-operative winery Ltd	Morone Citrus co-operative Ltd
Romansrivier wine cellar (co-operative) Ltd	Onderberg processing co-operative Ltd
Roodezant co-operative winery Ltd	**General**
Slanghoek Co-operative wine cellar Ltd	Hoeveld egg co-operative Ltd
Spruitdrift Co-operative wine cellar Ltd	OVK Bedryf Bpk
Tulbagh Co-operative wine cellar Ltd	Umzimkulu planters co-operative Ltd
Vlottenburg	Villiersdorp co-operative Ltd
Waboomsrivier Co-operative wine cellar Ltd	**Timber**
Wellington co-operative wine cellar Ltd	NCT forestry co-operative Ltd
Windmeul wine farmers (co-operative) Ltd	NTE Co-operative Ltd
Requisites	TWK Agriculture Ltd
East Cape Agricultural co-operative Ltd	Union Co-operative Ltd

1.4   Research Design

According to Zikmund (1997:48-49), research design is defined as a master plan that specifies the methods and procedures used for the collection and analyses of the required information. There are four main design techniques, namely, surveys (most commonly used to generate primary data), experiments, secondary data and observations.

1.4.1   Surveys

Surveys are classified as a research technique in which information is collected from a sample of people by means of interviews (verbally) or questionnaires (non-verbally).

a. Interviews

Interviews have certain advantages and disadvantages when used as a research technique (Zikmund, 1997:232):

- o The opportunity to provide feedback in the clarification of instructions of certain questions between the interviewer and the respondent;
- o More detail can be obtained than from lengthy questionnaires;
- o The survey's completeness may be increased by ensuring responses to all questions;
- o The percentage of people completing the questionnaire is increased by the presence of an interviewer.

2 Disadvantages
- o Respondents may not want to supply confidential information due to the fact that they do not have anonymity;
- o The interviewer's demographic characteristics may have an influence on the respondent's answers;
- o Interviewer bias may be created by different interview techniques;
- o Personal interviews are more expensive and time consuming than mail interviews.

All the above-mentioned advantages and disadvantages must be taken into consideration when determining whether interviews are the best technique for gathering the required information.

b. Questionnaires

Many situations exist where it is not essential to make use of an interview but rather where one can gather data by means of a questionnaire. A questionnaire is defined as a list of well-structured questions selected after careful and thorough testing, which aims at extracting reliable responses from the chosen sample. The aim of a questionnaire is to find out what a selected group of participants do, feel and think (Hussey & Hussey, 1997:161). Zikmund (1997:244) explains the advantages and disadvantages of using questionnaires as follows:

1. The use of questionnaires makes data gathering geographically easier because mail questionnaires reach respondents at the same time over a wide area and are cost effective;

2. Using mail to send questionnaires to the sample population is not inexpensive but is low in cost compared to personal and telephone interviews;

3. Mailed questionnaires are convenient for the respondent who can complete the questionnaire in his/her own time with more time to think about the reply;

4. In the absence of an interviewer the respondent will be more likely to provide sensitive information. This may also be to the disadvantage of the researcher as he/she has no control over the responses provided by respondents and there is no opportunity to clarify or ask questions;

5. Mailed questionnaires consist mostly of well structured questions that are standardised, clear-cut and straightforward;

6. If time is a critical factor in the research due to fast changing attitudes, mail surveys may not be the best method for it can take two to three weeks to receive the majority of the responses;

7. Mail questionnaires vary in length with a general rule of thumb that they should not be longer than six pages;

8. The response rate may be low due to the fact that the survey may be boring, unclear or complex and is therefore disregarded by most respondents; and

9. Individuals who show interest in the subject matter will have a higher response rate than those with less interest or experience. To increase the responses to mail surveys researchers can provide postpaid return envelopes, design attractive questionnaires and use easily accessible language.

1.4.2   Experiments

Leedy (1993:123) defines the experimental method, also known as the laboratory method or the cause and effect method, as data that is derived from an experimental control situation or pretest/post test design. This involves two separate groups, or one group from which data is derived at two separate intervals. The aim of experiments is to manipulate the independent variables so that the effect on the dependent variable can be observed

(Hussey & Hussey, 1997:60).

Leedy (1993:295) states that experimental studies attempt to control the entire research situation except for certain input variables that show the cause of the different changes that occur within the research design. The major disadvantage of experiments is that the laboratory settings do not always reflect the actual environment that is tested (Hussey & Hussey, 1997:60).

1.4.3   Secondary data

Secondary data, also known as historical data, is data that was previously collected and analysed for some research project. This data is usually found inside the company or in the library (Zikmund, 1991:40). Secondary data includes data found in books, articles and documents such as published statistics, annual reports and accounts of companies (Hussey & Hussey, 1997:149).

According to Zikmund (1991:102-103), there are certain advantages and disadvantages in using secondary data as a research technique.

1 Advantages
   o Secondary data builds the research on past research outputs which increases the body of business knowledge in the market.
   o Secondary data can be obtained faster and at a lower cost than primary data.
   o The use of secondary data is of greater value when doing exploratory research.

2 Disadvantages
   o Secondary data can be outdated and may not meet the needs of the

researcher because it was collected for another purpose.

- o Secondary data that is available may be inadequate because of outdated information, variation in the definition of the terms used, different units of measurements and a lack of information to verify the accuracy of the data.

The purpose of most studies is to utilise information for future purposes, therefore for secondary information to be helpful it must be timely and accurate (Zikmund, 1991:103).

1.4.4 Observations

Observation is a method of collecting data either in a laboratory setting or in a natural setting (Hussey & Hussey, 1997:159). The objective of the observation technique of research design is merely to record what can be observed. According to Zikmund (1991:192), the following six factors can be observed:

1 Physical action or evidence, for example the work patterns of people or television viewing;
2 Verbal behaviour such as office conversations;
3 Expressive behaviour, for example tone of voice or facial expression;
4 Spatial relations and locations such as the physical distance between workers;
5 Temporal patterns such as time spent shopping; and
6 Verbal records, for example the content of the memoranda of a meeting.

There are, however, both advantages and disadvantages associated with this technique. One of the advantages of observations is that behaviour can be recorded without relying on the reports of the respondents. However, observed behaviour is generally of short duration (Zikmund, 1991:192).

1.4.5 Research design for this study

After considering the different research designs described in the literature it was concluded that a survey, in particular a questionnaire survey, would be the most appropriate method to gather the information for this study, for the following reasons:

1 Secondary data is not a suitable research design technique because of the absence of a secondary database pertaining to agricultural co-operatives and their use of derivatives;

2 It is also inappropriate to use an observation technique or an experiment owing to the geographical distribution of agricultural co-operatives and the nature of the data that is required. The accountable persons within the co-operatives are in a position to provide the data;

1 Questionnaires are the most efficient way of reaching co-operatives that are geographically dispersed over South Africa as the geographical distribution of co-operatives makes personal interviews too time consuming and costly. Telephone interviews also carry a high cost and the time the respondents have to answer the questions is limited;

2 Questionnaires can be delivered by post, fax or via e-mail. Fax and e-mail allow for immediate delivery of the questionnaire and a faster response;

3 Respondents may be more open and relaxed when completing the questionnaires in their own time.

The data collection method has a significant effect on the format and phrasing of the questions. In this study the following guidelines set by Zikmund (1997:385) for developing a questionnaire were followed:

1 Simple, conventional language was used to avoid complexity;
2 Leading and loaded questions were avoided;

3 Ambiguity was avoided by being as specific as possible;

4 No assumptions were made;

5 Burdensome questions that may have imposed on the respondent's memory were
   avoided.

According to Zikmund (1997:380), two main types of questions are used in
questionnaires:

1 Open-ended response questions which give the respondent the freedom to answer
   the question in his/her own words; and

2 Fixed-alternative questions (closed questions), which provide the respondent with
   a specific or limited alternative in answering the question, asking only for a
   choice of the option closest to his/her own viewpoint.

Most of the questions used in the questionnaire are close-ended, where the respondent
simply has to select an answer. The main reasons for using close-ended questions are:

1 These questions are usually self-explanatory and the presence of an interviewer is
   not required;

2 The questions may be answered faster and the respondent's time is not wasted;

3 They require fewer instructions; and

4 They focus the attention of the respondent on a specific issue.

Open-ended questions are, however, also used to give respondents the opportunity to
provide their own personal opinion and to provide responses outside the given
alternatives.

1.5   Statistical analysis of findings

Statistical techniques are tools applied by the researcher in the measurement, comparison
and control of any uncertainties (Reid, 1987:10). There are two types of statistical
techniques, namely:

1   Inferential statistics which conduct the inference around the population/sample; and

2   Descriptive statistics that describe the characteristics for the population/sample (Zikmund. 1997:448).

In this research study the raw data can be interpreted by using a descriptive analysis.

1.6   Summary

Based on the literature review of derivatives, sampling techniques, research design and data analysis techniques, and with due consideration of the practical situation regarding agricultural co-operatives in South Africa, it was decided to use a non-probability sampling design with the limitation that the findings cannot confidently be generalised to the whole population. With a lack of secondary information on the use of derivatives by agricultural co-operatives to hedge financial risks and the geographic location of co-operatives in South Africa, a questionnaire was chosen as the most appropriate method for gathering the information from the identified respondents (agricultural co-operatives). The questionnaire included both open-ended and fixed-alternative questions. Open-ended questions gave the respondents the freedom to answer the questions in their own words and fixed-alternative questions limited them to certain alternatives that are closest to their own view.

The next chapter focuses on the interpretation and analysis of the empirical results by means of descriptive analysis, which was the statistical method used.

CHAPTER 4

FINDINGS OF THE STUDY

4.1 Introduction

In chapter 3 the research methodology and the available research design techniques were discussed. After considering all the different research designs, a questionnaire was chosen as the most suitable method for use in this study.

In this chapter the analysis and interpretation of the data obtained from the completed questionnaires are discussed. It comprises, firstly, an analysis of the respondents and response rate and, secondly, the findings pertaining to the application of derivative instruments to hedge the financial risks they are exposed to.

4.2   The responses received from agricultural co-operatives

A total of 66 agricultural co-operatives were included in the sample, as listed in table 3.1.

The returned questionnaires totalled 44, which represent a 66, 67% response rate. Six co-operatives which did not respond indicated upon telephone enquiry that they were busy with year-end financials and were experiencing time constraints. Telephonic enquiries also revealed that one co-operative had been sold and was now privately owned and another no longer existed. Fourteen of the co-operatives included in the sample did not provide any reason for the non-completion of the questionnaire, although all were reminded telephonically.

4.2.1   The responses received from the different types of agricultural co-operatives

The co-operatives included in the sample were classified according to their main activities; namely, grain and oilseed, meat, timber, tobacco, fruit and vegetables, general, and requisite co-operatives. Of the 66 questionnaires sent out, 11 were sent to grain and oilseeds co-operatives, 34 to wine co-operatives, five to meat co-operatives, four to timber co-operatives, two to tobacco co-operatives, five to fruit and vegetable co-operatives, four to general co-operatives and one to a requisite co-operative, as indicated in table 4.1.

Table 4.1 summarizes the different types of agricultural co-operatives that were included in the sample, the number of questionnaires sent out and the number of completed questionnaires returned.

Table 4.1   Summary of responses received per type of co-operative

Type of co-operative	Number questionnaire sent	Total number of completed questionnaires	Percentage response rate (%)
Grain & Oilseed	11	10	91
Wine	34	18	53
Meat	5	4	80
Timber	4	1	25
Tobacco	2	2	100
Fruit & vegetables	5	3	60

General	4	4	100
Requisite	1	1	100
Total	**66**	**44**	

As indicated in table 4.1, the response rate for all co-operatives included in the study was satisfactory to excellent, except for timber co-operatives: only one of the four co-operatives included in the sample responded by returning a completed questionnaire. The tobacco, general and requisite co-operatives had a 100% response rate, with grain and oilseeds co-operatives, meat co-operatives and fruit and vegetable co-operatives having a 91%, 80% and 67% response rate respectively. Although wine co-operatives were more representative in the sample, only 56% responded.

4.3   Statistical analysis and interpretation of the data obtained from the completed questionnaires

4.3.1   Interest rate risk

The aim of the questions pertaining to interest rate risk in the questionnaire was to determine whether agricultural co-operatives are exposed to interest rate risk through borrowing money from the Land Bank or other financial institutions and whether or not they use derivative instruments to hedge against this risk.

Forty-three co-operatives indicated that they borrow funds for working capital purposes and/or for capital expenditure. Only one co-operative does not make use of borrowed funds. One of the co-operatives also indicated that it borrows working capital from members by means of a levy of 5% on each year's crop income. These levies are paid back to the members after five years with an annual interest of 7, 5% paid on the loan balance.

Figure 4.1   Sources of finance utilized by co-operatives
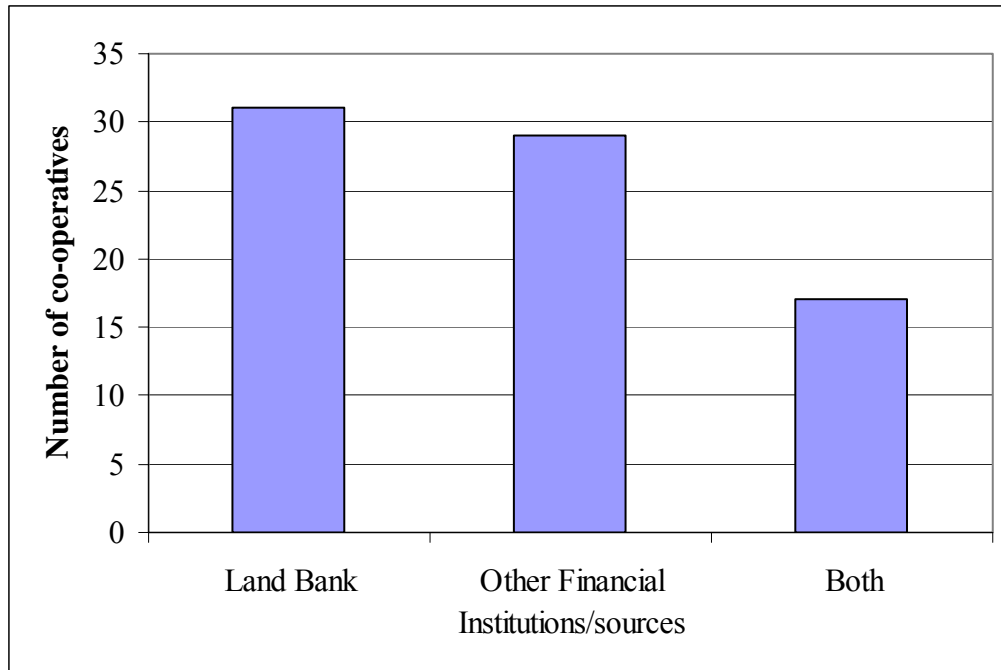
As indicated in figure 4.1, 31 co-operatives make use of the Land Bank as a source of finance, 29 use other financial institutions/sources and 17 co-operatives borrow from both these sources of finance.

The amount of interest bearing funds utilized by co-operatives ranges between R500 000 and R1, 2 billion and is largely based on the size of the co-operatives and the functions and activities that they perform. The co-operatives that make use of large amounts of interest bearing funds are the larger co-operatives that have transformed to companies.

As indicated in figure 4.2, grain and oilseed co-operatives utilise an average of almost

R200 million of borrowed funds, followed by meat, general and requisite co-operatives with just over R50 million. Wine, timber and fruit and vegetable co-operatives utilise on average R14 million, R25 million and R17 million respectively, with tobacco co-operatives only utilising an average of R8 million of borrowed funds. One wine co-operative and one grain and oilseed co-operative did not disclose this information because they felt it was confidential information. For this reason a comprehensive conclusion about wine, and grain and oilseed co-operatives cannot be reached.

Figure 4.2   Average amount of borrowed funds utilised per type of co-operative
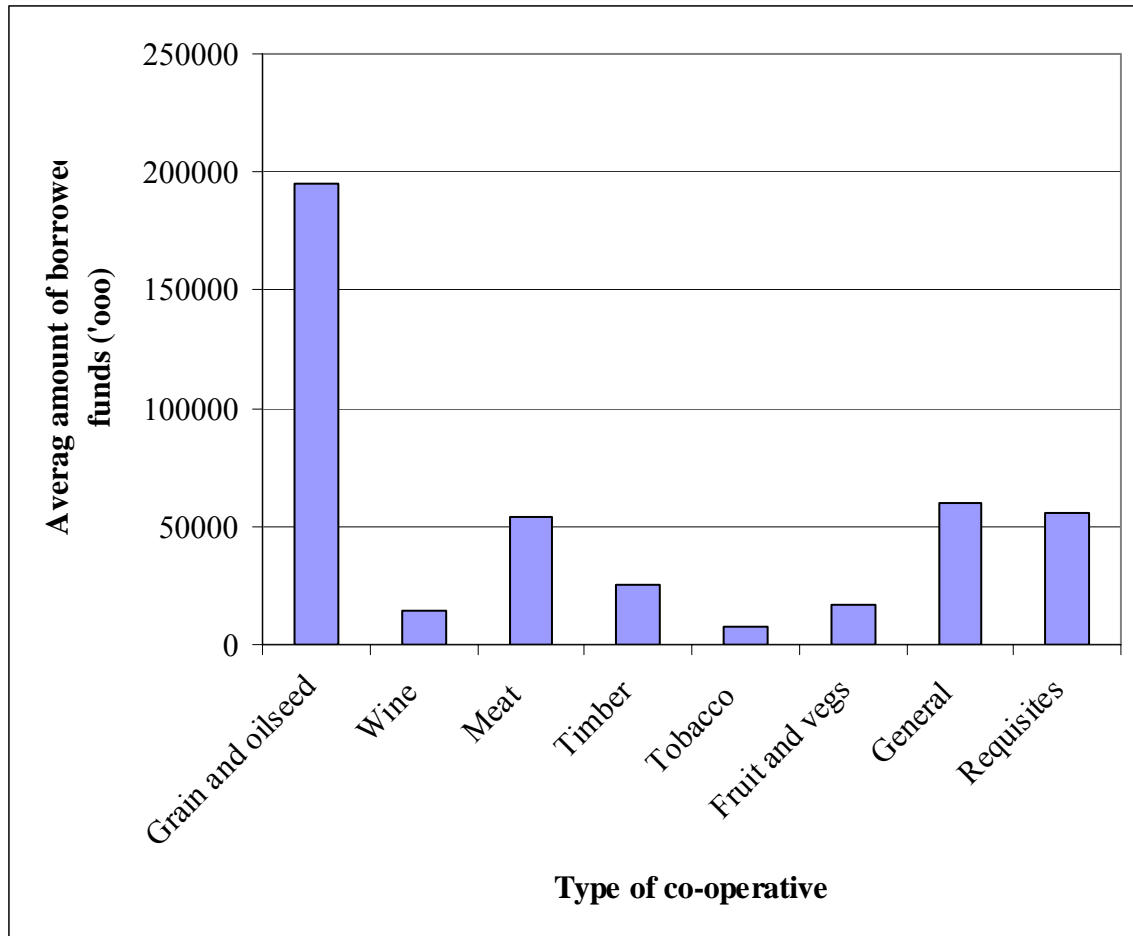
Figure 4.3 indicates the average amount of borrowed funds that are utilised by the different types of co-operatives that have transformed to companies, compared to those that retained the co-operative form of ownership. Only nine of the respondents indicated that they had transformed to companies between 1996 and 2001. Seven of the companies

are grain and oilseed co-operatives, one a meat co-operative and one a general co-operative. As indicated in figure 4.3, in the case of grain and oilseeds and general co-operatives, companies utilise considerably more borrowed funds than co-operatives. The exception is meat, where co-operatives utilise more than companies because only one meat company was included in the sample (utilising an average of R10 million) compared to the three co-operatives that utilise more than R60 million on average.

Figure 4.3   Average amount of borrowed funds utilised
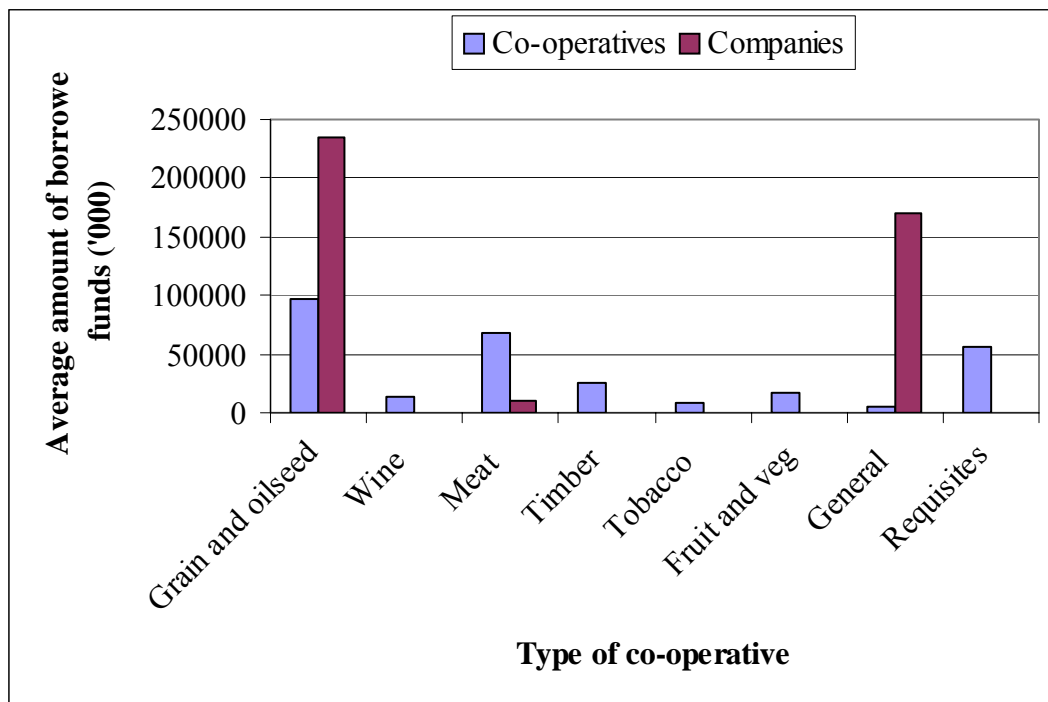
Figure 4.4 shows that 32 co-operatives borrow funds at prime linked floating interest rates. Four of the co-operatives borrow at fixed interest rates that range between 7 and

12 percent and seven co-operatives borrow at both fixed and floating interest rates.

Figure 4.4   Funds borrowed at fixed and floating interest rates
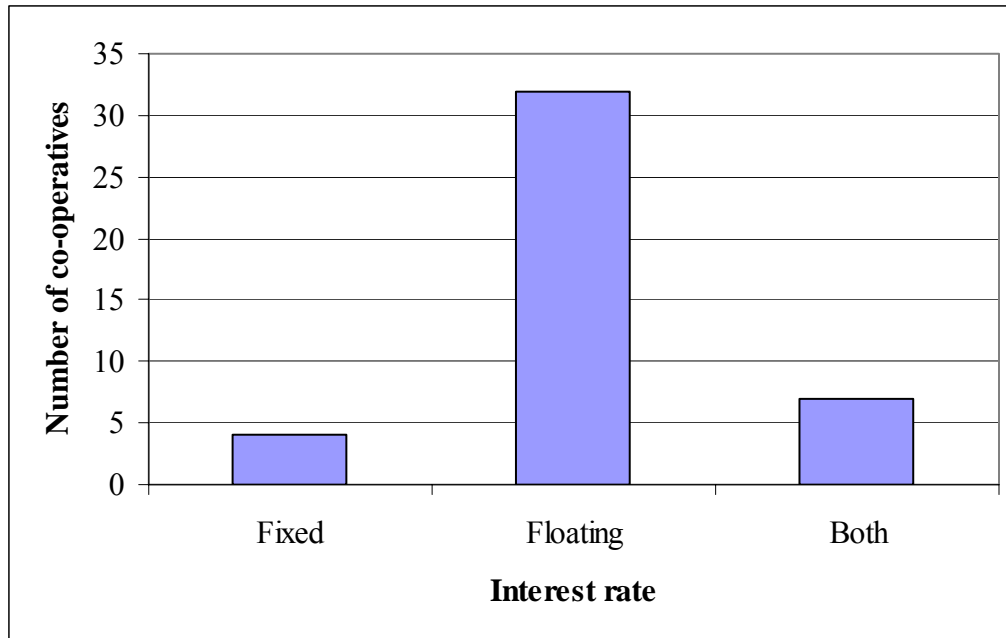
Thirty-eight of the respondents indicated that the borrowing of funds from the Land Bank and other financial institutions exposes them to interest rate risk. Only five co-operatives were of the opinion that there is no risk effect. The following reasons were given by the latter group of co-operatives:

1   They make use of fixed interest rate borrowings;

2   They only borrow money intermittently over short-term periods, for example borrowing R1 million from the bank for three months. Thereafter they make use of own funds; and

3   Borrowed funds comprise a very small percentage of their total capital requirements.

Of the 38 co-operatives that indicated that they are exposed to interest rate risk through borrowing from the Land Bank or other financial institutions, only three co-operatives hedge against this exposure by making use of derivative instruments. The three co-operatives that hedge against interest rate risk utilise R10, 4 million, R185 million and R1, 2 billion borrowed funds respectively. From the information provided it is evident that not all co-operatives with immense amounts of borrowed funds hedge this exposure. In this regard there are four co-operatives that each utilizes more than R100 million of borrowed funds but do not hedge this exposure.

Figure 4.5 compares the average amount of borrowed funds of co-operatives that hedge and the average amount of borrowed funds of those that do not hedge. As indicated in figure 4.5, the average amount of borrowed funds for co-operatives that hedge is just over R450 million. This is much more than the average of less than R50 million for co-operatives that do not hedge. One shortcoming of this diagrammatic comparison is that two of the co-operatives that hedge against the interest rate risk had a skewed effect on the comparative figures: one co-operative had a borrowed funds exposure of R1,2 billion while the other had an exposure of only R10,4 million. The comparison therefore does not show that hedging is applied by co-operatives with a high borrowed funds exposure only.

Figure 4.5   Average amount of borrowed funds of co-operatives that apply derivative instruments and those that do not
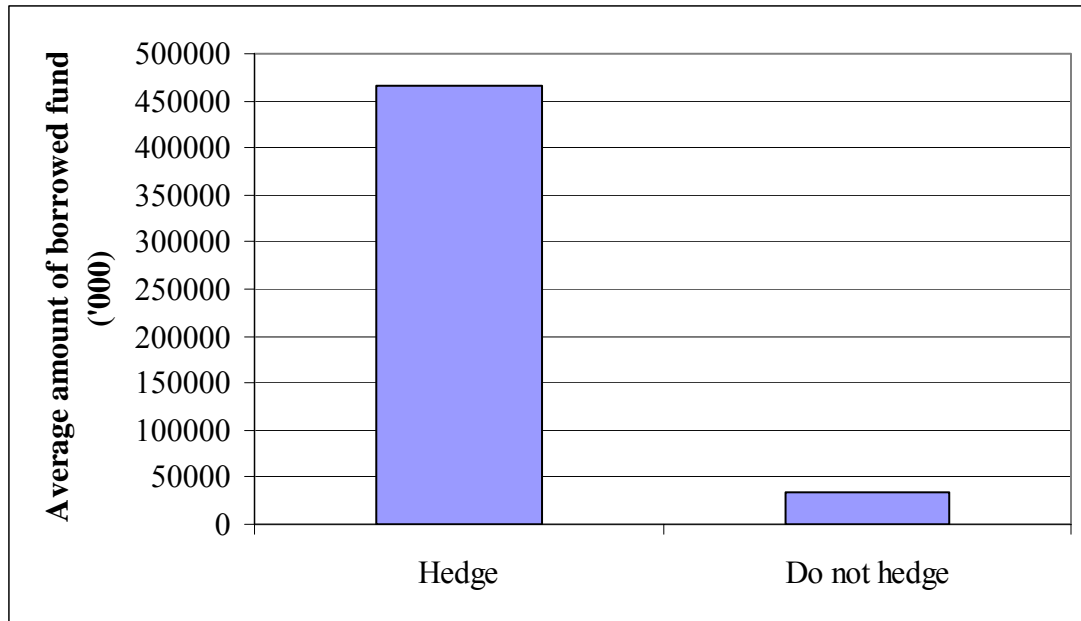
The derivative instruments that were provided as alternatives to respondents in the questionnaire included futures contracts, options, swaps and forward rate agreements (FRAs). Of the three respondents that indicated that they use derivative instruments to hedge against interest rate risks, one makes use of both futures contracts and swaps, one uses only futures contracts, and one uses only swaps, as indicated in figure 4.6. None of the respondents make use of options or FRAs.

Figure 4.6   Instruments used to hedge interest rate risk
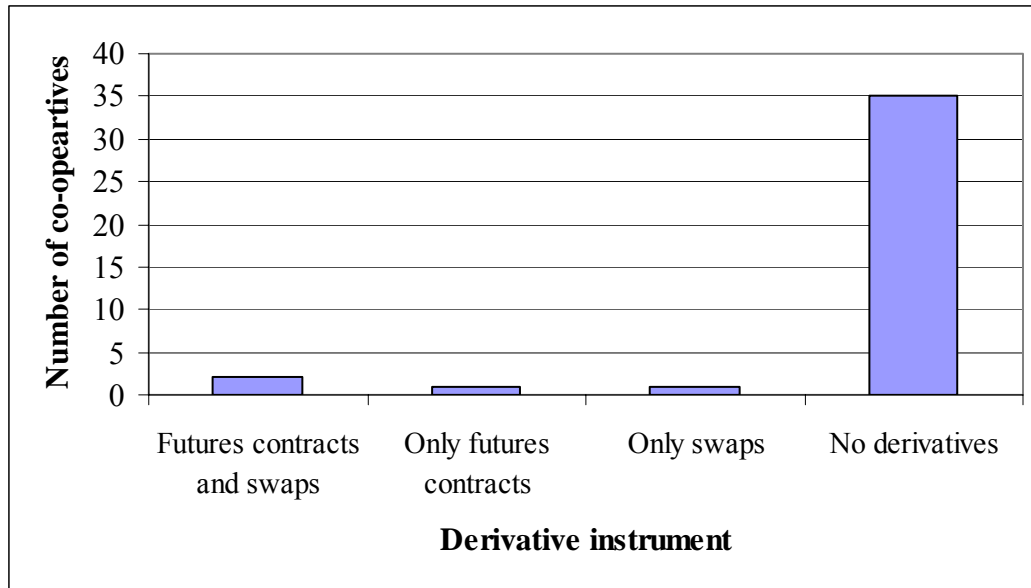
4.3.2 Counter party credit risk

According to the information obtained from the questionnaire, 24 of the co-operatives lend money to members or shareholders whilst 20 co-operatives do not provide any credit facilities. As indicated in figure 4.7, production credit is the most commonly provided credit type (provided by 19 of the co-operatives). Eleven co-operatives also provide consumer credit and eleven provide seasonal loans. Other types of credit and/or loans provided include instalment sales, long-term loans and short-term loans. Two co-operatives provide instalment sales, two provide long-term loans and five co-operatives provide short-term loans. Not all credit facilities and loans that are provided to members are interest bearing, due to the following reasons supplied by the respondents:

1   Some credit/loans are in the form of production advances, which are not interest bearing.

2 Current accounts/consumer credit up to 60 days are not interest bearing.

3 Monthly accounts that are payable within 30 days are interest free.

Figure 4.7   Types of credit/loans to members
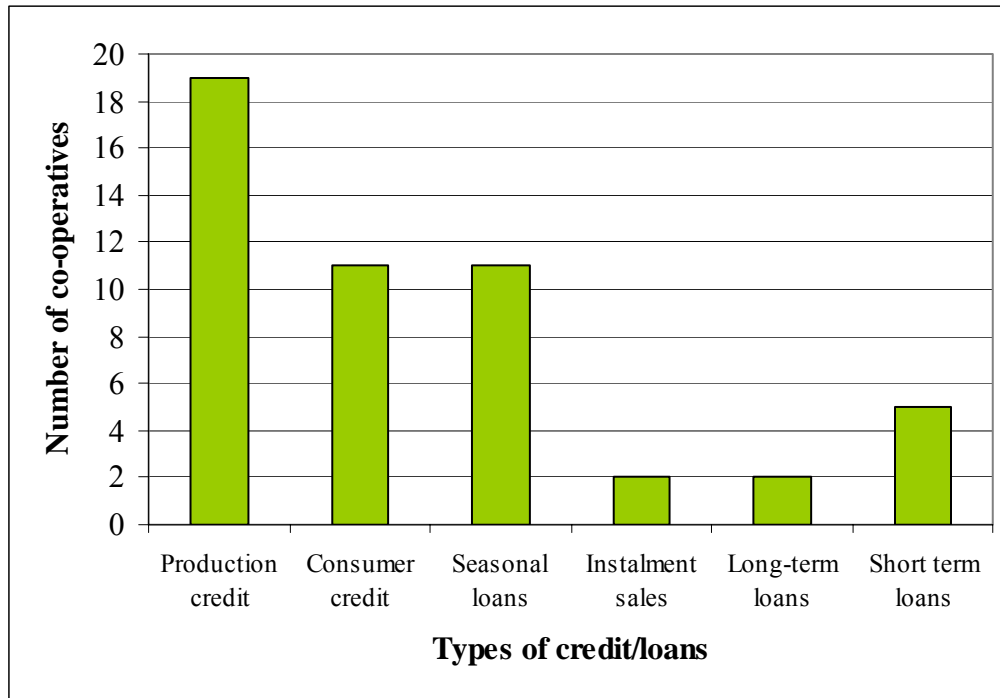
As far as borrowing money is concerned, most of the co-operatives lend money at floating interest rates that are prime related. Only three lend at fixed interest rates and one lends at both fixed and floating interest rates, as indicated in figure 4.8.

Figure 4.8   Lending of money at fixed or floating interest rates
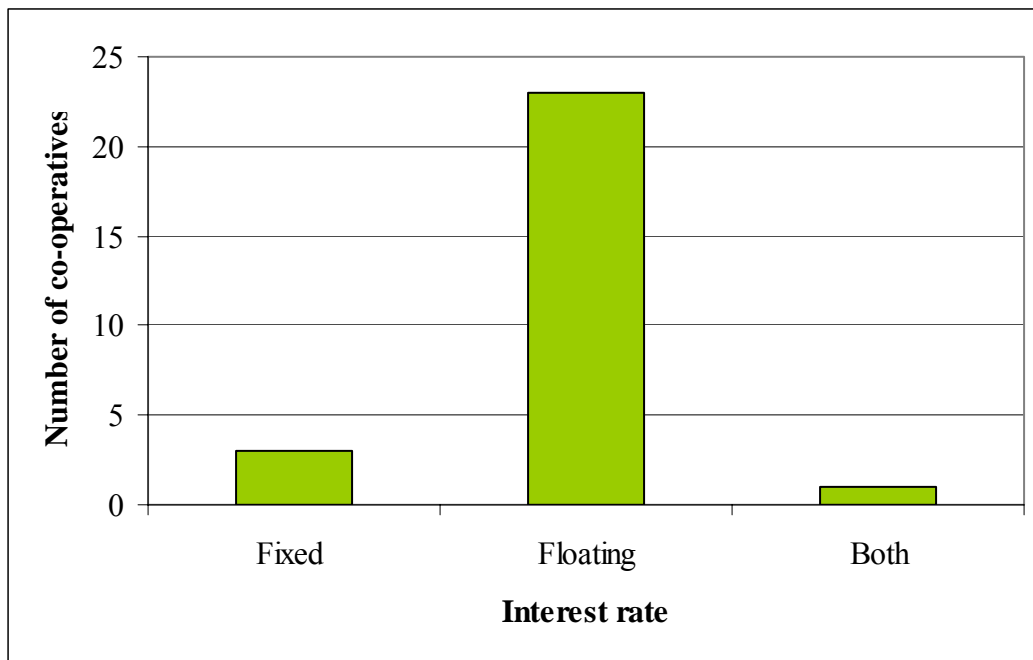
Nineteen of the 24 co-operatives that indicated that they lend money to their members indicated that the activity of lending money exposes them to counter party credit risk, but only three hedges against this risk, although not by way of derivative instruments (refer to figure 4.9). Co-operatives cannot as a general rule use credit derivatives as credit derivative trading desks of banks and other financial institutions would require the reference entities (co-operatives) to have listed and rated debt for them to consider selling/buying protection on the credit event. Swaps and insurance were also included in the questionnaire as instruments that could be used to hedge against credit risk. The three co-operatives that do hedge this exposure all make use of insurance as a hedging tool.

Figure 4.9   Instruments used to hedge counter party credit risk
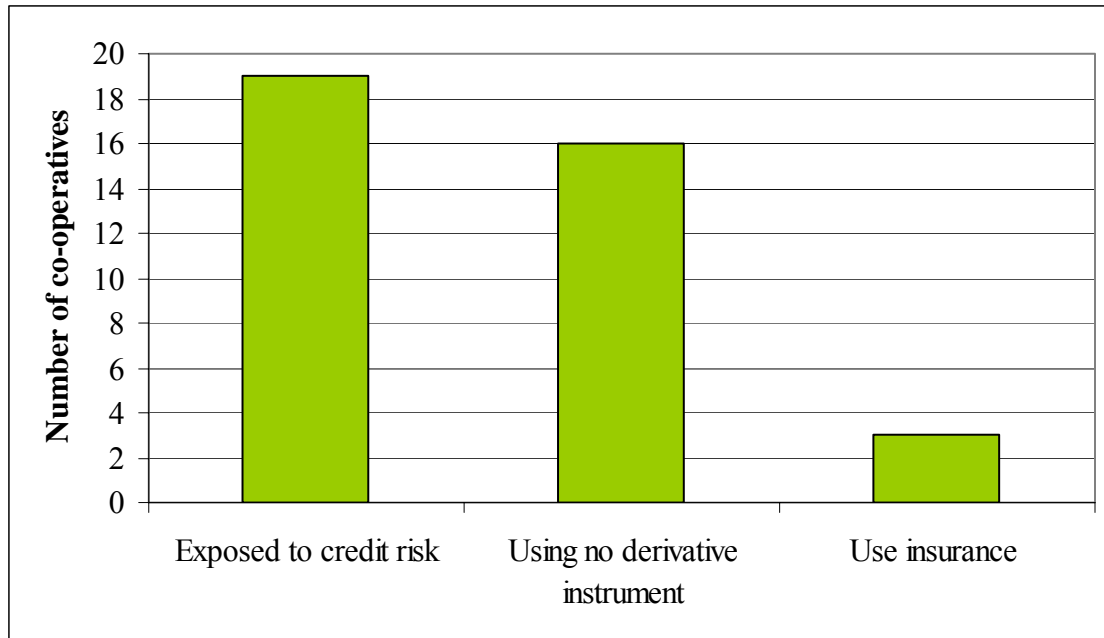
The following reasons were provided by those co-operatives that lend money to members but do not regard this activity as a credit risk:

1 Short-term consumer credit accounts do not represent significant amounts.
2 Co-operatives take sufficient collateral to cover the credit exposure of members.
3 Members borrow against their own products/commodities that are supplied to the co-operative as co-operatives utilise extensive information on historical production figures of members to determine their supply of commodities/products. Only then will the co-operative advance credit to members to a maximum of 60% of what the co-operative will owe members for the products.

4.3.3 Currency risk

According to the responses, fifteen co-operatives are importers and twenty-five are exporters of products and/or commodities. In figure 4.10 the number of co-operatives that import products and/or commodities are grouped per type of co-operative. Six of the ten grain and oilseed co-operatives, five wine co-operatives, two of the four meat co-operatives, one tobacco co-operative and one fruit and vegetable co-operative indicated that they are importers of commodities/products.

Figure 4.10   Number of importers per type of co-operative
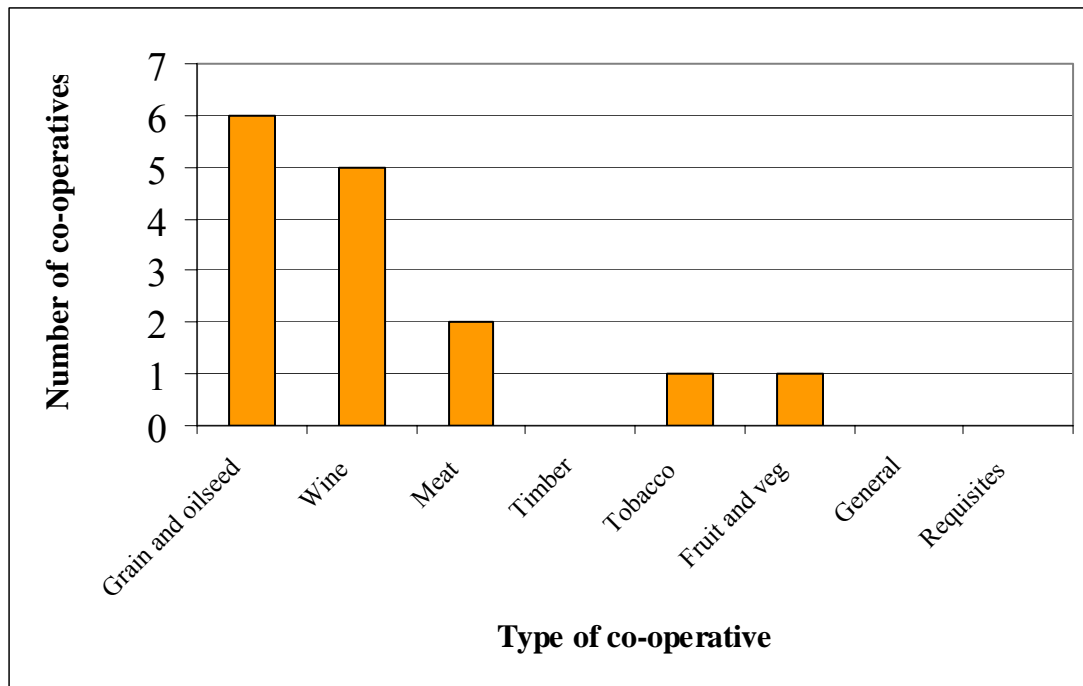
Figure 4.11 indicates the number of exporters per type of co-operative. Wine co-

operatives export most of their products, with fourteen co-operatives performing this function, followed by grain and oilseed co-operatives with four and fruit and vegetables with three. Two meat co-operatives export products but only one timber co-operative and one tobacco co-operative do so. General and requisite co-operatives indicated that they do not perform this function.

Figure 4.11   Number of exporters per type of co-operative
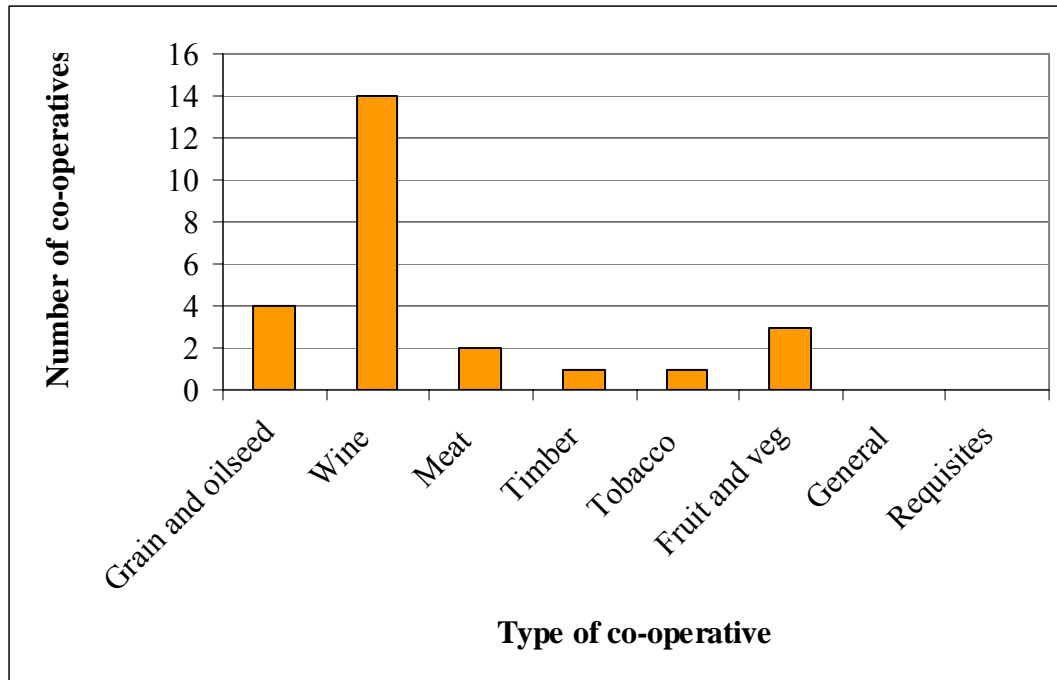
Of the 31 co-operatives that indicated that they import or export products, only six import products and/or commodities, only 16 export and nine perform both import and export activities, as indicated in figure 4.12.

Figure 4.12   Importers and exporters of products and/or commodities
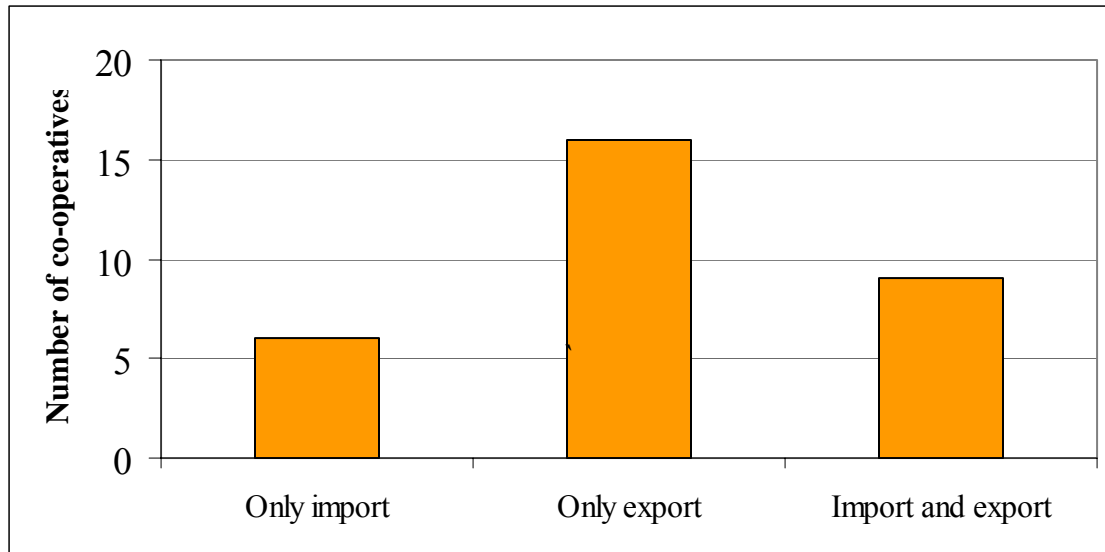
Seventy-four percent of the imports are denominated only in foreign currency, thirteen percent only in South African Rand (ZAR) and thirteen percent are denominated in either currency depending on the situation, as indicated in figure 4.13. Forty-eight percent of the exports are denominated only in foreign currency, 28 percent only in South African Rand (ZAR) and 24 percent in either foreign or domestic currency depending on the situation, as indicated in figure 4.14.
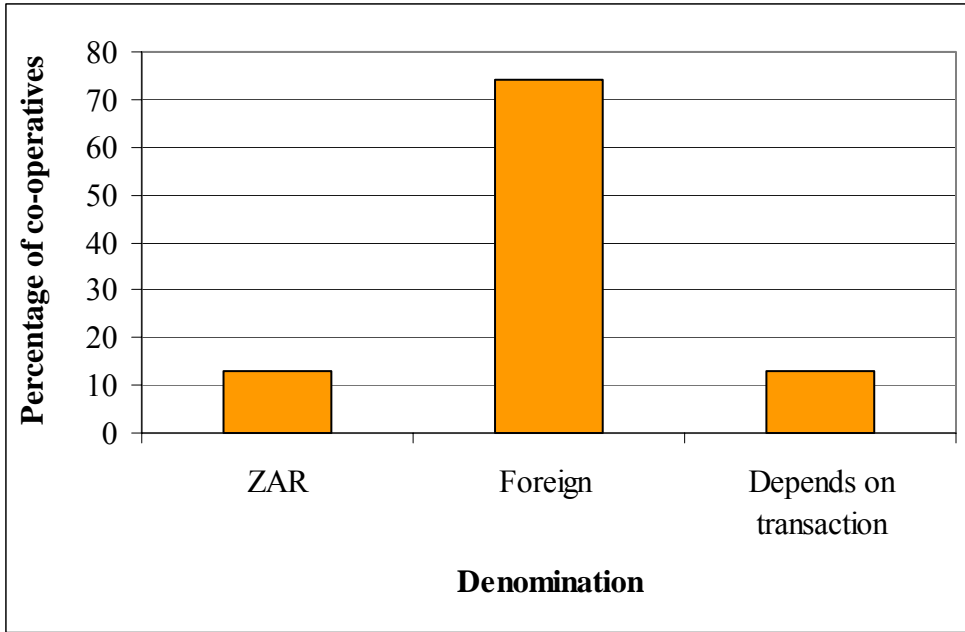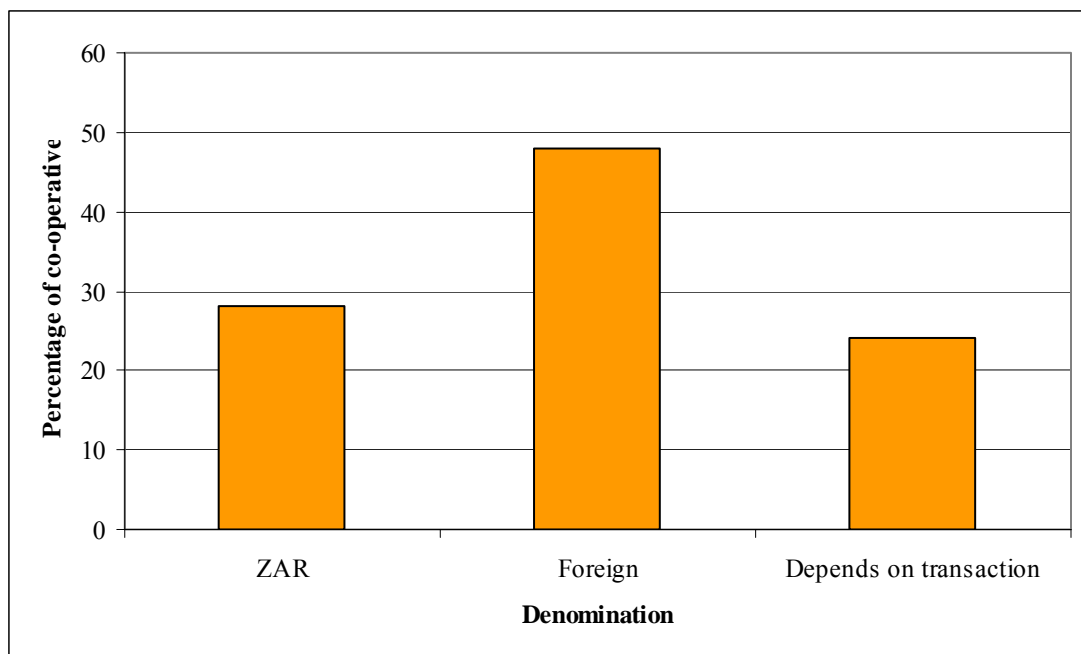
Figure 4.13   Denomination of imports

**Figure 4.14   Denomination of exports**

The activity of importing and exporting products and/or commodities exposes the co-operatives to currency risk due to the fluctuation of different currencies in the market. Of the 15 importers, 13 indicated that by importing they are exposed to currency risk although only twelve of the co-operatives hedge against this risk. Two importers indicated that they are not exposed to currency risk because one imports only spare parts for machinery which is not part of the main business activities of the co-operative, and the other's imports are denominated in South African Rand (ZAR) and set at a fixed predetermined rate. Of the 25 exporters, 21 indicated that they are exposed to currency risk through exporting products and/or commodities. Four exporters indicted that they are not exposed to currency risk because they either make use of agents to hedge them

against this type of exposure, or they do not perform the activity themselves, or their exports are denominated in South African Rand (ZAR) and set at a predetermined exchange rate. Eleven of the twenty-one respondents indicated that they hedge against the currency risk of exporting commodities.

The exposure to currency risk depends on the fluctuation in the exchange rate and the currency in which the imports or exports are denominated. Forward contracts, futures contracts, options and swaps were included in the questionnaire as usable alternatives to hedge currency risk.

**Figure 4.15   Instruments used to hedge currency risk**
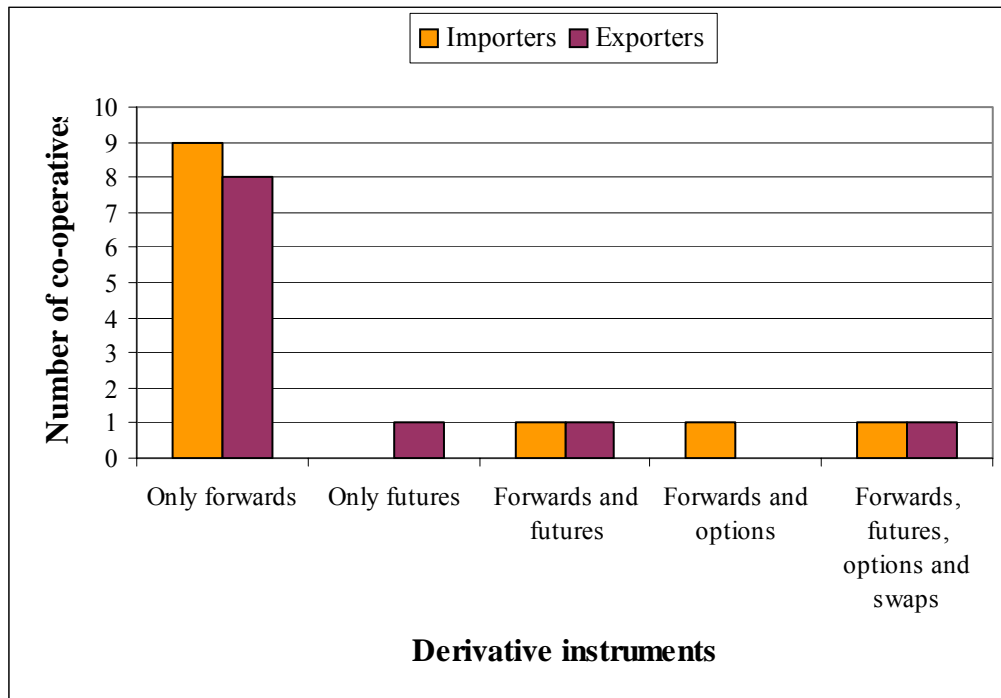
As indicated in figure 4.15, nine importers and eight exporters use only forward contracts to hedge against currency risk. One exporter makes use of only futures contracts and one importer uses both forward and options contracts. One importer and one exporter make use of forward and futures contracts and one of forwards, futures, options and swaps.

4.3.4   Price risk

Thirty-one (70%) of the respondents indicated that they buy commodities from their members either to re-sell them in the market or to use them in their own processing plants. Figure 4.16 shows that 19 co-operatives buy products for the purpose of re-selling them in the market and 27 use them in further processing. Fourteen use products for both processing and re-selling in the market and 12 do not buy commodities from members at all. Of the 31 co-operatives that indicated that they do perform this function, 23 indicated that buying commodities/products from members exposes them to price risk. The eight that indicated that they are not exposed to price risk provided the following reasons:

1 The co-operative is only there to provide a service to the members, for example bottling. In this regard only production material, i.e. bottles and lids, will be purchased. The price risk is insignificant.
2 The co-operative receives the commodity from the members and then processes it and sells it thereafter. After all the costs have been deducted the members get what is left. The price risk is therefore with the member and not the co-operative.
3 Product prices are fixed and do not fluctuate due to the fact that prices are annually fixed.
4 The co-operative is the only buyer of the commodity in a specific geographical area and the sellers do not travel outside this area to the next co-operative to sell their products.
5 They make use of a pooling system for products.

Figure 4.16   Buying of commodities by co-operatives
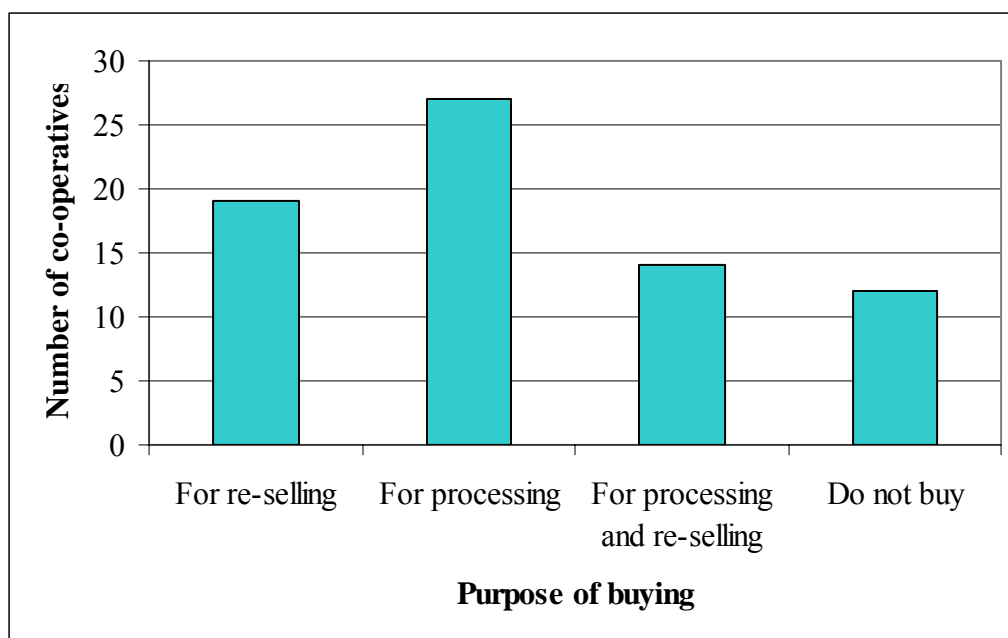
Price risk is defined in chapter 1 paragraph 1.1.1 as the probability that the price of a certain product will in the future differ from the price today, with a positive or negative effect on the business. Twenty-three of the respondents indicated that they are exposed to price risk through buying and selling commodities. Of these respondents, only eight make use of derivative instruments to hedge against this type of risk.

Of the eight respondents that indicated that they hedge against price risk, seven make use of forward contracts, two of forward and futures contracts, three use forwards, futures and option contracts, two use forwards, futures, options and swaps and one make use only of futures contracts to hedge against this risk (figure 4.17).

**Figure 4.17   Instruments used to hedge price risk**
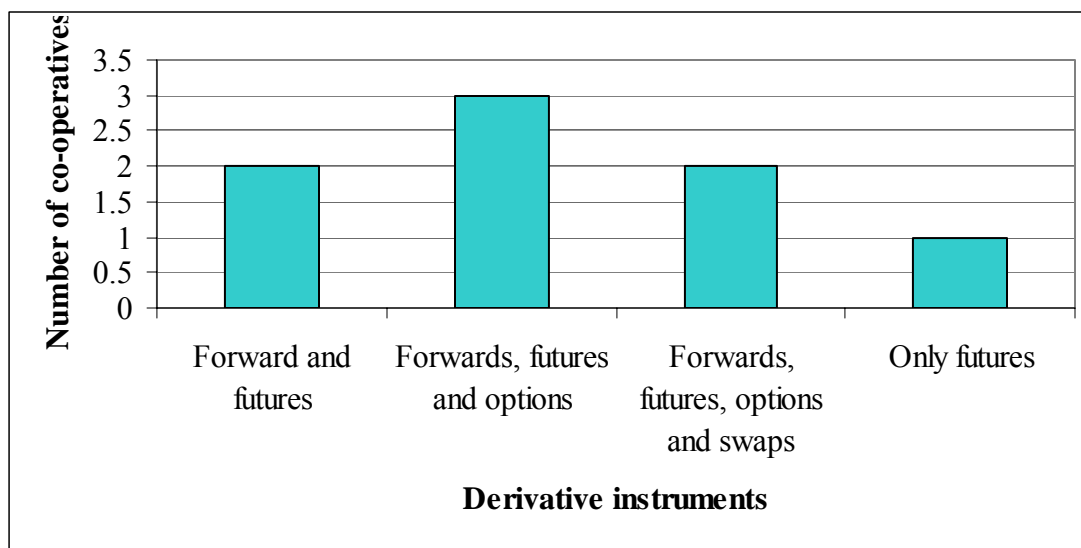
4.3.5   Yield risk

Twenty-one of the respondents indicated that they enter into forward arrangements to buy or sell products/commodities. All of these co-operatives indicated that they are exposed to delivery/yield risk through entering these arrangements.

Yield risk mostly affects agriculture when adverse events cannot be controlled.   Ten of the 21 co-operatives that are exposed to this type of risk make use of derivative instruments to hedge against this risk.

Six co-operatives use only futures contracts and four use both futures contracts and options to hedge against the exposure, as can be seen in figure 4.18. None of the respondents make use of weather derivative instruments. One reason for this may be that it is a fairly new product in South Africa.

Figure 4.18   Instruments used to hedge yield/delivery risk
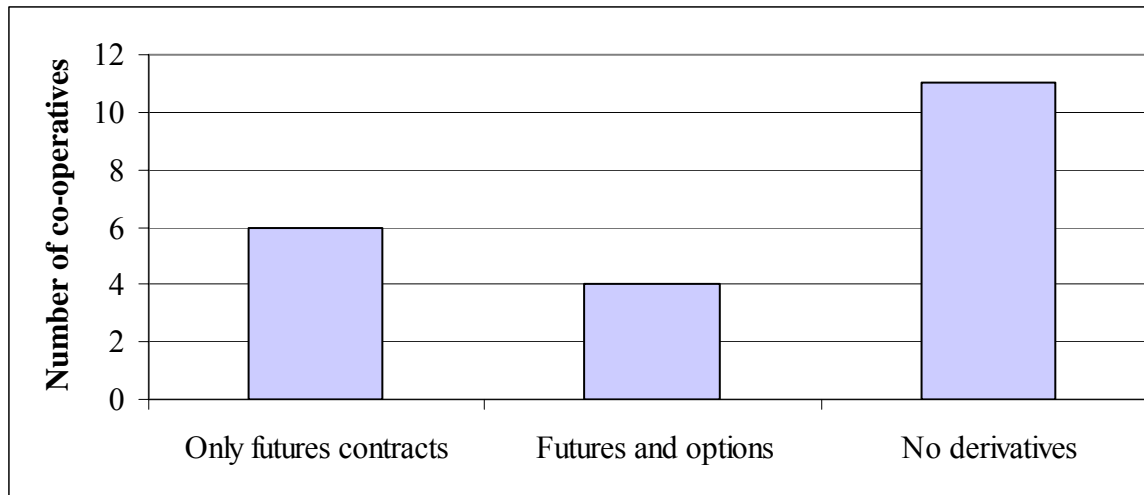
4.3.6   Concluding remarks

Figure 4.19 provides a comparison of the number of co-operatives that indicated that they are exposed to different types of risk, namely interest rate risk, credit risk, currency risk emanating from imports and exports, price risk, and yield risk, and the number of co-operatives that hedge against these risks. From this figure it is clear that most co-operatives are exposed to interest rate risk through borrowing funds but this is also the risk against which the respondents are least likely to hedge. Respondents also indicated that although many are exposed to credit risk through lending to members or shareholders, very few hedge this risk. All but one of those exposed to currency risk through imports hedge this exposure, with only half of the respondents exposed to currency risk through exports applying hedging. Fewer than half of the respondents hedge their price risk and yield risk exposures.

Figure 4.19   Summary of results
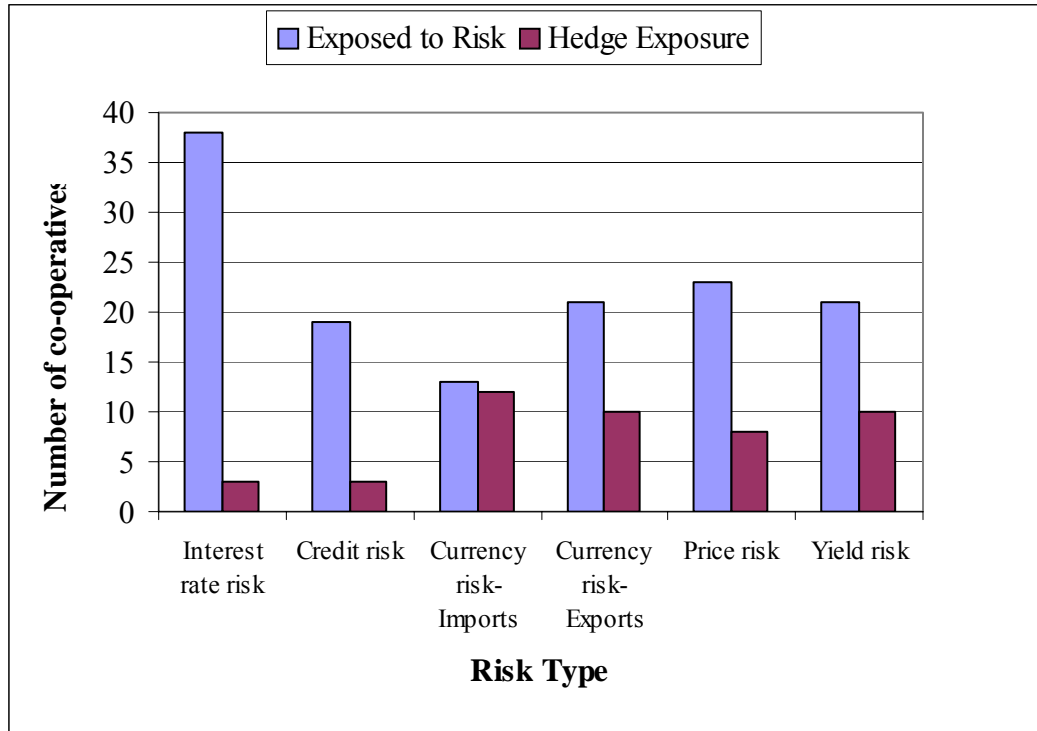
Of all the instruments included in this study, forward contracts are most widely used for most of the risk types, with 24 co-operatives making use of only forward contracts. Eight co-operatives make use of only futures contracts while one uses only swaps to hedge against the different risks, as indicated in figure 4.20. Three co-operatives use insurance as instrument to hedge their credit risk exposure as there is a lack of derivative

instruments to hedge this type of exposure. FRAs and weather derivatives were included as alternative hedging instruments but are not used by any of the co-operatives in the study.

Figure 4.20   Number of individual derivative instruments used by co-operatives
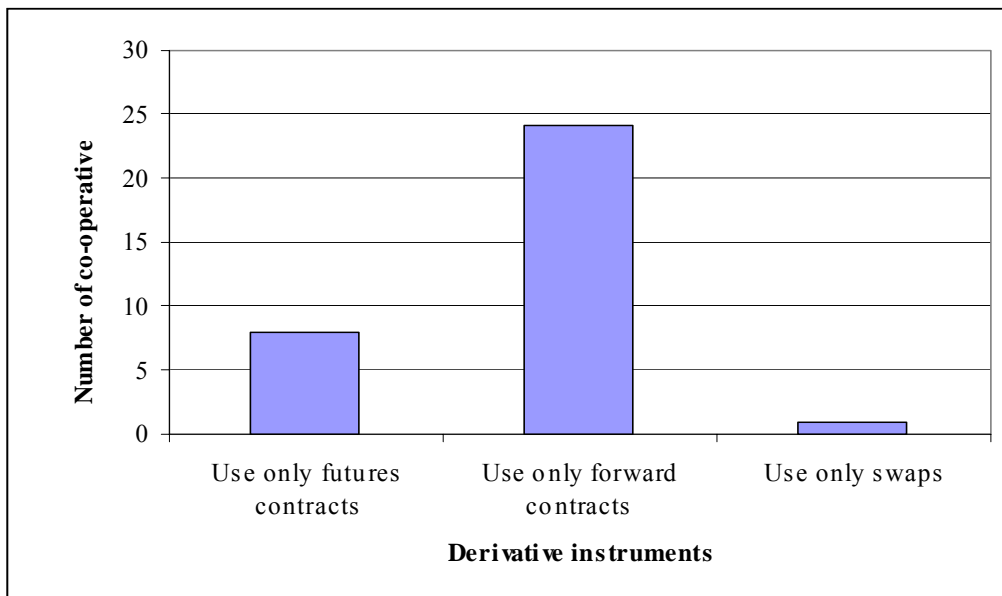
Figure 4.21 shows the combination of derivative instruments used. Four co-operatives indicated that they use futures and forward contracts or futures, forward, options and swap contracts. Three co-operatives use futures and options or futures, forwards and options.

Figure 4.21   Combinations of derivative instruments used by co-operatives

Derivative instruments
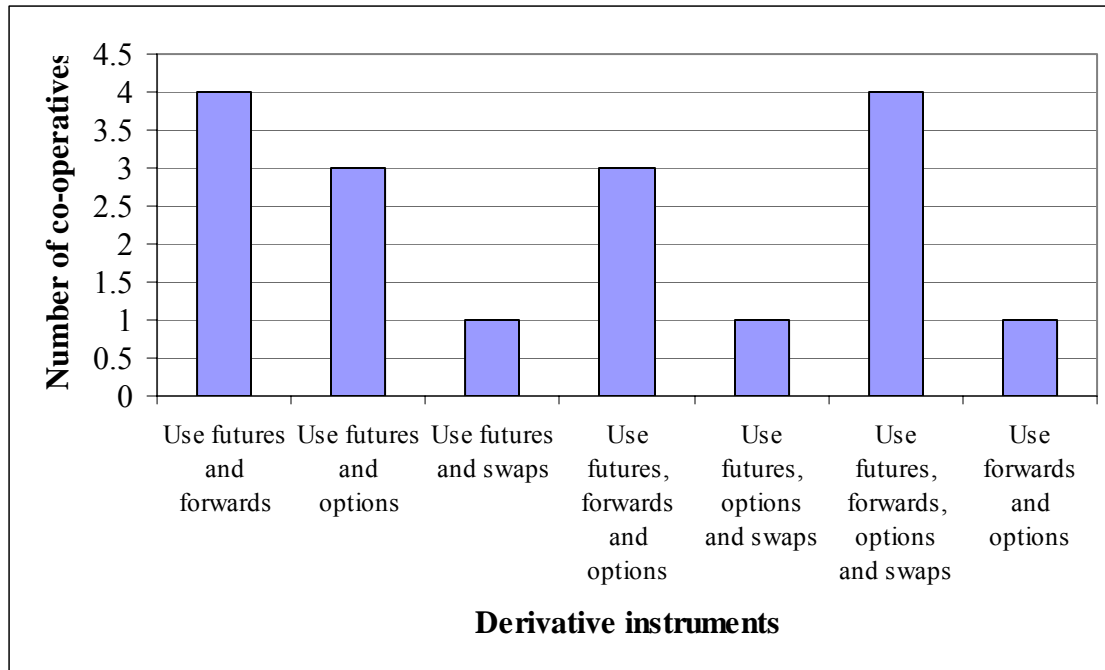
4.4 Summary

From the analysis and interpretation of the data it is evident that a large number of co-operatives are exposed to various risk types but that only a small percentage of these co-operatives utilise derivative instruments to hedge against the risk exposures. Some reasons for not hedging these risks were given.

In chapter 5 a summary of the research results obtained from this study is provided and conclusions on the use of derivatives by co-operatives are made. Recommendations for future research are also made.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1   Introduction

Each of the previous chapters focussed on a specific area of the research. In chapter1 the background, problem statement and purpose of the research was discussed. Chapter 2 focussed on a literature review of the different derivative instruments that can be applied by agricultural co-operatives. Chapter 3 described the research methodology, and chapter 4 provided the findings of the research.

This chapter firstly provides a summary of the literature review, empirical research and the findings of the data gathered. Secondly, recommendations are made for further research to enhance risk management in South African agricultural co-operatives.

5.2   Summary and overview of the research

Agriculture plays a very important role in the South African economy. It contributes to the GDP, provides employment and earns foreign exchange. The traditional co-operatives were not able to source capital from share issues and had to rely on retained earnings and member contributions. After the deregulation and liberation of the fixed price system, co-operatives had more freedom to decide on the prices of their

commodities and were afforded an option to transform to companies to attract capital.

The functions of the traditional co-operatives and transformed co-operatives, however, remained the same, namely, pooling of resources, providing finance to members/shareholders, giving access to domestic and international markets and offering a service to members/shareholders. Because of these functions co-operatives are exposed to certain financial risks, namely:

1 *Price risk.* The volatility of commodity prices in South Africa is due largely to changes in local and international supply and demand, international grain prices, fluctuation in the exchange rate, and the adverse weather conditions in South Africa.

2 *Yield risk.* Agricultural co-operatives enter into forward contracts to purchase/sell products in the local and international market. This function exposes co-operatives to yield risk because adverse weather can change the production of crops and could affect the ability of co-operatives to fulfil the obligations of the forward contracts, or the ability of the counter-parties in the case of purchasing agreements.

3 *Interest rate risk.* Agriculture in South Africa is classified as a net borrower with debt exposure growing by 10% each year since 1995. Co-operatives borrow from the Land Bank as well as from other financial institutions, and this borrowing exposes them to interest rate risk. They also provide loans to members and shareholders. This function in turn exposes them to counter party credit risk.

4 *Currency risk.* The exposure of agricultural co-operatives to currency risk depends on the extent to which they are involved in import and export activities as well as the currency in which their imports and exports are denominated.

A derivative instrument is defined as a contract for which the value is derived from the underlying asset or commodity. The most common derivative instruments available in

the South African market for agricultural co-operatives to hedge their exposure to financial risks are as follows:

1 *Futures and forward contracts.* Buyers of commodities apply these contracts when they have a bullish outlook on the market. These buyers expect the prices of the commodities to increase and when entering these contracts they hedge their position by fixing the prices of commodities that they require in the future. By contrast, producers or sellers of commodities expect the price to decrease. Therefore, by entering into forward and futures contracts they have a predetermined future price at which they will sell the commodities if the price decreases in the market. When calculating this forward/futures price the carry cost for holding the commodity to expiration date must be considered. The following are different futures contracts available in the market:

   o Commodity futures contracts.
   o Interest rate futures contracts.
   o Currency futures contracts.

   Using these different futures contracts, agricultural co-operatives can hedge against price risk, interest rate risk, and currency risk.

2 *Option contracts.*   These contracts are different from futures contracts in that they give the holder the right to exercise the option if it is profitable to do so. Different option contracts exist in the market but the most common ones are the generic European and American put and call options. Combinations of puts and calls can also be used to make the risk and return characteristics of the option position more precise. Some of these combinations include bull and bear spreads, straddles, strangles, and butterfly spreads.

   Mathematical models such as the Black and Scholes and Binomial models are used for the pricing of option contracts. Asset and strike price, time to maturity,

volatility, risk free interest rate and dividends are all factors that influence the pricing of an option and must be considered in the calculation thereof.

Agricultural co-operatives can enter into option contracts to hedge against financial risks such as interest rate risk, currency risk, price risk and yield risk.

3   *Swaps.* These can be used by two parties to exchange recurring payments. The most popular swap is the plain vanilla interest rate swap. Other swaps that are available in the market include currency swaps and commodity swaps. The interest rate swaps use the JIBAR as a benchmark rate in calculating the floating interest rate in the transaction. Swaps are normally facilitated by the banking sector and do not trade on a formal exchange (JSE) like futures and option contracts.

Swaps are mostly used to hedge existing assets or liabilities; to adjust existing cash flows to a desired structure; to access markets that are not always accessible; and to capture value in the market. Swaps have limitations in the cost of time and resources to find suitable swap participants and to negotiate the terms and conditions. There is also the risk that the counter party will default on the swap transaction.

4   *FRAs.* These constitute agreements between borrowers and lenders where interest rates are locked in for a certain period of time in the future. This is a very popular way of hedging short-term interest rates in South Africa. FRAs trade between three months and two years and are very liquid instruments in the South African market. The borrower makes a profit when the interest rates increase, and the lender when interest rates decrease. Therefore, agricultural co-operatives enter into FRAs to hedge against increasing interest rates.

A non-probability sampling design was used for this research because of the unavailability of a comprehensive database about South African agricultural co-operatives, their size and activities. The sample of agricultural co-operatives was chosen

from a previous study by Liebenberg (2004:53-83) and information from the ABC on transformed agricultural co-operatives was obtained and used to add the transformed co-operatives to the list. A total of 66 agricultural co-operatives were included in different fields and geographical areas. Questionnaires were sent out to them all. Only 44 completed questionnaires were received. Telephonic enquiries after the non-completion of questionnaires revealed that six co-operatives were busy with year-end activities and the questionnaire, furthermore one had been sold and was now privately owned and one no longer existed. The other 14 provided no reason for non-completion of the questionnaire.

Due to the geographic dispersion of South African agricultural co-operatives, a structured questionnaire was chosen as the most appropriate method to determine whether agricultural co-operatives make use of derivative instruments to hedge against financial risks. The questionnaire included open-ended as well as fixed-alternative questions, with the first giving them the freedom to answer in their own words and the latter to choose those alternatives that applied to them.

From the findings of the research it is evident that although all the derivative instruments are available in the South African market not all agricultural co-operatives make use of these instruments to hedge against financial risks. The following findings were made:

5   Only three of the 38 co-operatives that are exposed to interest rate risk through borrowing money from the Land Bank or other financial institutions hedge against interest rate risk;

6   Only three co-operatives hedge against credit risk that they are exposed to through lending money to members/shareholders, although 24 indulge in this activity;

7   Thirteen of the 15 importers and 21 of the 25 exporters hedge against currency risk;

8   Only eight co-operatives of the 23 that indicated that they are exposed to price risk hedge against this risk; and

9   Ten of the twenty-one co-operatives that enter into forward agreements for the

supply of commodities hedge against yield risk.

The research shows that most of the co-operatives make use of forward contracts to hedge against different financial risk types. FRAs and weather derivatives are not used by any of the co-operatives included in the study. Insurance is used to hedge against counter-party credit risk. More than half the respondents use futures contracts. Swaps and options are not often used. Only four co-operatives make use of swap transactions and seven make use of option contracts to hedge against different financial risks.

5.3   Conclusions

Although most of the co-operatives are exposed to financial risks through the different activities they perform, only a few make use of derivative instruments to hedge against these risks. Some reasons for not using derivative instruments may be a lack of knowledge in the field of risk management and derivatives, a shortage of information on the different risk types, or insufficient planning to reduce financial risks.

Of all the derivative instruments included in the research, it is evident that forward contracts are used most often. A reason for their popularity may be the fact that these instruments are traded on the OTC market; they are customised contracts, less complex and very liquid.

Interest rates in South Africa are currently on a downwards trend, which can be considered a reason for none of the co-operatives making use of FRAs as hedging instruments. Weather derivatives, on the other hand, are fairly new products on the South African market and not known to most participants, and are therefore not used.

The fact that only four co-operatives make use of swap transactions and only seven of option contracts may be due to a lack of knowledge and understanding of these instruments and also because of the time and resources associated with swap transactions.

After considering all the information obtained from the research, the following initiatives

could assist in increasing the use of derivatives by South African agricultural co-operatives:

1 Training and education of key staff of agricultural co-operatives on the derivative market in South Africa to increase their knowledge of the mechanics of this market.
2 Using other companies or individuals that are in possession of the necessary skills and experience to provide alternative solutions to co-operatives that want to enter into these contracts.
3 Improving the risk management functions in co-operatives.

5.4 Limitations of the research

Certain omissions in the questionnaire that restrain the conclusions regarding the actual reasons for not applying derivative instruments to hedge against financial risks include the following:

1 No questions were included in the questionnaire on the gender, age, educational level and the number of years that the person making the hedging decisions had been involved in the agricultural co-operative;
2 No questions were included on why the co-operative preferred certain derivative instruments above others;
3 No questions were included about how co-operatives perceive the practical applicability of derivative instruments; and
4 No questions were included to determine co-operatives' knowledge of the different derivative instruments.

5.5 Recommendations for further research

Although the research provides statistically sound information on the use of derivatives by agricultural co-operatives, further areas of research that could be conducted to

elaborate on these findings include the following:

1. Determining the knowledge and experience of different levels of managers and directors in the agricultural co-operatives with regard to risk management and derivative instruments.

2. Determining the factors that most influence agricultural co-operatives to participate in the derivative market.

3. Developing a relevant risk management framework for agricultural co-operatives in South Africa.

4. Determining the economic factors that influence the use of derivative instruments by South African agricultural co-operatives.

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