

**AN ECONOMIC EVALUATION OF FACTORS
AFFECTING THE ADOPTION OF AN
INCOME EQUALISATION DEPOSIT (IED) SCHEME
FOR COMMERCIAL FARMERS IN SOUTH AFRICA**

BY

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ABSTRACT

Recent research suggests that an Income Equalisation Deposit (IED) scheme could be a feasible new risk management tool for commercial farmers in South Africa. This prompted a study of practicing consultants' (tax experts) views on the viability of an IED scheme, how it would relate to existing tax provisions for farmers, and what types of farmers would be likely to use the scheme. Twenty-four consultants based mainly in KwaZulu-Natal, and in the Maize Triangle and surrounding areas (North-West Province, North-Eastern Free State and Mpumalanga), were surveyed in 2000 using mail documents comprising of a questionnaire and a scenario section. Each consultant was asked to answer eight questions that were compiled to obtain information on whether practicing tax consultants think an IED scheme would be viable for commercial farmers in South Africa, whether they would recommend it to their clients, and their perceptions of how it would fit with existing tax provisions for farmers and, the tax deferral effects of such a scheme

Consultants were then asked to review nine scenarios of typical farms in the study regions and to decide whether they would recommend an IED scheme for each scenario. A statistical experimental design was used to structure the scenarios, allowing for main and interaction effects between variables that could influence the potential use of an IED scheme by commercial farmers in South Africa. These farms were depicted using four variables that showed different levels of farm business leverage (debt/asset ratio), net farm income, business risk (index of net farm income variability), and off-farm income, based on representative farm record data supplied by the National Department of Agriculture. Discriminant analysis (n=192) was used to estimate which of the four variables best distinguished between scenario farms that the consultants would and would not consider as likely users of an IED scheme.

Consultants perceived that the scheme could be feasible, help farmers to avoid over-capitalising during years of good cash flow, and provide liquidity in “lean” times. Most of them would support recommendations that the Land Bank drought relief scheme for livestock farmers be replaced with an IED scheme that all farmers could access. They also felt that the capital expenditure and accumulated depreciation allowance provisions available to farmers should remain in place. In the consultants’ view, farmers with higher annual net farm incomes (>R300 000), lower debt/asset ratios (<15%), more variable net farm incomes, and less off-farm income would more likely use an IED scheme. In terms of ranking, *ceteris paribus*, high risk maize farmers, intermediate risk maize farmers and high risk livestock farmers are more likely to use an IED than are low risk maize farmers, low and intermediate risk livestock farmers, and diversified farmers. Since maize farmers have been the main beneficiaries of past government drought aid, this could mean reduced demands on government drought relief funds in future if an IED scheme is introduced.

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INTRODUCTION

Farmers operate and make decisions in an uncertain environment characterised by business and financial risk (Gabriel and Baker, 1980). More variable product prices following agricultural marketing deregulation, drought, and more variable nominal interest rates, are recent examples of such risks in South Africa. These risks lead to income variability, especially in the grain sectors where widespread droughts are common. Past South African government response to drought mainly involved providing drought relief, culminating in R3.8 billion worth of assistance - mostly to maize farmers - in 1992/93 (Willemse, 1992 p15). Since 1994, the South African government has changed this policy and has encouraged farmers to manage risks themselves, in order to reduce demands on government funds. One option currently being proposed to the National Department of Agriculture (NDA, 1997) is an Income Equalisation Deposit (IED) scheme. An IED could provide a reserve fund in which farmers invest part of their income during “good”¹ years, and then are taxed on this income only when they withdraw the money for use in “bad”² years. In this way, the IED would operate as a risk management tool to help stabilise farm incomes.

In a progressive income tax structure, taxpayers with fluctuating incomes are more likely to have a greater tax liability than taxpayers with relatively stable incomes. Thus, taxpayers with comparable incomes over a time period may not be treated similarly and tax equity may not be achieved. Because of this, South African farmers can elect to be taxed at a rate that is based on a moving average income. However, this tax instrument does not promote better cash flow and better risk

¹ A “good” year is defined as a high annual net income year before tax set-offs.

² A “bad” year is defined as a low annual net income year before tax set-offs.

management as the farmer is not provided with additional incentives to save in good years and to be better prepared for the “lean” years. The drought relief provision (paragraph 13A of the First Schedule of the Income Tax Act) provides some drought relief to livestock farmers, but no scheme is available to crop farmers who are more vulnerable to droughts.

The establishment of an IED scheme is not a new issue in South Africa since it was first considered in 1951, put forward again in 1960, and later proposed in 1979 and 1987 (RSA, 1951; 1979 and 1987). The scheme was seen as a means of stabilising farm incomes, acting as a risk management tool. The recommendation was rejected in all cases. The government and all commissions involved were not convinced of the feasibility of the proposed scheme stating it was open to serious objections. Criticisms included (1) it leads to tax deferral, (2) the current income averaging scheme also allows farmers to provide for poor years via tax savings in good years, and (3) the scheme may be misused in conjunction with the current income averaging scheme that has an in-out option, to destabilise income and reduce tax (Lamont, 1990 p410).

More recently, the use of an IED scheme as a tax instrument to promote improved cash flow and risk management has been considered by many, focusing primarily on the tax implications (Lamont, 1990; NDA, 1997 and Fuchs, 1999). Nieuwoudt and Howell (2000), however, perceived that the economic feasibility of such a scheme had not been fully researched and the economic environment had changed considerably over the years making the scheme more attractive. Most crop insurance schemes had collapsed, deregulation had led to an increase in uncertainty and real interest rates became positive creating more of an incentive to save. In light of these events, the economic feasibility of introducing an IED scheme in South Africa was evaluated by Nieuwoudt and Howell (2000). They suggested that the proposed scheme could be feasible in the South African situation,

promoting better cash flow and risk management over time. This study reports on a postal survey which was conducted amongst 24 South African tax consultants (experts) in 2000. It complements Nieuwoudt and Howell's study by researching whether practicing tax consultants consider an IED scheme to be viable for commercial farmers in South Africa. It reports on whether they would recommend it to their clients, their perceptions of how it would fit with existing tax provisions for farmers, the tax deferral effects, and what types of farmers are likely to use an IED. Discriminant analysis was conducted to identify and rank factors that distinguish between potential adopters and non-adopters of an IED scheme. The responses could assist consultants and farmers in the management of their operations toward becoming self-sufficient by being more liquid and better prepared to handle risk.

Chapter one reviews literature on IED scheme proposals in South Africa, providing a brief history with emphasis on the criticisms of the scheme in the past and current evaluations of these criticisms. Chapter two presents current tax provisions available to commercial farmers in South Africa, providing a brief discussion on each provision. Chapter three describes the research methodology used in the study, and Chapter four presents the survey results from the questionnaire and discriminant analysis. Chapter five concludes with a discussion on the policy implications of the results, with future research options considered.

CHAPTER 1

BACKGROUND HISTORY OF IED PROPOSALS FOR SOUTH AFRICA

This chapter provides an overview of past IED scheme proposals in South Africa. In addition, a brief overview of the current Australian scheme is presented and briefly discussed. The Australian scheme is discussed as it operates in a similar way to the proposed IED scheme in South Africa.

1.1 Past reviews of IED schemes in South Africa

The establishment of an IED scheme in South Africa was initially considered by the Steyn Committee in 1951 (RSA, 1951). The Committee recommended against its introduction as other forms of the industry were also subjected to income variations. In 1960, the De Swart Study Group on Agricultural Credit recommended IED's as a means to counter excessive capital expenditure and consequent financial difficulties of farmers. The principle was not accepted. In 1979, the Jacobs Committee supported IED schemes in principle, but did not consider themselves to have the expertise to evaluate the practical implications of the proposal (RSA, 1979). The proposal was referred to the Standing Commission of Taxation and the Commission for Inland Revenue who found the IED scheme was open to serious objections. The government (RSA, 1982) accepted the recommendations of the Standing Commission that the scheme be rejected. Finally, the Margo Commission recommended against the use of IED's in 1987 (RSA, 1987), commenting that an IED scheme, whether as a complement to or a replacement of the current averaging scheme, should not be implemented.

The main advantages of IED schemes mentioned in the past were (Lamont, 1990 p407; RSA, 1987):

- (a) Stability. The implementation of IED's would result in greater stability in the agricultural sector, which due to the nature of its production circumstances is subject to income and production variations from year to year.

- (b) Voluntary. IED's will enable farmers to overcome crises and setbacks on their own, which improve the extent of independence and the image of agriculture in general.

- (c) Welfare. The greater degree of stability which the system will effect together with the fact that farmers will be able to help themselves to a larger extent during adverse times, will reduce the extent of assistance rendered to agriculture by the government.

- (d) Efficiency. Income fluctuations and the bunching of investment expenditure will be smoothed, allowing for more efficient resource allocation.

- (e) Administration. If funds are deposited at a bank, the scheme will be easy to administer. If funds are deposited at the Land and Agricultural Bank of South Africa, "IED certificates" could be issued when deposits are made and supply the Department of Inland Revenue with duplicates for record-keeping purposes.

Major criticisms of IED schemes in the past are presented below, with recommendations provided by Nieuwoudt and Howell (2000):

- (a) An IED scheme will favour the rich (Hattingh, 1986) and indications are that a small percentage of farmers would be able to use an IED scheme (RSA, 1987).

Current deposits in the drought relief scheme for livestock sales (paragraph 13A) are estimated at just over R200 million and the number of investors has increased three-fold since the Margo Commission enquiry. This indicates that deposits will not be insignificant if an IED scheme is adopted and caters for both crops and livestock.

- (b) The scheme impinges on the sound principle that revenue should be taxed in the year in which it accrues (RSA, 1987).

Farmers cannot benefit from deferred taxes while the funds are deposited as they cannot access these funds. Tax deferral can also be limited by specifying a time limit on holding deposits. This principle has already been ignored under the drought relief measure provided by the Land Bank.

- (c) There are many other sectors of the economy which suffer vagaries of fluctuating markets, sales and income. To make an exception for farming would be indefensible if others were refused (Lamont, 1990 p409).

Agricultural risk has different components which distinguish it from risk in other sectors. The first component is the risk arising from adverse weather which affects vast areas simultaneously. This is common in South African agriculture. The second component is the severity of the risk when compared to North America and Europe where a 30% decline in corn production is seen as a disaster. A decline of more than 60% in maize production is not uncommon in South Africa. Lastly, the farmer has little control over his environment and often has little scope to diversify. This is especially true in the cropping areas of South Africa. Other sectors may experience risk, but more opportunities are available to spread business risks.

- (d) Current averaging schemes lend themselves well to enable farmers in good years to make provision for poorer years by means of a tax saving (Lamont, 1990 p409).

These concessions, [paragraph 15 (3) (plantation farming) and paragraph 19 (2) (average taxable income)of the First Schedule of the Income Tax Act. No 58 of 1962 (Huxham and Haupt, 2000)], provide the farmer with some tax relief and removes some of the incentives to overcapitalise in “good” years. However, these concessions provide no incentive to the farmer to make provision for “bad” years.

- (e) An excessively high tax burden could result on the death of a taxpayer (RSA, 1987). Since it is only logical that a person cannot continue to be a taxpayer after his death, the Income Tax Act requires that a deceased person shall be taxed on all income received by or accruing to him up to and including the date of his death. The total amount to his credit on that date

in the proposed reserve fund and not yet taxed, would therefore have to be taxed at that stage and, if it was a large amount, an excessively high tax burden could result.

This tax burden has also been ignored as livestock farmers are given the same concession under the drought relief measure provided by the Land Bank.

- (f) The scheme offers considerable scope for tax sheltering and can be misused. There is nothing preventing a farmer depositing non-farm income into IED's and withdrawing it as part of farm income (RSA, 1987 and Lamont, 1990 p410).

If a rule is applied that no funds may be deposited in an IED scheme if current taxable income is below the moving average taxable income, misuse of the scheme for tax sheltering purposes could be avoided.

Nieuwoudt and Howell (2000) emphasized two determining factors pertaining to the feasibility of introducing an IED scheme in South Africa. One factor, briefly discussed in the criticisms, relates to the misuse of an IED scheme and the second factor relates to the implementation of an IED scheme.

If farmers have access to both an in-out tax provision and an IED scheme, they may use the scheme to deliberately destabilise income to obtain tax advantages. The problem arises when funds are deposited in low income years to bring down the tax rate even further. This practice could be avoided by enforcing a rule that funds cannot be deposited in an IED scheme in the current year if

actual taxable income in that year is below the moving average taxable income. This rule would require no additional information for tax purposes as the current income averaging concession uses information on both average and current taxable income (Nieuwoudt and Howell, 2000).

It may be possible to replace the livestock drought relief scheme (paragraph 13A) with an IED scheme and have one scheme that caters for both livestock and crop farmers. This implies that deposits can be made only if current taxable income is above the moving average taxable income. This will still allow livestock farmers to make deposits into this fund during drought conditions as incomes will be above the moving average (Nieuwoudt and Howell, 2000).

1.2 Present (2000) IED provisions in Australia

The Australian Government introduced IED's in 1976 with the aim of encouraging farmers to stabilise their incomes. They were intended to provide farmers with a "self-help" means of handling income instability. Besides the small usage, a number of developments reduced the attractiveness of IED's which resulted in the introduction of a new scheme in 1983. The new scheme was intended to provide an incentive for farmers to set aside in good years money for use in bad years. The introduction of the in-out option and the lifting of the deposit limit had a number of consequences which contributed to the repeal of the IED scheme. Reasons for the repeal will be discussed.

- (a) The interaction of the averaging scheme and the IED scheme produced anomalous results whereby a tax benefit could be gained by farmers deliberately destabilising their taxable income by lodging deposits in low income years and withdraw them in high income years (RSA, 1987; Lamont, 1990 p369).

- (b) Since monies deposited in the IED scheme could be derived from any source (other than investment income), methods existed that enabled some weaknesses in the averaging scheme to be exploited.

The present IED scheme in Australia is called a Farm Management Deposit Scheme (FMD). FMD's have the same purpose as IED schemes, namely to encourage farmers to save money in "good" years for use in "bad" years. FMD's provide an important risk management tool to help farmers deal with uneven income streams common in Australian agriculture due to climate and market risks. Deposits into an FMD are not regarded as taxable income in the year of deposit, but are taxable when money is withdrawn. FMD's provide a tax linked savings tool for farmers which can complement other risk management strategies such as forward selling and futures contracts. Deposits can be made at a financial institution that meets the government's prudential requirements and interest is paid at the commercial rate offered by the institution. On withdrawal, a tax is deducted at marginal rates. It is expected that the scheme will result in an increase in savings levels by farmers, at the same time reducing the tendency to financially over-gear farming operations. It is also expected that farmers holding deposits in FMD's will be regarded as having better risk profiles, which could have a beneficial impact on borrowing costs. Significant tax savings from the use of FMD's may be comparatively rare (Neilson, 1999 p3-4).

CHAPTER 2

TAX PROVISIONS IN SOUTH AFRICAN AGRICULTURE

Currently, there are a number of special tax provisions available to commercial farmers in South Africa. These provisions were designed to reduce the impact of disasters on farm income, assist with abnormal receipts of farm income, assist in the purchasing of capital items, and reduce the tax liability of livestock on hand. These provisions are presented and discussed in this chapter.

2.1 Anti-bunching measures

The anti-bunching provisions in the First Schedule of the Act, the thrust of which is to ignore abnormal receipts in the calculation of the rate of tax, are as follows (Huxham and Haupt, 2000):

- (i) paragraphs 13 and 13A (forced and drought relief provisions)
- (ii) paragraph 15(3) (plantations)
- (iii) paragraph 17 (sugar cane)
- (iv) paragraph 20 (profit in consequence of acquisition of land by the State and other bodies)

2.1.1 Forced sales of livestock (paragraph 13)

Paragraph 13 provides relief for a farmer who has been forced to sell livestock due to drought, disease, plague or fire. If livestock is replaced within four years after the end of the year of

assessment in which the livestock was sold, the farmer has the option of deducting the cost of the replacement stock from his income in the year of assessment in which the forced sale took place or deducting it from the income in the year in which the replacement livestock is purchased. The claim for a deduction must be made within five years after the close of the year of assessment during which the livestock was sold. (Huxham and Haupt, 2000).

If the farmer purchases livestock to replace stock which was sold in terms of a government livestock reduction scheme, the same provisions apply, except that the farmer has nine years to replace the stock. The farmer may not elect to use this paragraph if he is taxed in terms of paragraph 19 (rating formula for farmers) in the year that the livestock is sold. In this case, the claim for a deduction must be made within ten years (Huxham and Haupt, 2000).

2.1.2 Drought relief provision (paragraph 13A)

If a farmer receives proceeds from the sale of his livestock because of drought and has deposited the proceeds or a portion of the proceeds with the Land Bank within three months of receiving the proceeds, the proceeds so deposited, will not be included in his gross income. If at any time within six months after the end of the year of the sale, the farmer withdraws the money from the Land Bank, he will be taxed as if the concession in this paragraph did not apply. If he withdraws the money after the end of the six month period (above), but before six years have passed from the end of the (tax) year of sale, he will be taxed on the withdrawal. If he leaves the money on deposit for six years or more, it will be deemed to be his gross income on the last day of the six year period and if he dies or goes insolvent within the six year period, the money still on deposit will be deemed to be his gross income on the day before his death or insolvency (Huxham and Haupt, 2000).

2.1.3 Plantation farming (paragraph 15(3))

If a farmer (other than a close corporation or company) derives taxable income from disposal of plantations of forest produce, and this income exceeds the annual average taxable income from plantations for the preceding three years, then according to paragraph 15(3), the excess (actual minus annual average) is subject to tax in terms of the rating formula in section 5(10) of the Act. The farmer is thus taxed on his actual income at a rate derived from his average income. The section 5(10) formula (taken from Huxham and Haupt, 2000 p194) is as follows:

$$Y = \left(\frac{A}{B + D - (C + L)} \times (B - L) \right) + (L \times R)$$

- Y = Normal tax to be determined before rebates are deducted, and before transition levy (if applicable) is added.
- A = Normal tax (before the deduction of any rebate and before the addition (if applicable) of any transition levy) calculated for taxable income of “B + D - © + L”.
- B = Taxable income for the year.
- C = Excess plantation taxable income (actual less previous three years’ average).
- L = Lump sums from retirement accrued on or after 1 September 1995.
- D = RAF contributions based on L and C.
- R = Relevant rate of taxation.

2.1.4 Sugar cane destroyed by fire (paragraph 17)

Paragraph 17 of the Act, as adapted from Lamont (1990 p398) and Huxham and Haupt (2000), provides that where sugar cane has been sold by a farmer, other than a company, because the sugar cane fields have been damaged by fire, taxable income from such sale shall be taxed in accordance with the rating provisions in section 5(10). In this instance “C” in the formula in section 5(10) is equal to so much of the taxable income derived from the disposal of sugar cane as a result of fire in the cane fields, which but for such fire would not have been derived by the farmer in that year. If the farmer is taxed on his annual average income per paragraph 19 in that year, paragraph 17 will not apply. A farmer who is not taxed under the general rating formula (paragraph 19) may rate both his sugar cane income (paragraph 17) and his plantation income (paragraph 15(3)).

2.1.5 Sale of land to the State and other bodies (paragraph 20)

Paragraph 20 provides that if a farmer’s land is acquired or expropriated by the State or any other specified body and as a result discontinues his farming operations, he may apply to be subjected to tax on a special basis on the abnormal profits he derives in the year of the acquisition/expropriation of his farm or in two tax years succeeding the year of acquisition. If the farmer qualifies, his excess farming profit is taxed at a rate of nine percent (12 percent if unmarried). The excess farming profit may consist of excess livestock profit or excess plantation profit. The excess livestock profit is an amount by which current livestock profit exceeds average livestock profit for a period not exceeding five years. Excess plantation farming profit represents abnormal plantation profit, but is limited to the difference between the total taxable income from plantation farming and the average taxable income from plantation farming for the three years prior to the current year (Huxham and Haupt, 2000).

2.1.6 Discussion of anti-bunching measures

According to Fuchs (1999) paragraph 13 (forced sales of livestock) can be seen as a positive incentive for farmers to take actions to reduce the impact of the drought because as soon as the farmer has purchased livestock to replace the livestock sold before the drought, the assessment is revised and a refund is made. This refund could assist the farmer to finance restocking. The ultimate benefit to the farmer is however uncertain. If rates of tax are lower in the year when restocking takes place than in the year in which the bulk sales took place a saving in tax may result if the farmer decides to make an election in terms of paragraph 13 of the Act. On the other hand, if rates of tax have increased, the farmer may be worse off if he makes the election.

The impact which the forced sale of livestock (due to drought) and the restocking to replace those livestock has on taxable income is being eliminated to a large extent. The farmer should therefore be in a similar position to which he would have been had it never been necessary to sell and restock livestock due to droughts. There is, however, a timing effect. The farmer needs to establish well in advance as to which year the provision will be made applicable, the year of livestock sales or the year of restocking. The farmer must take note that an application must be submitted to effect the tax revision in the applicable year of his choice. Cash flow problems might arise if the farmer replaces stock before his tax has been revised and a refund is made (Fuchs, 1999).

According to Fuchs (1999), paragraph 13A (drought relief provision) could be seen as a positive incentive for farmers to take actions to reduce the impact of drought because the provision of the Act allows farmers to deposit proceeds of the sale of livestock due to drought in an account in his name

with the South African Land Bank. To the extent that proceeds are deposited with the South African Land Bank, they are deemed not to be gross income derived by the farmer for that year. The provisions mentioned, effectively prevent a farmer from postponing the taxation of the proceeds of the disposal of livestock disposed of on account of drought for a year simply by placing those proceeds on deposit with the Land Bank for a short period ending less than 6 months after the end of the year of assessment in which those proceeds were derived. It was, however, noted that no such provisions are available for crop farmers who are more severely impacted by droughts (Fuchs, 1999; NDA, 1997). According to NDA (2000), dry land crop farmers are more vulnerable to the effects of seasonal and disastrous droughts than livestock farmers.

It is in the writer's opinion that paragraphs 15(3) (plantation farming), 17 (sugar cane destroyed by fire) and 20 (sale of land to the State and other bodies) do go some way to assist farmers with abnormal receipts of taxable income, but provide no incentive to farmers to become more liquid and better prepared to handle risk.

2.2 Average taxable income (paragraph 19(2))

The farmer's average taxable income from farming is calculated as follows (adapted from Huxham and Haupt, 2000). The aggregate of the current year's taxable income from farming, plus the previous four-year's taxable income from farming, is divided by five to arrive at an average. If the farmer has farmed for less than four years prior to the current year, the average is taken over as many years as he has farmed. According to the rating formula in section 5(10), the farmer pays tax on his actual (current) income at a rate based on his average income. In this instance "C" in the formula in section 5(10) is the amount by which the farmer's taxable income from farming for the year

exceeds his average taxable income from farming. If actual farming income is lower than the average farming income, tax will be paid on actual income. In the latter case, the tax rate is based on actual income and not on average income. Paragraph 13 (forced sales of livestock), paragraph 15(3) (plantation farming) and paragraph 17 (sugar cane destroyed by fire) may be used if actual income is lower than the average income, if applicable. If the farmer has a loss from farming in the current year, the provisions of paragraph 19 (rating formula for farmers) obviously cannot apply.

2.2.1 Discussion of average taxable income

According to the Margo Commission (RSA, 1987) the averaging provision had several advantages: it is well understood by taxpayers and administered with relative ease, it is well integrated with other features of the law, and it confers substantial benefits upon farmers in that they can never pay more tax than other taxpayers with the same taxable income and often pay less. Assistance via averaging, however, is seen as creating inequity as only those with fluctuating incomes benefit.

The current South African averaging provision includes an in-out option that automatically releases a farmer from the provision when farm income is below the average income. Averaging, therefore, applies only when taxable income is greater than average income. This option was introduced to alleviate the problem of taxpayers being subject to burdensome tax liabilities in years when they have little or no income. The in-out option means that farmers are favoured by the taxation system in the sense that the tax rate is reduced below that of the tax rate of the moving average income (RSA, 1987). According to Nieuwoudt and Howell (2000), the averaging provision as a risk management strategy provides the farmer with some tax relief in a bad year as his tax rate is calculated on his actual income in that year, and not on his higher moving average income.

2.3 Capital expenditure

The deduction of capital expenditure is permitted in the determination of taxable income. However, according to the South African Revenue Services (SARS, 2000), the Act provides that the deduction in this respect in any year shall not exceed the farmer's taxable income from farming operations in respect of that year, and the amount by which such expenditure exceeds such income in that year shall be carried forward and be deducted in succeeding years, subject to the same limitation. A farmers' capital expenditure is deducted either in full (subject to certain limits) under the provisions of paragraph 12 of the First Schedule (capital development expenditure), or as a special depreciation allowance under section 12B.

2.3.1 Capital development expenditure (paragraph 12(1))

The following expenditure is allowed as a deduction in determining the taxable income of a farmer (adapted from Huxham and Haupt, 2000), ie. expenditure incurred during the year of assessment in respect of:

- (a) eradication of noxious plants;
- (b) prevention of soil erosion;
- (c) dipping tanks
- (d) dams, irrigation schemes, boreholes and pumping plants;
- (e) fences;
- (f) erection of, or extensions, additions or improvements (not repairs) to, buildings used in connection with farming operations other than those used for domestic purposes of persons who are not employees of such farmer;

- (g) planting of trees, shrubs, perennial plants for the production of grapes or other fruit, nuts, tea, coffee, hops, sugar, vegetable oils or fibres, and the establishment of any area used for the planting of such trees, shrubs or plants;
- (h) building of roads and bridges used in connection with farming operations;
- (i) carrying of electric power from the main transmission lines to the farm apparatus.

Amounts under (a) and (b) are deductible in full in the year of assessment while limitations are placed on the amount allowed for on other items.

2.3.2 Machinery, implements, utensils and articles - special depreciation allowance (section 12B)

Any machinery, implements, utensils or articles (other than livestock), acquired by a farmer and brought into use by him for the first time on or after 1 July 1998, are subject to a depreciation allowance on the *cash cost* of the asset. The allowance is claimable on new as well as used assets. The asset must be used by the farmer in the carrying on of his farming operations in order for the allowance to be granted. The allowances (as taken from Huxham and Haupt, 2000) are as follows:

- First year of use: 50% of such cost
- Second year: 30% of such cost
- Third year: 20% of such cost

2.3.3 Discussion of capital expenditure provisions

Prior to the implementation of section 12B, the Margo Commission (RSA, 1987) received numerous submissions on farming taxation during its investigation, of which many argued that the concession of paragraph 12(1); (a) encouraged the bunching of farm investment expenditures, particularly in high income years as many farmers make management and investment decisions purely on tax considerations; detrimentally affected rural towns and supply industries, this view was supported by Nieuwoudt and Howell (2000); (b) encouraged a propensity to spend rather than to save, which more often than not results in overcapitalisation and an exacerbation of cash flow problems; and (c) effectively benefitted only larger-scale farmers. The latter view was supported by Hattingh (1986 p21). A few submissions, however, argued that this capital expenditure provision should remain in place to encourage productivity and farmers in a start-up situation.

On evaluation of the submissions, the Margo Commission (RSA, 1987) believed that the criticisms applied particularly to the acquisition of plant and machinery, which assets represent approximately two thirds of agricultural investments (excluding farm land). The commission consequently introduced section 12B with the hope of generating a more neutral tax system and to ensure that investment decisions in agriculture were determined by real profitability. Nieuwoudt and Howell (2000) reported that the section 12B provision allowed farmers to bring down their income tax in good years by purchasing capital items; the farmers' disposable income is higher with these high depreciation rates; and in the absence of these high depreciation rates, the farmer may have postponed the purchase of capital items. It was also noted that since the farmer can elect to be taxed on an average income, the tax rate will not be higher in a good year and most of the tax advantages

from over-capitalisation in good years may thus disappear as the farmer does not face high marginal tax rates in such a year.

Nieuwoudt and Howell (2000) estimated the impact of farm income variations on the purchase of durable capital assets (farm tractors and machinery) using data from 1976 to 1999. It was shown that the real purchases of tractors and machinery were negatively related to real prices of the item and positively related to gross income of crops and horticultural products. Better liquidity management and potential tax advantages were postulated as possible reasons for an increase in input purchases in good years.

2.4 Stock values

There are a number of paragraphs that apply to a farmer when accounting for stock (livestock and produce) for income tax purposes. The tax concession comes by way of using standard values (paragraph 5) in reporting closing stock instead of using market related values.

2.4.1 Valuation of closing stock in respect of livestock (paragraph 5)

According to Huxham and Haupt (2000), a farmer must include the opening and closing stock of livestock in his income tax return. All animals used by a farmer in his farming operations are included in livestock and all closing stock of livestock is valued at standard values. Standard values are much lower than market values, and are fixed by regulation in terms of the Act. The standard values of livestock are provided in Table 2.1.

Table 2.1: Standard values of livestock as permitted by the SARS, 2000

Livestock type	Amount	Livestock type	Amount
Cattle		Horses	
- Bull	R50	- Stallions, over 4 years	R40
- Ox	R40	- Mares, over 4 years	R30
- Cow	R40	- Geldings, over 3 years	R30
Tollies and Heifers		- Colts and fillies, 3 years	R10
- 1 to 2 years	R14	- Colts and fillies, 2 years	R8
- 2 to 3 years	R30	- Colts and fillies, 1 year	R6
- Calves	R4	- Foals, under 1 year	R2
Sheep		Donkeys	
- Wethers	R6	- Jacks, over 3 years	R4
- Rams	R6	- Jacks, under 3 years	R2
- Ewes	R6	- Jennies, over 3 years	R4
- Weaned lambs	R2	- Jennies, under 3 years	R2
Goats		Mules	
- Weaned kids	R2	- 4 years and older	R30
- Fully grown	R4	- 3 years	R20
Pigs		- 2 years	R14
- Under 6 months (weaned)	R6	- 1 year	R6
- Over 6 months	R12	Ostriches, fully grown	R6
Poultry, over 9 months	R1	Chinchillas, all ages	R1

Source: Adapted from Huxham and Haupt (2000)

2.4.2 Discussion of standard values for livestock

According to Lamont (1990 p301), standard values were generally introduced as a means to simplify income measurement and to avoid the impracticability of other bases of valuation, particularly cost. The Steyn Committee (RSA 1951 p71) reported on the harmful effects of the standard values for livestock. Stock which would otherwise find its way on to the market would be withheld causing stock prices to become inflated, to the detriment of the consumer, land becomes overstocked, land prices are forced up due to farmers purchasing additional land to accommodate livestock purchased

with this object in view and, the farmer himself in the long run gets into still greater taxation difficulties from which he is unable to extricate himself. Russell (1987 p7) reported that standard values has led to the distortion of investment patterns, and the Ross Committee (NZ, 1967 p300) reported that standard values create a “lock-in” factor which discourages existing farmers to convert their livestock to cash.

Following the presentation and discussion of tax provisions available to commercial farmers in this chapter, it is apparent that these provisions do go some way in assisting farmers in their farming operations. These provisions can help reduce the impact of disasters on farm income, assist with abnormal receipts of farm income, assist in the purchasing of capital items which are relatively costly, and reduce the tax liability of livestock on hand. It must, however, be noted that these provisions do not provide an incentive for farmers to become more liquid and better prepared to handle risk. According to Nieuwoudt and Howell (2000), the improvement of agricultural cash flow through a risk management strategy, such as an IED scheme, could benefit the rural sector and its support activities by means of income stabilisation. The next chapter deals with the research methodology followed in the study.

CHAPTER 3

RESEARCH METHODOLOGY

Following the review on tax provisions in South Africa, this chapter describes the survey conducted amongst South African consultant firms. The objectives of the study were two-fold. The first objective was to determine whether there is a need for an IED scheme and, if there is a need, how the scheme should be implemented with regards to certain tax provisions available to commercial farmers. The second objective was to determine what types of farmers are most likely to use an IED. To achieve these objectives, a postal survey was conducted where documents consisting of a questionnaire section and a scenario section were sent to consultants (tax experts). A pilot survey was conducted with two consultants from different accounting firms to confirm the clarity and realism of the questions and the scenarios before the survey was posted to participating consultants. Consultants were approached as they deal directly with farmers, and farmers will most likely rely on their advice. Discriminant analysis was conducted on data collected to determine which explanatory variables best differentiate between potential adopters and non-adopters of an IED scheme.

3.1 Data collection

Fifty-two consultants based mainly in KwaZulu-Natal (KZN), and in the Maize Triangle and surrounding areas (North-West Province, North-Eastern Free State and Mpumalanga), were surveyed. These areas were selected to obtain the views of consultants that dealt with tax matters

for a range of farm situations, from relatively low risk livestock and diversified farmers in KZN (less variable net farm incomes), to relatively high risk maize farmers (more variable net farm incomes) in the Maize Triangle and adjacent regions. Owing to the design of the statistical model used to construct the scenarios, a response rate of 46% (24 consultants) was desired. Of the 52 consultants contacted, only 14 responded, a rate of 27%. Non-responsive consultants were sent a second set of documents including an incentive. Consequently, with only four additional replies received, appointments were made with six consultants in order to obtain the desired total of 24 responses.

The respondents were divided into the following strata:

Table 3.1: Strata of consultants (tax experts) who reported on the potential viability of an IED scheme, 2000 (n=24)

	Consulting Firms	Accounting Firms	University Lecturer	Total
Maize Triangle	5	4	-	9
KZN	5	4	-	9
Bloemfontein	2	1	-	3
Ficksburg	2	-	-	2
Cape Town	-	-	1	1
Total	14	9	1	24

3.2 Questionnaire section

The questionnaire section (see Appendix A, pg77, for original questionnaire) was compiled to obtain information on whether practicing tax consultants consider an IED scheme to be viable for commercial farmers in South Africa, whether they would recommend it to their clients, and their

perceptions of how it would fit with existing tax provisions for farmers and, the tax deferral effects of such a scheme. Each consultant was asked to answer eight questions on whether:

- (1) an IED scheme was feasible, and whether they agreed with the concept of an IED;
- (2) they would recommend an IED to farm clients;
- (3) they recommend the Land Bank drought relief provision (Paragraph 13A) to livestock farm clients;
- (4) they would support replacing the Paragraph 13A provision with an IED scheme;
- (5) the SARS would consider their liquidity shortfall due to tax deferral with an IED as a problem;
- (6) the accelerated depreciation allowance provision (Section 12B) and the capital expenditure provision (Paragraph 12(1)) should be used with an IED scheme, or whether these schemes should be withdrawn;
- (7) an IED scheme, if implemented, should be used with or without the income averaging provision (Paragraph 19(2)), and
- (8) they foresee any disadvantages if an IED scheme is implemented.

The questions were designed to:

- (1) determine whether the scenarios were realistic for the purpose of analysis and to gain general information relating to the concept and viability (need) of an IED scheme.
- (2) obtain a relative estimate of the degree of use of an IED scheme.
- (3) identify the gains perceived by consultants in using the Land Bank drought relief scheme (paragraph 13 A), as this scheme operates in a similar way to the proposed IED scheme.

- (4) obtain information on implementing a scheme similar to the Land Bank drought relief provision (paragraph 13A) that caters for all farmers, not only livestock farmers.
- (5) gain information on problems potentially faced by the SARS as perceived by the consultants.
- (6/7) establish details of how the proposed IED scheme should be implemented - whether certain tax provisions available to farmers should be used in conjunction with an IED scheme or withdrawn.
- (8) obtain consultants impressions on any disadvantages foreseen with the implementation of an IED scheme. This could provide information on any obstacles that would need to be addressed.

3.3 Scenario section

The scenarios were compiled to determine what types of farmers are most likely to use an IED scheme. Each consultant was asked to review nine scenarios of typical farms in the study regions and to decide whether they would recommend an IED scheme for each scenario. Scenarios one to eight used in the analyses were constructed using a statistical experimental design, with the ninth scenario serving as a control to measure the consistency between consultants. These scenarios (farms) were depicted using four variables that showed different levels (high, low and intermediate) of farm business leverage (debt/asset ratio), net farm income, business risk (net farm income variability), and off-farm income, based on representative livestock, maize and diversified farm record data supplied by the NDA (1999).

Debt/asset ratios ranged from under 15 percent to over 40 percent, while net farm income ranged from a low of less than R50 000 per annum to a high of over R300 000 per annum. Net farm income was defined as gross farm income less farm operating costs, excluding any rent, management salary and interest on debt (foreign factor costs). Net farm income variability was used as a measure of risk. For construction of the scenarios, net farm income variability was measured as an index of net farm income variability. This index was shown for each year during 1995-1999 by expressing annual net farm income in each year as a percentage of the average net farm income over the five-year period. In this way, the index for high risk (high net farm income variability) maize farmers (ranging from -30 to 276 around a mean of 100) showed far more net farm income variability than the index for low risk livestock farmers (ranging from 58 to 124 around a mean of 100). Annual off-farm incomes typically ranged from zero to a high of over R20 000 on the study area farms.

A typical set of scenarios given to a particular consultant can be seen in Appendix B (pg81), and the data set obtained from the scenario section can be seen in Appendix C (pg83). The high, low and intermediate values of the four variables used in the survey are depicted below in Table 3.2.

Table 3.2: Respective values of variables used in the scenarios

Variable	High	Low	Intermediate
Debt/Asset ratio	> 40 %	< 15 %	30 %
Annual off-farm income	> R20 000	0	R10 000
Annual net farm income	> R300 000	< R50 000	R 175 000
Index of variation in NFI			
1995	28	58	119
1996	201	116	89
1997	-30	124	111
1998	276	91	83
1999	25	111	97

To enhance the simplicity of the survey, livestock net farm income variability was depicted using a typical livestock farmer with a low index of net farm income variability. Likewise, maize net farm income variability was depicted using a typical maize farmer with a high index of net farm income variability. For analysis purposes, in order to cover all combinations of net farm income variability with farming type, other than livestock and maize farmers with low and high levels of net farm income variability respectively, the coefficient of variation in net farm income variability was calculated using the original representative livestock, maize and diversified farm record data supplied by the NDA (1999). In the analysis, high net farm income variability for a maize farmer was measured using an index of net farm income variability but coded according to its coefficient of variation of net farm income. Likewise, low net farm income variability for a livestock farmer was measured using an index in net farm income variability, but coded according to its coefficient of variation in net farm income. The function obtained separating potential IED scheme adopters from non-adopters could then be used to determine the outcome of different enterprise combinations with various levels of debt, off-farm income and net farm income.

Thus, for survey purposes, risk was measured in terms of an index in net farm income variation. For analysis purposes, risk was measured as an index of net farm income variability, but coded according to the coefficient of variation in net farm income in order to determine the function and to exploit all possible combinations of net farm income variability with farming type.

The coefficient of variation (CV) (adapted from Barry *et al.* 1995 pg30) was calculated as follows:

$$CV = \frac{\sigma}{\bar{X}} \dots\dots\dots(1)$$

Where: σ is the standard deviation

\bar{X} is the mean

Note:
$$\sigma = \sqrt{(x_1 - \bar{X})^2 + (x_2 - \bar{X})^2 + \dots + (x_n - \bar{X})^2} \dots\dots\dots(2)$$

The following is an example of how the coefficient of variation was calculated for selected enterprise and business risk combinations. For illustration purposes, the coefficient of variation for a livestock farmer with a high net farm income variability will be calculated.

Table 3.3: Calculation of the standard deviation for a maize farmer depicting high business risk (NDA, 2000)

Year	Annual Net Farm Income (1000's)	$x_i - \bar{X}$	$(x_i - \bar{X})^2$
1995	(x_1) R143.088	36.47	1330.06
1996	(x_2) R267.370	160.75	25840.56
1997	(x_3) R48.749	-57.87	3348.94
1998	(x_4) R47.575	-59.05	3486.9
1999	(x_5) R26.329	-80.30	6488.09
	\bar{X} R106.622		Σ 40494.55

Table 3.3 depicts the various steps performed in calculating the standard deviation from which the coefficient of variation is derived. The raw annual net farm income data obtained over a five year period is depicted in column two. Column three presents the product once the variable ($x_1 \dots x_5$) for

each year has been subtracted from the mean for the five year period. Column four depicts the square of the value in column three, yielding the sum of the five year period. The standard deviation is calculated by determining the square root of the sum (40494.55) in column four (201.23). The coefficient of variation is thus:

$$\frac{\sigma}{\bar{X}} = \frac{201}{106.622} = 1.89$$

Coefficients of variation calculated for selected enterprise and net farm income variability combinations are presented in Table 3.4.

Table 3.4: Coefficients of variation calculated for selected enterprise and business risk combinations, data extrapolated from farm financial records supplied by the NDA, 1999

Enterprise combination	Coefficient of variation
Maize farmer - high net farm income variability	2.630
Livestock farmer - high net farm income variability	1.886
Maize farmer - intermediate net farm income variability	1.963
Livestock farmer - intermediate net farm income variability	0.947
Maize farmer - low net farm income variability	1.453
Livestock farmer - low net farm income variability	0.523
Diversified farmer	0.303

3.4 Statistical design

The scenarios to each consultant were constructed using the 2^5 factorial treatment set as presented by Cochran and Cox (1957 p235). There were 32 different combinations for the five different variables under consideration, each at two levels. These variables were:

A = Debt/asset ratio (low or high)

B = Annual off-farm income (low or high)

C = Annual net farm income (low or high)

D = Index of variation in net farm income (low or high)

E = Type of farming (livestock vs maize)

Three replications of the design were considered with four blocks (consultants) per replication. In other words, each consultant was presented with a set of eight different “financial record scenarios” with the set of scenarios (blocks) being different for each consultant. The choice of a block size of eight permitted the partial confounding of 3-factor and 4-factor interactions with different effects being confounded in each replication. The confounded effects in each of the three replications used are summarised in Table 3.5.

Table 3.5: Confounded effects over three replications

Replication	Effects confounded in each replication
I	ABC, ADE, BCDE
II	ABD, BCE, ACDE
III	ACE, BCE, ABDE

By partially confounding 3-factor and 4-factor interactions, it was assumed that such interactions would be less important than “main effects” and “2-factor” interactions. By presenting each consultant with a different set of “financial record combinations”, considered “blocks” in experimental design terminology, possible differences between blocks (consultants) could be eliminated statistically in the subsequent analyses. Halfway through the study it became apparent that more data was required to separate the product effect (maize or livestock) from the risk effect. The augmented data depicting 32 different scenarios for four blocks (consultants) for Replication I, II and III are provided in Appendix D (pg92). It is to be noted that as additional consultants became available the sets of questionnaires were repeated, with four consultants per replication. The desired response was to cover all sets at least once (12 responses). If additional responses were received, it would be optimal to cover all sets completely ie. 12 responses to 24 responses to 36 responses etc.

Analysis of the original data showed that the blocking effect of the design was not necessary and therefore could be analysed as a simple random designed based on the 2^5 factorial treatment factor. In the analysis of the augmented data the design structure was ignored.

3.5 Econometric technique employed in the empirical analysis

One econometric technique was employed in the data analysis. Discriminant models were estimated to determine which explanatory variables best differentiate between potential adopters and non-adopters of an IED scheme. The object of this multivariate analysis was to generate information for

policy purposes. This section provides a brief overview of the technique followed by an explanation of the variables considered in the models.

3.5.1 Discriminant analysis

Discriminant analysis is a statistical technique used to predict group membership. Linear combinations of the independent, or predictor, variables are formed and serve as the basis for grouping cases. In order to distinguish between these groups, the researcher must assemble a set of explanatory or discriminating variables on which the two groups are expected to differ. On selecting the discriminating variables, the mathematical objective is to weight and linearly combine the variables so that the groups are forced to be as statistically distinct from one another as possible (Klecka, 1980 p7; Norusis, 1994 p1).

The discriminant function is of the form:

$$D_i = B_1X_1 + B_2X_2 + \dots + B_pX_p \dots\dots\dots(3)$$

- where :
- D_i is the i-th respondent's discriminant score on the function
 - $X_1 \dots X_p$ are the values of the independent variables
 - $B_1 \dots B_p$ are standardised coefficients estimated from the data

The coefficients are computed so as to maximise the ratio of the variance of D between the two groups relative to the variance of D within groups. The index D is an optimum linear discriminator between the groups. The relative contribution of each discriminating variable to the discriminating function is determined by the magnitude of its associated coefficient. The standardised coefficients (B_p) reflect the relative importance of the independent variable (X_p). Independent variables with relatively large (B_p) contribute most to the discrimination between the two groups (Klecka, 1980 p15-16; Norusis, 1994 p7). The sign of the coefficient indicates whether the variable is positively or negatively related to D.

Upon the estimation of the discriminant function it is necessary to assess its discriminating power. There are a number of statistics available for this estimation with the most important being the eigenvalue, Wilks' Lambda, Chi-square, canonical correlation and F-statistic. The eigenvalue is a direct measure of the function's discriminating power; the larger the value the better the discriminating power of the function. The Wilks' Lambda provides a basis for verifying the statistical significance of this function. With a range of between zero and one, a value closer to zero denotes a high level of discriminating power. Both the Chi-square and F-statistic indicate the way in which the independent variables differentiate significantly between groups (ie: potential adopters vs non-adopters), with a high value indicating a high level of significance. The canonical correlation is a measure of the degree of association between the discriminant scores and group membership. With a range of between zero and one, a value closer to one denotes a good predictive model. The explanatory power of a discriminant function can also be gauged by comparing its classification of sample cases with actual group membership.

Analysis refers to the interpretation of the original data, and to the interpretation of the discriminant function. The F-test can be used to check whether or not the individual discriminating variables contribute to the separation of groups (potential adopters and non-adopters). This test is valid only if the explanatory variables are multivariate normally distributed (Truett *et al*, 1967 p521). According to Klecka (1980 p61), the assumption of a multivariate normal distribution (normality assumption) is important for tests of significance. In these tests, a statistical computed from a sample is being compared to a theoretical probability distribution for that statistic. A theoretical distribution can be computed by making some convenient mathematical assumptions, such as requiring that the population meet the normality assumption. If the sample population does not satisfy this requirement, the true sampling distribution for the statistic will be different from the theoretically derived distribution. The difference between the two distributions may be very small or very large, depending on the degree of deviation from the assumption.

The normality assumption is violated in the study by the dichotomous nature of the independent variables. In practice, however, discriminant analysis is a rather robust which can tolerate some deviation from the normality assumption. Violation of the assumption does not render the analysis useless. Lachenbruch (1975 p 40-50) reviewed numerous discriminant studies and showed that the discriminant function performs fairly well on such non-normal data. In practice, this assumption can also be checked by observing the distribution of the discriminant scores (D_i) estimated for each group. If the distribution is approximately normal, the test is considered valid. According to Klecka (1980 p62), in the interest of developing a mathematical model which can predict well or serve as a reasonable description of the real world, the best guide is the percentage of correct classifications. If this percentage is high, the violation of any assumption was not very harmful. Efforts to improve the data or use alternative formulas can give only marginal improvements.

3.5.2 Variables considered and hypotheses

The variables which were expected to distinguish potential IED scheme adopters from non-adopters are presented in Table 3.6 and discussed in this section. A dependent variable **Y_N** was constructed using (1) for farmers for whom the consultant would recommend investing in an IED scheme and (0) for farmers he would not recommend investing in an IED scheme.

Table 3.6: Definition of variables considered for discriminant analysis

Variable	Definition
Y_N	= yes/no (1 for potential adopter; 0 for potential non-adopter)
DA	= debt/asset ratio (dummy variable scoring 1 for high; 0 for low)
OI	= off-farm income (dummy variable scoring 1 for high; 0 for low)
NFI	= net farm income (dummy variable scoring 1 for high; 0 for low)
RISK	= index of variation in net farm income (dummy variable scoring 2.630 for high; 0.523 for low)
ENT	= enterprise (dummy variable scoring 1 for livestock farmer; 0 for maize farmer)
R_DA	= index of variation in net farm income multiplied by debt/asset ratio (interaction variable)

Independent variables with their expected signs were as follows:

- (i) Debt/asset ratio (-). This ratio was used as a measure of solvency. The critical issue relating to leverage is the farm's ability to generate the cash to meet all expenses and service the debt with an acceptable margin of safety. Due to the cost of borrowing being higher than the interest rate earned on investing in an IED, it was expected that farmers with debt will redeem debt first before investing in an IED scheme.

- (ii) Off-farm income (-). The off-farm income of a farming business serves as an additional source of funds which can be used in the farming operation or invested outside of agriculture. It was hypothesised that higher levels of off-farm income may indicate clients that have diversified investments and so would be less likely to need an IED. It was also hoped that farmers with relatively higher off-farm incomes would not use the scheme as a perceived tax shelter.
- (iii) Net farm income (+). The net farm income of a farm business is a reflection of how well the business has performed. According to Barry *et al* (1995 p), the level of net farm income reflected in the income statement is a meaningful absolute measure with which to monitor profitability of the business from year to year. It was postulated that adopters would have higher net farm incomes (higher profits) as they would have the means to save.
- (iv) Index of variation in net farm income (+). This variable reflects the business risk inherent in a particular enterprise. It was hypothesised that an IED scheme would suite farms having a higher index of variation in net farm income variability as they are exposed to more business risk. The introduction of an IED scheme is primarily as a risk management tool and it is therefore expected that farmers with a higher variation in income will make more use of such a scheme. The conventional dummy variable scoring (1; 0) was weighted using a coefficient of variation which provided a score of 2.630 for a high index of variation in net farm income and a score of 0.523 for a farmer with a low index of variation in net farm income.

- (v) Enterprise (+). This variable was considered to capture the effects of relatively lower risk livestock farmers (less variable net farm incomes) compared to relatively high risk maize farmers (more variable net farm incomes). It was postulated that both livestock and maize farmers would adopt an IED scheme, with the scheme being more valuable to the higher risk maize farmers. Due to the design of the scenarios (maize farmers-high net farm income variability, livestock farmers-low net farm income variability), the business risk experienced by maize and livestock farmers is captured in both the **ENT** and **RISK** variable. As a result of this relationship, perfect multicollinearity was expected between these two variables.
- (vi) Risk - debt/asset ratio. This variable was constructed to determine what the combined effects of risk and debt/asset ratio would have on the potential use of an IED scheme. The relationship between the interaction effect **R_DA** and an IED scheme was not clear and for this reason no hypotheses was presented. Farmers with a high combination of risk and debt may be advised to first reduce their debt before investing in an IED scheme. This situation would imply a negative relationship between the variable and an IED scheme. However, a high debt/asset ratio (financial risk) coupled with a high variation in net farm income (business risk) would increase a farmers total risk. In this situation, a consultant may advise the client to invest in an IED scheme thus implying a positive relationship.

Due to the nature of the multiplicative term, multicollinearity was anticipated between the variable **R_DA** and its component variables **RISK** and **DA**. The next section provides a brief background to the problems associated with the use of multiplicative terms and how the multicollinearity problem was addressed.

3.6 Multicollinearity issues

The use of multiplicative terms in discriminant analysis focuses on the issue of multicollinearity. Critics have noted that multiplicative terms usually exhibit strong correlations with the component parts. Because multiplicative terms can introduce high levels of multicollinearity, critics have often recommended against their use (Jaccard et al, 1990 p30). According to Gujarati (1999), in cases of perfect and high multicollinearity, estimation and hypothesis testing about individual discriminant coefficients in a multiple regression are not possible. The partial correlation coefficient technique is commonly used in quantifying the strength of association between two variables. By using this technique, multicollinearity between two variables can successfully be detected and preliminary results can be extracted. Table 3.7 presents the partial correlations between main and interaction variables. The enterprise variable (**ENT**) was retained to determine its relationship with the index of variation in net farm income variable (**RISK**).

Table 3.7: Partial correlation matrix using standardised variables, sample of SA consultants, 2000 (n=192)

	ENT	DA	OI	NFI	RISK	E_DA	R_DA	Y_N
ENT	1.000							
DA	0.266*	1.000						
OI	0.022	-0.033	1.000					
NFI	-0.225	0.339*	0.028	1.000				
RISK	1.000	0.266*	0.022	-0.225	1.000			
E_DA	0.673*	0.621*	-0.005	0.055	0.673*	1.000		
R_DA	0.673*	0.621*	-0.005	0.055	0.673*	1.000*	1.000	
Y_N	0.388*	-0.535*	-0.052	0.472*	0.388*	-0.103	-0.103	1.000

Note: * signifies statistical significance at the 1% level of probability

From Table 3.7 it is clear that multicollinearity exists between the interaction variable **R_DA** and its component variables **RISK** and **DA**, with coefficients of 0.621 and 0.673 respectively. Cronbach (1987) suggested centering the independent variables, prior to forming the multiplicative term, as a means of addressing the problem of multicollinearity (as cited by Jaccard *et al.* 1990 p31). Following this technique, the independent variable scores were centered (ie. deviation scores were formed) and the product of the centered scores was computed for each subject. Table 3.8 presents the partial correlations between main and interaction variables using centered scores.

Table 3.8: Partial correlation matrix using centered scores, sample of SA consultants, 2000 (n=192)

	ENT	DA	OI	NFI	RISK	E_DA	R_DA	Y_N
ENT	1.000							
DA	0.266*	1.000						
OI	0.022	-0.033	1.000					
NFI	-0.225	0.339*	0.028	1.000				
RISK	1.000*	0.266*	0.022	-0.225	1.000			
E_DA	0.013	-0.020	-0.002	0.017	0.013	1.000		
R_DA	0.013	-0.020	-0.002	0.017	0.013	1.000*	1.000	
Y_N	0.388*	-0.535*	-0.052	0.472*	0.388*	-0.031	-0.031	1.00

Note: * signifies statistical significance at the 1% level of probability

From Table 3.8 it is evident that the multicollinearity that existed between the multiplicative term **R_DA** and its component variables **RISK** and **DA** has been eliminated, with coefficients of 0.013 and -0.020 respectively. For the purpose of discriminant analysis, non-centered scores were used to produce the results of the main effects model (Model 1) and centered scores were used to produce the results of the interaction model (Model 2). As anticipated, the variables **RISK** and **ENT** were

perfectly correlated. The results obtained by substituting **RISK** for **ENT** and vice versa in the subsequent discriminant analysis would therefore be consistent, allowing one variable to be excluded from the analyses. This would effectively remove the effects of perfect collinearity. The enterprise variable **ENT** was subsequently dropped and the index of variation in net farm income variable **RISK** was retained for analysis purposes.

3.7 Preliminary results

Preliminary results can be extrapolated from the coefficients of variation calculated in Table 3.4 and the partial correlation matrix presented in Table 3.8. According to Barry *et al* (1995 p31), the coefficient of variation serves as an indicator of the amount of risk relative to the amount of expected return. It is a measure of the amount of risk inherent in a particular venture or enterprise. The higher the value, the more risky the venture/enterprise. The coefficients of variation calculated from the original representative livestock, maize and diversified farm record data indicate that maize farmers carry more risk (high of 2.630, low of 1.453) relative to livestock farmers (high of 1.886, low of 0.523), with diversified farmers carrying the least risk (0.303). It is worth noting that a maize farmer with an intermediate value (1.963) is above a livestock farmer with a high value (1.886). These results indicate the relative proportions of risk maize farmers experience relative to livestock and diversified farmers, making the scheme more valuable to maize farmers relative to livestock and diversified farmers.

The correlation coefficients for **Y_N** with **DA**, **NFI** and **RISK** were all statistically significant at the 1% level of probability, while the coefficient for **OI** and **R_DA** was not statistically significant. The

signs of the coefficients all agree with *a priori* reasoning. The relative contribution of the **DA** variable overshadows the relative contribution of the **RISK** variable, resulting in a negative coefficient of the interactive term **R_DA**. The non-significant sign of the coefficient indicates that, *ceteris paribus*, the study consultants would advise farmers to first reduce their debt before investing in an IED scheme. In the study consultants' view, farmers with less leverage (debt/asset ratio), higher net farm incomes and more variable net farm incomes are more likely to use an IED scheme. The relative size of the explanatory coefficient estimates indicate that statistically, **DA** is the most important determinant of an IED scheme, followed by **NFI** and then **RISK**. An in-depth look at the research results are presented in the following chapter.

CHAPTER 4

RESEARCH RESULTS

This chapter presents the results obtained from the questionnaire section of the survey, followed by the results obtained in discriminant analysis. Responses to individual questions are presented in the questionnaire section together with a statistical indication of responses to individual questions. Two models are presented in the discriminant analysis section, followed by a brief discussion on the results obtained. The discriminant function obtained separating potential users and non-users of an IED scheme is then presented and used to predict the potential membership of specific cases (samples) selected from the original data set. These results are then tabulated and briefly discussed. The chapter ends with an assessment of the discriminant analysis due to the violation of the normality assumption.

4.1 Questionnaire section results

Responses to the individual questions are presented in Table 4.1. Most of the consultants agreed with the concept of an IED scheme, and felt that it would be feasible in helping farmers to avoid over-capitalising (purchasing more machinery and equipment than needed) during “good” cash flow years, and in providing liquidity for use in “lean” times. By legally delaying payment of tax, farmers could stabilise income and cash flows. All but one of the consultants would recommend an IED scheme to their clients, but they would advise clients that were carrying forward large debt loads to rather make debt repayments before investing in an IED.

The Land Bank drought relief provision was highly recommended, but consultants suggested that it should be available as an option to *all* farmers, not only livestock farmers. These farmers may have no accumulated losses and so would have to pay much needed money as additional income tax on forced livestock sales without the provision. The consultants supported replacing the Land Bank drought relief provision with an IED scheme, as all farmers under any conditions would then have access to potential risk management benefits. The Land Bank drought relief provision could further be modified into an IED scheme, allowing farmers to invest surplus profits, not taxed, in "good" years and not only when drought occurs - for instance, when a farmer must sell all or part of his land and, therefore, has to reduce his livestock numbers.

Table 4.1: Sample consultants' responses to survey questions, 2000 (n=24)

Question	Question focus	% Yes
Question 1	Feasibility of IED	92
	Agree with IED concept	96
Question 2	Recommend IED to clients	96
Question 3	Recommend Land Bank drought relief provision (paragraph 13A)	96
Question 4	Replace Land Bank drought relief provision with an IED scheme	92
Question 5	Tax deferral perceived as a problem by SARS	75
Question 6	IED used with accelerated depreciation allowance provision (section 12B)	92
	IED used with capital expenditure provision (paragraph 12(1))	96
Question 7	IED used with the income averaging provision (paragraph 19(2))	100
Question 8	Any disadvantages with an IED scheme	96

According to 75 percent of the consultants, the SARS would consider the tax deferral implied by the IED scheme as a problem. The 25 percent of consultants who felt that it would not be a problem considered the amount involved would not be material relative to the total income tax collected by the SARS. Consultants noted that a tax deferral was already implied by the Land Bank drought relief provision, and, therefore, changing to an IED scheme would be similar. In addition, taxable income is more “visible” with both schemes, which aids tax monitoring.

The consultants had mixed opinions about using an IED scheme in conjunction with the accelerated depreciation allowance and capital expenditure provisions. Most agreed that both provisions should stay in place if an IED is introduced, as capital assets are relatively costly to purchase. They cautioned, however, that many farmers had misused these two provisions and over-capitalised in an attempt to avoid tax. This had resulted in a number of farm bankruptcies.

All of the consultants supported using an IED scheme with the current income averaging provision. Farmers not able to use the IED scheme due to cash flow problems would still be able to benefit from income averaging. This provision leads to a lower rate of tax on taxable income, whereas an IED scheme defers the tax liability and creates an incentive to save. For these reasons, the consultants felt that what happens to the income averaging provision if an IED scheme is introduced would also influence whether or not a farmer would participate in an IED scheme.

Implementing an IED scheme was seen as a benefit to all farmers, with only a few disadvantages cited. Firstly, if income tax rates increase due to fiscal drag, the deferred liability may be greater than if the farmer had paid the tax liability earlier. The administrative costs of setting up and staffing such a scheme may be prohibitive, and it was suggested that the Land Bank drought relief scheme with its present structures could be used to house an IED scheme, with only minor changes to the Income Tax Act. Farmers who have not withdrawn funds within the IED time limit may also face a large tax liability in the final year, whether they need the funds or not. As noted in Question 5, the tax deferral implied by the scheme would be a possible concern for the SARS.

4.2 Discriminant analysis results

4.2.1 Discrimination between potential adopters and non-adopters of an IED scheme

All 24 tax consultants felt that the nine farm scenarios considered were realistic, implying that their views were a good representation of what they would advise their clients. This, together with a consistency rate of 91% achieved through the control scenario, ensured a realistic and consistent data set for analysis purposes. Two discriminant models are presented in Table 4.2. Model 1 consists of the main effects and Model 2 consists of the main effects with the interaction effect.

Table 4.2: Results of the discriminant models identifying the characteristics of potential adopters and non-adopters of an IED scheme, sample of SA consultants, 2000 (n=192)

	Model 1		Model 2	
Explanatory variables	Standardised coefficient			
DA	-0.955*		-0.956*	
NFI	0.879*		0.880*	
RISK	0.756*		0.756*	
OI	-0.111		-0.111	
R_DA			-0.067	
Discriminant function statistics	Statistic			
Chi-square	203.871*		203.878*	
Wilks' Lambda	0.338		0.338	
Canonical correlation	0.814		0.814	
Eigenvalue	1.958		1.966	
Overall classification	Potential Adopter	Potential Non-adopter	Potential Adopter	Potential Non-adopter
% correctly classified	100.0	89.7	100.0	89.7
Overall % correctly classified	94.3		94.3	

Note: * signifies statistical significance at the 1% level of probability

The overall Chi-square value (significant at the 1% level of probability) in both models indicates that, collectively, the explanatory variables in each model distinguish significantly between potential adopters and non-adopters of an IED scheme. The Wilks' Lambda in both models indicates a high level of discriminating power. In addition, the Eigenvalue (ratio of between-groups to within-groups sum of squares) and the Canonical correlation (measure of degree of association between the discriminant scores and group membership) indicate good predictive models. Both models correctly

classified 94% of overall cases. Due to the restrictions imposed by the statistical model, no hold-out sample was used in determining classification rates.

The relationships (coefficient signs) between dependent and independent variables were in accordance with *a priori* expectations and supported the preliminary results obtained from the partial correlation matrix in Chapter 3. In Model 1, the debt/asset ratio (**DA**) was found to be the most important variable (highest standardised coefficient) distinguishing between potential adopters and non-adopters of an IED scheme. The negative sign of the variable indicates that, *ceteris paribus*, farmers with lower debt/asset ratios are more likely to make use of an IED scheme. Farmers with a high debt/asset ratio will most likely be advised to reduce their debt before investing in an IED scheme. It is in any case a recommended strategy that farmers with high debt first repay their debt. The second most important distinguishing variable was net farm income (**NFI**). The sign was positive which confirms that, *ceteris paribus*, farmers with higher annual net farm incomes are more likely to invest in an IED scheme. Farmers with a high net farm income are more likely to have the resources to firstly, cover any existing debt, and then invest in an IED scheme. This supports the view expressed by Hattingh (1986 p22) that wealthier farmers are more likely to make use of an IED scheme.

The third most important variable was that of the index of variation in net farm income (**RISK**). The sign was positive indicating that, *ceteris paribus*, maize farmers with a high variation in net farm income are more likely to invest in an IED scheme than livestock farmers with a low variation in net farm income. This indicates that an IED scheme could act as a potential risk management strategy. The fourth distinguishing variable listed was that of off-farm income (**OI**). Even though the

standardised coefficient was found to be non-significant, it was retained in the model as the sign of the coefficient and its magnitude are of significance to the adoption of an IED scheme. The non-significant coefficient estimate indicates that, *ceteris paribus*, off-farm income will most likely not be invested in an IED. This implies there are no gains to be made in the misuse of the scheme as a tax shelter. Alternative investment avenues outside agriculture (diversified investments) could be a use of off-farm income where more gains could be made to provide the farmer with better risk spreading.

In Model 2, the interaction variable was tested with the main variables. The main variables were all in accordance with the results obtained in Model 1. The standardised coefficient of the interaction variable (**R_DA**) was found to be non-significant but retained in the model to reveal its contribution to the decision to adopt an IED scheme. The relative contribution of the debt variable (**DA**) overshadows the relative contribution of the net farm income variability variable (**RISK**), forcing the sign to be negative. The negative sign of the variable indicates that, *ceteris paribus*, maize farmers with a high index of variation in net farm income carrying high debt are less likely to invest in an IED. In the consultants' views, high variability in net farm income (business risk) coupled with high debt (financial risk) may increase a farmers total risk but the farmer should first redeem the debt before investing in an IED.

The discriminant function, obtained from Model 1, using unstandardised coefficients that separates potential users and non-users of an IED scheme is presented below.

$$D_i = - 0.978 - 2.249DA + 1.984NFI + 0.774RISK - 0.22OI.....(4)$$

In Model 1, high risk maize farmers (high index of net farm income variability) were compared to low risk livestock farmers (low index of net farm income variability). The coefficients of variation for seven farming types were calculated from the actual data obtained from the Department of Agriculture (NDA, 2000) and presented to consultants. The following farming types were selected for different risk classes (high, intermediate and low): maize, livestock and diversified (one class) (see Table 4.3). By substituting the coefficients of variation for the **RISK** variable in the discriminant function, all possible combinations of net farm income variability with farming type could be exploited. Specific samples from the scenario data set were selected depicting different combinations and levels of the explanatory variables. With the use of the discriminant function, the potential membership of a specific case (sample) could be predicted based on the discriminant score. The off-farm income variable (**OI**) in Model 1 was statistically non-significant and was therefore retained with a low score (0) as it had no influence on the outcome of the discriminant scores. Additionally, as the interaction effect in Model 2 was also statistically non-significant, no predictions are presented for Model 2.

Table 4.3 presents selected samples with their respective discriminant scores (D_i). The group centroids were -1.241 and 1.562 for potential non-adopters and adopters respectively, yielding a cutoff point of 0.161. A sample case yielding a discriminant score of less than 0.161 would be classified as a potential non-adopter (N) and a discriminant score of greater than 0.161 would be classified as a potential adopter (Y).

Table 4.3: Predicted membership of specific samples, as selected from a sample of SA consultants, 2000 (n=192)

	Farmer type	D A	OI	NFI	RISK	D _i	Y N
Block 1	MH	0	0	1	2.630	3.042	Y
	MI	0	0	1	1.963	2.525	Y
	LH	0	0	1	1.886	2.466	Y
	ML	0	0	1	1.453	2.131	Y
	LI	0	0	1	0.947	1.739	Y
	LL	0	0	1	0.523	1.411	Y
	D	0	0	1	0.303	1.241	Y
Block 2	MH	0	0	0	2.630	1.058	Y
	MI	0	0	0	1.963	0.542	Y
	LH	0	0	0	1.886	0.482	Y
	ML	0	0	0	1.453	0.147	N
	LI	0	0	0	0.947	-0.245	N
	LL	0	0	0	0.523	-0.573	N
	D	0	0	0	0.303	-0.743	N
Block 3	MH	1	0	1	2.630	0.793	Y
	MI	1	0	1	1.963	0.276	Y
	LH	1	0	1	1.886	0.217	Y
	ML	1	0	1	1.453	-0.118	N
	LI	1	0	1	0.947	-0.510	N
	LL	1	0	1	0.523	-0.838	N
	D	1	0	1	0.303	-1.008	N
Block 4	MH	1	0	0	2.630	-1.191	N
	MI	1	0	0	1.963	-1.708	N
	LH	1	0	0	1.886	-1.767	N
	ML	1	0	0	1.453	-2.102	N
	LI	1	0	0	0.947	-2.494	N
	LL	1	0	0	0.523	-2.822	N
	D	1	0	0	0.303	-2.992	N

Note: MH = maize-high risk LH = livestock-high risk
MI = maize-intermediate risk LI = livestock-intermediate risk
ML = maize-low risk LL = livestock-low risk
D = diversified

In Block 1 of Table 4.3, various levels of net farm income variability (risk) are depicted with a high level of net farm income, holding the remaining variables constant at low levels. The discriminant scores (D_i) suggest that all these types of farmers will most likely make use of an IED scheme. Farmers carrying little debt with a high net farm income have the resources to make use of the scheme. The relative size of the discriminant scores indicate which farmer would most likely make use of the scheme relative to other farmers. According to the results, more value is given to high risk maize farmers, followed by intermediate risk maize farmers and then high risk livestock farmers. Least value is given to diversified farmers. This ranking was expected as farmers facing more business risk are more likely to invest in an IED scheme.

Block 2 depicts farmers with various levels of net farm income variability, holding the remaining variables constant at low levels. The discriminant scores revealed that only high and intermediate risk maize farmers, and high risk livestock farmers would most likely invest in an IED scheme. The risk associated with maize farmers carrying low levels of net farm income variability, livestock farmers carrying intermediate and low levels of net farm income variability, and diversified farmers is not sufficient to justify the use of an IED scheme. This again supports the use of an IED scheme as a risk management tool as higher risk farmers are more likely to make use of the scheme.

In Block 3, farmers with various levels of net farm income variability are depicted with a high level of net farm income and debt. According to the discriminant scores, the only likely users of an IED scheme under these conditions are high and intermediate risk maize farmers, and high risk livestock

farmers. The positive effect of the net farm income and risk variable offsets the negative effect of the debt/asset variable in these particular samples. In the remaining samples, the combined effects of the risk and net farm income variable is too low to offset the debt/asset variable. Block 4 depicts farmers with various levels of net farm income variability with a high level of debt, holding the remaining variables constant at a low level. The discriminant scores suggest that all the farmers depicted will most likely not make use of an IED scheme. The negative effect of the debt/asset variable offsets the positive effect of the risk variable.

The results indicate that maize, livestock and diversified farmers carrying large amounts of debt (>40%) are less likely to invest in an IED scheme. Amongst the high debt farmers, only high and intermediate risk maize farmers, and high risk livestock farmers are most likely to make use of an IED scheme. The relative contribution of the debt variable in the analyses indicates the importance of this variable in distinguishing between potential adopters and non-adopters of an IED scheme. Several studies revealed the leverage (debt/asset) ratio to be the most important determinant of maize farm bankruptcies between 1970 and 1994 (Leslie and Darroch, 1993; De Jager and Swanepoel, 1994; Swanepoel *et al.*, 1996). A later study by Swanepoel *et al.* (1998) indicated that the leverage ratio was the most important determinant of extensive beef farm bankruptcies over the same period (1970 to 1994). From these studies, it is evident that profits and cash flow could be of concern in the key livestock and crop sectors of South Africa. The extent of this problem in the grain sector has been addressed in a recent study where the financial position of the Northern and Southern grain regions of South Africa was reviewed by du Toit (2001). It was reported that since 1998, 694

farmers in these regions have been sequestrated, with a further 271 farmers being sequestrated in 2001. Another study conducted by Esterhuizen *et al.* (2001) revealed the financial position of the agricultural business sector. Bankruptcies almost doubled (0,4% in 1998 to 0,74% in 2000), 59% more loans have been rejected by agribusinesses since 1998, the debt recovery account has grown by 22%, clients against whom action was taken increased by 63% with money involved increasing by 255%, new entrants securing loans increased by 9% and the money involved in new loans increased by 99%, indicating that more agricultural producers are dependant on loans. Unfavourable and fluctuating climatic conditions, primarily in the summer crop areas of South Africa, were identified as possible causes of this situation.

4.2.2 Assessment of the discriminant analysis results

Since the multivariate normality assumption was violated by the dichotomous nature of the independent variables, the discriminant scores for the main effects model and interaction model were estimated and presented by frequency tables and histograms. The discriminant scores estimated in the main effects model for potential adopters and non-adopters of an IED scheme are presented in Table 4.4/Figure 4.1 and Table 4.5/Figure 4.2 respectively. The discriminant scores estimated in the interaction model for potential adopters and non-adopters of an IED scheme are presented in Table 4.6/Figure 4.3 and Table 4.7/Figure 4.4 respectively.

Table 4.4: Discriminant scores estimated in the main effects model for potential non-adopters of an IED scheme

Code	Score	Frequency
1	- 3.25 to - 2.76	13
2	- 2.75 to - 2.26	-
3	- 2.25 to - 1.76	-
4	- 1.75 to - 1.26	18
5	- 1.25 to - 0.76	41
6	- 0.75 to - 0.26	18
7	- 0.25 to 0.24	-
8	0.25 to 0.74	10
9	0.75 to 1.24	7

		107

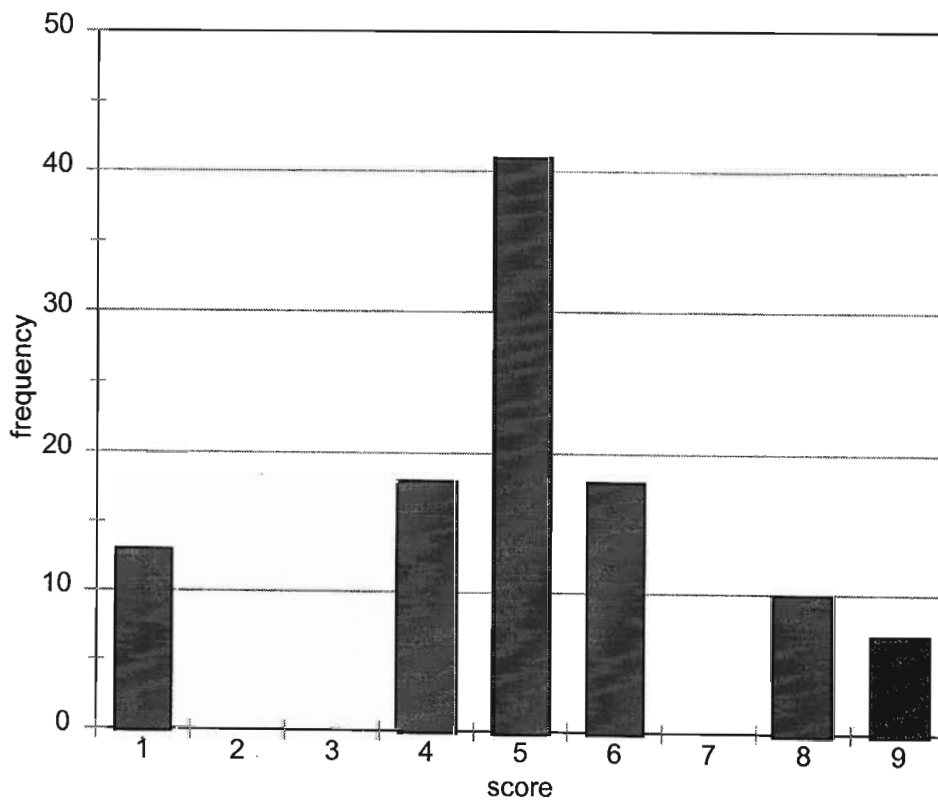


Figure 4.1: Histogram for Table 4.4

Table 4.5: Discriminant scores estimated in the main effects model for potential adopters of an IED scheme

Code	Score	Frequency
1	0.25 to 0.74	15
2	0.75 to 1.24	31
3	1.25 to 1.74	32
4	1.75 to 2.24	-
5	2.25 to 2.74	-
6	2.75 to 3.24	7

		85

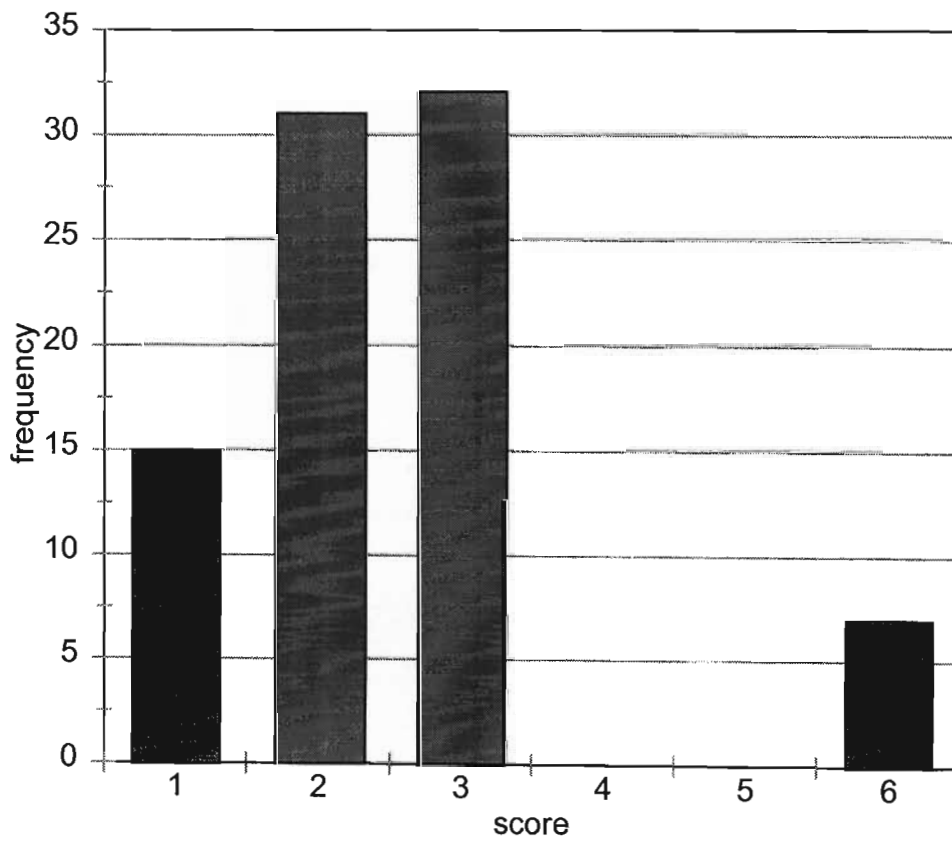


Figure 4.2: Histogram for Table 4.5

Table 4.6: Discriminant scores estimated in the interaction model for potential non-adopters of an IED scheme

Code	Score	Frequency
1	- 3.25 to - 2.76	14
2	- 2.75 to - 2.26	-
3	- 2.25 to - 1.76	-
4	- 1.75 to - 1.26	24
5	- 1.25 to - 0.76	37
6	- 0.75 to - 0.26	19
7	- 0.25 to 0.24	-
8	0.25 to 0.74	8
9	0.75 to 1.24	5

		107

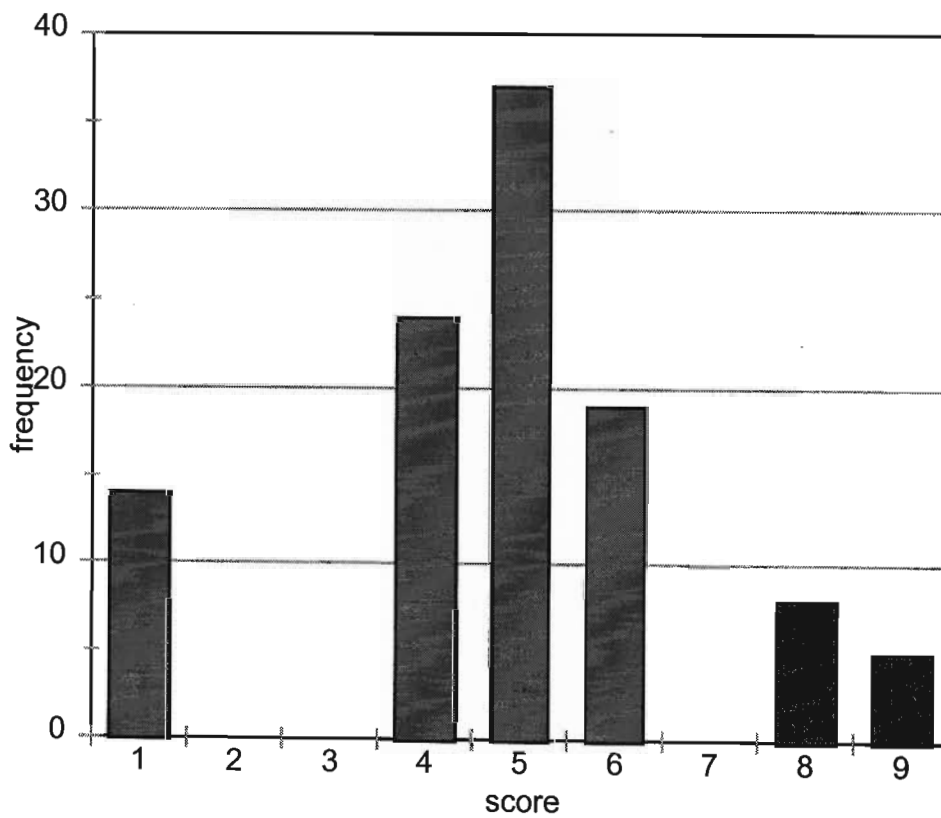


Figure 4.3: Histogram for Table 4.6

Table 4.7: Discriminant scores estimated in the interaction model for potential adopters of an IED scheme

Code	Score	Frequency
1	0.25 to 0.74	15
2	0.75 to 1.24	26
3	1.25 to 1.74	29
4	1.75 to 2.24	-
5	2.25 to 2.74	-
6	2.75 to 3.24	15

		85

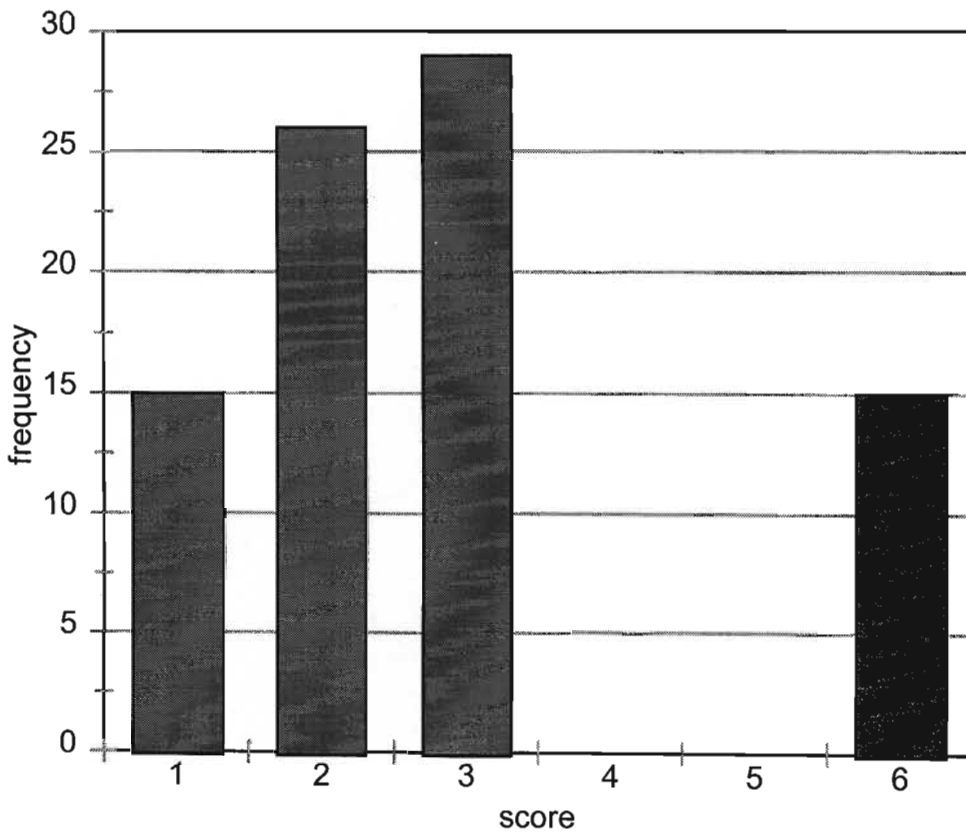


Figure 4.4: Histogram for Table 4.7

The discriminant scores estimated for the main effects potential non-adopter model (Figure 4.1) and the interaction potential non-adopter model (Figure 4.3) appear to be approximately normally distributed, while the scores for the main effects potential adopter model (Figure 4.2) and the interaction potential adopter model (Figure 4.4) are slightly positively skewed. In combination, the discriminant scores for potential adopter and non-adopter groups appear to be approximately normally distributed, thus, according to Lachenbruch (1975), rendering the test valid. The estimates can thus be accepted with reasonable confidence. A classification rate of 100 percent for potential adopters and 89.7 percent for potential non-adopters in both models, according to Klecka (1980), indicates that the violation of the normality assumption was not very harmful, thus suggesting that good predictive models were developed.

The questionnaire section of the survey revealed key issues regarding the potential use of an IED scheme in South Africa. Discriminant analysis was used to determine which factors distinguish best between potential adopters and non-adopters of an IED scheme. Conclusions and policy implications are presented in the next chapter.

CHAPTER 5

CONCLUSIONS AND POLICY IMPLICATIONS

The concept of an IED scheme as a potential risk management tool to promote better cash flow and thus stabilise farm income was well supported by the study consultants. An IED scheme could reduce the incentive to over-capitalise in good years, and hence raise the long-term tax proceeds from the farm sector. The consultants suggested that the averaging provision be used with an IED scheme, implying that the in-out option will remain in place. Past experience with IED's in Australia indicates that this combination has led to misuse of the averaging provision as farmers deliberately made IED deposits in low (below the moving average) income years in order to lower their tax rates. This would support the recommendation that such misuse could be avoided by not allowing farmers to make IED deposits in years when reported taxable incomes are below the five year moving average.

Replacing the Land Bank drought relief provision for livestock farmers with an IED scheme that caters for all (livestock, crop and horticultural) farmers would reduce the costs of setting up and staffing the scheme, as present Land Bank structures could be used to house the scheme. If the rule to prevent the misuse of an IED scheme is imposed, livestock farmers will still be able to make deposits during drought conditions as incomes will be above the moving average. An estimated R227.2 million was deposited in the Land Bank drought relief scheme during the year 2000 by an estimated 1178 depositors (Marais, 2000 as cited by Nieuwoudt and Howell, 2000). Deposits could, therefore, be considerable if an IED scheme is adopted and caters for all types of farmers. Those

farmers not able to make IED deposits due to cash flow problems could still use the income averaging provision. Tax monitoring by the SARS will be greatly enhanced if the IED scheme caters for all types of farmers. This advantage could, in part, offset the problem of tax deferral for the SARS. The consultants may, however, be over-concerned with the issue of deferred taxes, since experience with the Australian FMD scheme showed that significant tax savings from the use of the scheme are comparatively rare. Furthermore, if tax rates increase due to fiscal drag, farmers may pay more tax when they withdraw IED funds.

The accelerated depreciation allowance and capital expenditure provisions do enable farmers to purchase capital items that are becoming increasingly costly to replace, but these provisions have resulted in over-capitalisation, and, in cases, bankruptcy. The unwise use of these provisions decreases a farmer's ability to manage risks, as it reduces liquidity. Investing in an IED scheme can help a farmer to build up a reserve fund and increase his ability to manage risks by stabilising income fluctuations. A high tax burden on the death of a taxpayer using an IED scheme could result because of estate duty, but this criticism also applies to the Land Bank drought relief provision.

Discriminant analysis supported the preliminary results, confirming that, in the study consultants' view, farmers with less leverage (debt/asset ratios in the 15%-30% range), higher net farm incomes (>R300 000), and more variable net farm incomes, are more likely to invest in an IED scheme. The significance of these variables indicates the value of an IED scheme as a risk management tool, with the debt/asset ratio being the primary indicator when considering investing in such a scheme. Amongst the high debt farmers, high and intermediate risk maize farmers, and high risk livestock farmers are most likely to make use of an IED scheme. Study data showed that maize farmers faced

relatively more business risk than did livestock and diversified farmers, suggesting that maize farmers may more readily invest in an IED scheme. Since maize farmers have been the main beneficiaries of past government drought aid, this could mean reduced demands on government drought relief funds in future if an IED scheme is introduced.

The tax provisions available to commercial farmers can help reduce the impact of disasters on farm income, assist with abnormal receipts of farm income, assist in the purchasing of capital items which are extremely costly, and reduce the tax liability of livestock on hand, however, they do not provide an incentive for farmers to become more liquid and better prepared to handle risk. An IED scheme can be used to manage volatility at the total profit level, which is largely weather related, by providing an incentive for farmers to become more liquid and better prepared to handle risk. An IED scheme can potentially form an effective part of a risk management strategy, especially if it is used in conjunction with other strategies.

Results from the studies conducted on the causes of maize and extensive beef farm bankruptcies, and on the financial position of the Northern and Southern grain regions, suggest there may be an increase in debt in these sectors, but it is uncertain as to the extent of the problem. Bankruptcies and sequestrations could merely reflect inefficient farmers leaving the agricultural sector or, alternatively, the need for an alternative risk management tool. Farmers carrying large amounts of debt do not necessarily have profit or cash flow problems as the returns on debt may be higher than the cost of debt. These farmers are, however, more prone to cash flow problems. What the results do indicate is that debt is concentrated in certain areas where cash flow may be a problem, and these areas appear to be predominantly in the high risk maize and livestock regions of South Africa. According

to the results of the current study, it is these potentially high risk farmers (highly leveraged and high income variability) that need to make use of an IED scheme. In the short run, highly leveraged farmers with cash flow problems will most likely not be able to participate in an IED scheme. Consultants need to advise clients on the relationship between net farm income, interest costs and leverage levels for successful debt management. Only then can these farmers invest in an IED scheme which can help manage the effects of a changing agricultural and macroeconomic policy environment.

Results from the questionnaire section and discriminant analysis provided information regarding the major criticisms of an IED scheme. Results from discriminant analysis indicated that farmers with various levels of income variability and a high level of net farm income, holding the remaining variables constant at low levels, will most likely make use of an IED scheme. Irrespective of the income variability (risk) of a farmer, the model predicted that all farmers in the study would most likely invest in an IED scheme. When various levels of farm income variability were depicted with the remaining variable held constant at low levels, only three of the seven farmers depicted would invest in an IED scheme. This supports the criticism that an IED scheme will favour farmers with high net farm incomes. The questionnaire revealed that the SARS would consider the tax deferral implied by the IED scheme as a problem, however, it was noted that a tax deferral was already implied by the Land Bank drought relief provision and taxable income monitoring would be greatly enhanced if an IED scheme caters for all types of farmers. These findings do support the criticism that such a scheme impinges on the sound principle that revenue should be taxed in the year in which it accrues, but provides the incentive of enhanced tax monitoring which could partly offset the criticism.

Results do not support the criticism that current averaging schemes enable farmers in good years to make provision for poorer years by means of a tax saving. All of the consultants supported the use of an IED scheme with the current income averaging provision. It was noted that the current averaging provision leads to a lower rate of taxable income, whereas an IED defers the liability and creates an incentive to save. The non-significance of the off-farm income coefficient in the discriminant analysis indicates that off-farm income will most likely not be invested in an IED. This suggests that there are no gains to be made in the misuse of the scheme as a tax shelter. This finding does not support the criticism that an IED scheme offers considerable scope for tax sheltering in respect of depositing off-farm income into IED's.

Practicing consultants have provided valuable information regarding the viability of an IED scheme for commercial farmers in South Africa and the results have provided information on the criticisms of such a scheme in the past. An area of future research could involve determining where the debt is predominantly concentrated in the commercial livestock and crop sectors of South Africa, whether cash flow is a problem in these areas, and the extent to which these farmers can make use of an IED scheme. This could give more scope as to the potential short run use of an IED scheme. Additional research could be to look at the possibility of commercial banks offering IED facilities. This could reduce administration costs for the Land Bank, and may encourage more IED use as farmers would have more choice as to where they invest. Lastly, a comprehensive evaluation of the Australian FMD scheme should be made as this scheme has been successfully implemented with little financial support from the government and could serve as a possible guideline to the implementation of an IED scheme in South Africa.

SUMMARY

Business and financial risk inherent in agriculture can lead to income variability, especially in the grain sectors where droughts are common. In the past, the South African government response to drought mainly involved providing drought relief, culminating in billions of rands worth of assistance, mostly to maize farmers. The South African government has since changed this policy and has encouraged farmers to manage risks themselves, in order to reduce demands on government funds. One option currently being proposed to the National Department of Agriculture (NDA, 1997) is an Income Equalisation Deposit (IED) scheme. An IED scheme could provide a reserve fund in which farmers invest part of their income during “good” years, and then are taxed on this income only when they withdraw the money for use in “bad” years. An IED scheme would operate as a risk management tool to stabilise farm incomes.

The concept of establishing an IED scheme in South Africa has previously been rejected for a number of reasons. The use of an IED scheme as a tax instrument to promote improved cash flow and risk management has been considered by many, focusing largely on the tax implications of the scheme (Lamont, 1990; NDA, 1997 and Fuchs, 1999). More recently, the focus has been on the economic feasibility of such a scheme. Nieuwoudt and Howell (2000) evaluated the past criticisms of IED schemes and concluded that the IED scheme proposed to the NDA could be feasible in South Africa, possibly replacing the drought relief scheme for livestock farmers and being made available to all farmers. This study complements Nieuwoudt and Howell’s study by finding out whether practicing tax consultants think an IED scheme would be viable for commercial farmers in South Africa. The objectives of the study were two-fold. The first objective was to determine whether there is a need for an IED scheme and, if there is a need, how the scheme should be implemented

with regards to existing tax provisions available to commercial farmers. The second objective was to determine what types of farmers are most likely to make use of an IED.

Fifty-two consultants based mainly in KwaZulu-Natal (KZN), and in the Maize Triangle and surrounding areas (North-West Province, North-Eastern Free State and Mpumalanga), were surveyed using a mail questionnaire comprising of a scenario and a questionnaire section. These areas were selected to obtain the views of consultants that dealt with tax matters for a range of farm situations, from relatively low risk livestock and diversified farmers in KZN (less variable net farm incomes), to relatively high risk maize farmers (more variable net farm incomes) in the Maize Triangle and adjacent regions.

The questionnaire section was compiled to obtain information on whether practicing tax consultants think an IED scheme would be viable for commercial farmers in South Africa, whether they would recommend it to their clients, and their perceptions of how it would fit with existing tax provisions for farmers and, the tax deferral effects of such a scheme. The scenarios were compiled to determine what types of farmers are most likely to use an IED. Each consultant was asked to review nine scenarios of typical farms in the study regions and to decide whether they would recommend an IED scheme for each scenario. Scenarios one to eight used in the analyses were constructed using a statistical experimental design, with the ninth scenario serving as a control as a measure of consistency between the consultants. These scenarios (farms) were depicted using four variables that showed different levels (high, low and intermediate) of farm business leverage (debt/asset ratio), net farm income, business risk (index of net farm income variability), and off-farm income, based on representative livestock, maize and diversified farm record data supplied by the NDA (1999).

Results from the questionnaire revealed that, in the consultants' view, an IED scheme could be feasible, help farmers to avoid over-capitalising during years of good cash flow, and provide liquidity in "lean" times. Most of them supported the recommendations that the Land Bank drought relief provision (paragraph 13A) for livestock farmers could be replaced with an IED scheme that all farmers could access. They also felt that the capital expenditure (paragraph 12(1)) and accumulated depreciation allowance provisions (section 12B) available to farmers should remain in place and, all of the consultants supported using an IED scheme with the current income averaging provision (paragraph 19(2)). Implementing an IED scheme was seen as a benefit to all farmers, with only a few disadvantages cited. Firstly, if income tax rates increase due to fiscal drag, the deferred liability may be greater than if the farmer had paid the tax liability earlier. The administrative costs of setting up and staffing such a scheme may be prohibitive, and it was suggested that the Land Bank drought relief provision with its present structures could be used to house an IED scheme, with only minor changes to the Income Tax Act. Farmers who have not withdrawn funds within the IED time limit may also face a large tax liability in the final year, whether they need the funds or not. The tax deferral implied by the scheme would be a possible concern for the South African Revenue Services.

Discriminant analysis was used to determine which factors distinguish best between adopters and non-adopters of an IED scheme. The independent variables (and their expected signs) which were expected to distinguish IED scheme adopters from non-adopters included: a) debt/asset ratio (-), due to the higher cost of borrowing than investing, it was expected that farmers with debt will redeem debt first before investing in an IED scheme, b) off-farm income (-), it was hypothesised that higher levels of off-farm income may indicate clients that have diversified investments and so would be less likely to need an IED, c) net farm income (+), it was postulated that adopters would have higher net

farm incomes (higher profits) as they would have the means to save, d) index of variation in net farm income (+), it was hypothesised that an IED scheme would suite farms having a higher index of net farm income variability as they are exposed to more business risk. Results of the analysis revealed that all variables were in accordance with *a priori* expectations. The debt/asset ratio, net farm income and index of net farm income variable were all statistically significant at the 1% level of probability, with the debt/asset ratio being the most important variable distinguishing between adopters and non-adopters of an IED scheme. Amongst the high debt farmers, high and intermediate risk maize farmers, and high risk livestock farmers are most likely to make use of an IED scheme.

In order to cover all combinations of income variability with farming type, the coefficients of variation for business risk (index of net farm income variability) were calculated using the original representative livestock, maize and diversified farm record data supplied by the NDA (1999). The discriminant function obtained from discriminant analysis was then used to determine the outcome of different enterprise combinations with various levels of debt, off-farm income and net farm income. This effectively allowed all combinations of income variability with farming type. The coefficients calculated represented high, intermediate and low risk maize and livestock farmers, and diversified farmers. All farmers (maize, livestock and diversified) would most likely invest in an IED scheme if the net farm income variable is at a high level with the remaining variables held constant at low levels. Farmers carrying little debt with a high net farm income have the resources to make use of the scheme. High and intermediate risk (income variability) maize farmers, and high risk livestock farmers would most likely invest in an IED scheme if the debt/asset ratio, net farm income and off-farm income variables are held constant at low levels. The risk associated with low

risk maize farmers, intermediate and low risk livestock farmers, and diversified farmers is not sufficient to justify the use of an IED scheme. This signifies the use of an IED scheme as a risk management tool as higher risk farmers (higher income variability) are more likely to use the scheme. High risk maize farmers would be the only likely users of an IED scheme if the debt/asset ratio and net farm income variables are held at high levels with the off-farm income variable at a low level. The positive effect of the net farm income and risk variable offsets the negative effect of the debt/asset variable in this particular sample. In the remaining samples, the combined effects of the risk and net farm income variable is too low to offset the debt/asset variable. All farmers would most likely not invest in an IED scheme if the debt/asset variable is at a high level with the remaining variables held constant at low levels. The negative effect of the debt/asset variable offsets the positive effect of the risk variable.

The tax provisions available to commercial farmers do not provide an incentive for farmers to become more liquid and better prepared to handle risk. An IED scheme can be used to manage volatility at the total profit level, which is largely weather related, by providing an incentive for farmers to become more liquid and better prepared to handle risk. An IED scheme can potentially form an effective part of a risk management strategy, especially if it is used in conjunction with other strategies. Since maize farmers have been the main beneficiaries of past government drought aid, this could mean reduced demands on government drought relief funds in future if an IED scheme is introduced.

Results obtained from the questionnaire section and the discriminant analysis provided information regarding the major criticisms of an IED scheme in the past. Results supported the criticism that an

IED scheme will favour farmers with high net farm incomes. Results also supported the criticism that an IED scheme impinges on the sound principle that revenue should be taxed in the year in which it accrues, but provided the incentive of enhanced tax monitoring which could partly offset this criticism. The criticisms of the current averaging scheme enabling farmers in good years to make provision for poorer years by means of a tax saving, and an IED scheme offering considerable scope for tax sheltering were, however, not supported by the results of the study.

To obtain more scope as to the potential short run use of an IED scheme in South Africa, an area of future research could involve determining where the debt is predominantly concentrated in the livestock and crop sectors, and the extent to which these farmers could make use of an IED scheme. As a possible means to reduce administration costs for the Land Bank and encourage more IED use, additional research could be to look at the possibility of commercial banks offering IED facilities. Lastly, Australia has successfully implemented a Farm Management Deposit Scheme which operates in a similar way to the proposed IED scheme. A comprehensive evaluation of the Australian FMD scheme should be made as it could serve as a possible guideline to the implementation of an IED scheme in South Africa.

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APPENDICES

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Appendix A: Consultant questionnaire

24 July 2000

Dear Consultant

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IED Scheme Questionnaire

This questionnaire and the proceeding study attempts to highlight factors that need to be considered when assessing the viability of an Income Equalisation Deposit (IED) scheme for commercial farmers in South Africa. An IED scheme has been proposed as a means to stabilise farm incomes. An IED scheme would operate as a reserve fund into which farmers could invest part of their income during “good” years, and would only be taxed on this income when they withdrew it. Savings can be withdrawn during “bad” times. An IED scheme thus acts as a liquidity reserve and a means of tax deferral for the farmer.

The aim of this questionnaire is to determine whether or not you would recommend that farmers use an IED scheme, and under what circumstances you would recommend its use. Four factors have been chosen to assess the viability of an IED scheme, namely, debt/asset ratio; off-farm income; net farm income and the index of variation in net farm income. A high (H), low (L) and intermediate (A) figure for each variable is depicted. Please could you carefully evaluate the nine scenarios with different values of these four factors, and then give your expert opinion on whether you would or would not recommend the use of an IED scheme for each scenario. There are four scenarios for livestock farmers, four scenarios for maize farmers and one scenario for a diversified farmer. We would also be grateful if you could provide answers to eight key questions regarding the use and implementation of an IED scheme. On completion, could the survey kindly be posted back in the self addressed envelope. Your expert opinion is of great importance to the success of the survey. An executive summary of the research results and implications of the scheme will be posted to you on completion of the study. For any enquiries, please contact John on 082 924 8617.

SURVEY QUESTIONS

1. Do you consider the scenarios to be realistic? Do you consider an IED scheme to be feasible and, do you agree with the concept of an IED scheme?

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2. Would you recommend an IED scheme to your farmer clients? What percentage of clients do you think will use it?

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3. Would you recommend the Land Bank provision (paragraph 13A) with respect to drought related livestock sales to livestock farmers? Why?

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4. Would you support replacing the Land Bank provision mentioned in question 3 (for all farmers) with an IED scheme for all farmers? Why?

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5. Do you perceive that the tax deferral implied by the IED will be considered a problem (liquidity shortfall) by the South African Revenue Services? Why?

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6. Should the accelerated depreciation allowance provision (section 12B) and the capital expenditure provision (paragraph 12(1)) be used in conjunction with an IED scheme, or should they be withdrawn? Why?

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7. If an IED scheme is implemented, should it be used with or without the averaging provision (paragraph 19(2))? Why?

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8. In your opinion, are there any disadvantages that you foresee with an IED scheme? Why?

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Appendix B: Typical consultant scenario set

CONSULTANT 1

Scenario 1: Livestock

Debt/Assets	(L)		<15%
Off-farm income	(L)		0
NFI*	(L)		<R50 000
Index of variation in NFI (100 = average)	(L)	1995	58
		1996	116
		1997	124
		1998	91
		1999	111
Yes/No			

Scenario 2: Livestock

Debt/Assets	(H)		>40%
Off-farm income	(H)		>R20 000
NFI*	(L)		<R50 000
Index of variation in NFI (100 = average)	(L)	1995	58
		1996	116
		1997	124
		1998	91
		1999	111
Yes/No			

Scenario 3: Maize

Debt/Assets	(H)		>40%
Off-farm income	(H)		>R20 000
NFI*	(L)		<R50 000
Index of variation in NFI (100 = average)	(H)	1995	28
		1996	201
		1997	-30
		1998	276
		1999	25
Yes/No			

Scenario 4: Maize

Debt/Assets	(L)		<15%
Off-farm income	(L)		0
NFI*	(L)		<R50 000
Index of variation in NFI (100 = average)	(H)	1995	28
		1996	201
		1997	-30
		1998	276
		1999	25
Yes/No			

Scenario 5: Livestock

Debt/Assets	(L)		<15%
Off-farm income	(H)		>R20 000
NFI*	(H)		<R300 000
Index of variation in NFI (100 = average)	(L)	1995	58
		1996	116
		1997	124
		1998	91
		1999	111
Yes/No			

Scenario 6: Livestock

Debt/Assets	(H)		>40%
Off-farm income	(L)		0
NFI*	(H)		<R300 000
Index of variation in NFI (100 = average)	(L)	1995	58
		1996	116
		1997	124
		1998	91
		1999	111
Yes/No			

Scenario 7: Maize

Debt/Assets	(H)		>40%
Off-farm income	(L)		0
NFI*	(H)		<R300 000
Index of variation in NFI (100 = average)	(H)	1995	28
		1996	201
		1997	-30
		1998	276
		1999	25
Yes/No			

Scenario 8: Maize

Debt/Assets	(L)		<15%
Off-farm income	(H)		>R20 000
NFI*	(H)		<R300 000
Index of variation in NFI (100 = average)	(H)	1995	28
		1996	201
		1997	-30
		1998	276
		1999	25
Yes/No			

Scenario 9: Diversified

Debt/Assets	(A)		30%
Off-farm income	(A)		R10 000
NFI*	(A)		R175 000
Index of variation in NFI (100 = average)	(A)	1995	119
		1996	89
		1997	111
		1998	83
		1999	97
Yes/No			

Note:

(L) = low value
(H) = high value
(A) = average value

*NFI=Gross farm income less farm operating costs, excluding foreign factor costs

Appendix C: Data set

	E	D_A	OI	NFI	RISK	Y_N
1	0	0	0	0	0.523	0
2	0	1	1	0	0.523	0
3	1	1	1	0	2.630	0
4	1	0	0	0	2.630	1
5	0	0	1	1	0.523	1
6	0	1	0	1	0.523	0
7	1	1	0	1	2.630	1
8	1	0	1	1	2.630	1
9	0	0	1	0	0.523	0
10	0	1	0	0	0.523	0
11	1	1	0	0	2.630	0
12	1	0	1	0	2.630	1
13	0	0	0	1	0.523	1
14	0	1	1	1	0.523	0
15	1	1	1	1	2.630	1
16	1	0	0	1	2.630	1
17	0	1	0	0	0.523	0
18	0	0	1	0	0.523	0
19	1	0	1	0	2.630	1
20	1	1	0	0	2.630	0
21	0	1	1	1	0.523	0
22	0	0	0	1	0.523	1
23	1	0	0	1	2.630	1
24	1	1	1	1	2.630	0
25	0	1	1	0	0.523	0
26	0	0	0	0	0.523	0
27	1	0	0	0	2.630	1

	E	D_A	OI	NFI	RISK	Y_N
28	1	1	1	0	2.630	0
29	0	1	0	1	0.523	0
30	0	0	1	1	0.523	1
31	1	0	1	1	2.630	1
32	1	1	0	1	2.630	1
33	0	0	0	0	0.523	0
34	0	1	1	0	0.523	0
35	1	1	0	0	2.630	0
36	1	0	1	0	2.630	1
37	0	1	1	1	0.523	0
38	0	0	0	1	0.523	1
39	1	0	1	1	2.630	1
40	1	1	0	1	2.630	0
41	0	0	1	0	0.523	0
42	0	1	0	0	0.523	0
43	1	1	1	0	2.630	0
44	1	0	0	0	2.630	1
45	0	1	0	1	0.523	0
46	0	0	1	1	0.523	1
47	1	0	0	1	2.630	1
48	1	1	1	1	2.630	1
49	0	1	0	0	0.523	0
50	0	0	1	0	0.523	0
51	1	0	0	0	2.630	1
52	1	1	1	0	2.630	0
53	0	0	1	1	0.523	1
54	0	1	0	1	0.523	0

	E	D_A	OI	NFI	RISK	Y_N
55	1	1	1	1	2.630	1
56	1	0	0	1	2.630	1
57	0	1	1	0	0.523	0
58	0	0	0	0	0.523	0
59	1	0	1	0	2.630	0
60	1	1	0	0	2.630	0
61	0	0	0	1	0.523	1
62	0	1	1	1	0.523	0
63	1	1	0	1	2.630	1
64	1	0	1	1	2.630	1
65	0	0	0	0	0.523	0
66	0	1	0	0	0.523	0
67	1	0	1	0	2.630	0
68	1	1	1	0	2.630	0
69	0	1	1	1	0.523	0
70	0	0	1	1	0.523	1
71	1	1	0	1	2.630	0
72	1	0	0	1	2.630	1
73	0	0	1	0	0.523	0
74	0	1	1	0	0.523	0
75	1	0	0	0	2.630	1
76	1	1	0	0	2.630	0
77	0	1	0	1	0.523	0
78	0	0	0	1	0.523	1
79	1	1	1	1	2.630	0
80	1	0	1	1	2.630	1
81	0	1	0	0	0.523	0

	E	D_A	OI	NFI	RISK	Y_N
82	0	0	0	0	0.523	0
83	1	1	1	0	2.630	0
84	1	0	1	0	2.630	1
85	0	0	1	1	0.523	1
86	0	1	1	1	0.523	0
87	1	0	0	1	2.630	1
88	1	1	0	1	2.630	1
89	0	1	1	0	0.523	0
90	0	0	1	0	0.523	0
91	1	1	0	0	2.630	0
92	1	0	0	0	2.630	1
93	0	0	0	1	0.523	1
94	0	1	0	1	0.523	0
95	1	0	1	1	2.630	1
96	1	1	1	1	2.630	1
97	0	0	0	0	0.523	0
98	0	1	1	0	0.523	0
99	1	1	1	0	2.630	0
100	1	0	0	0	2.630	1
101	0	0	1	1	0.523	1
102	0	1	0	1	0.523	0
103	1	1	0	1	2.630	1
104	1	0	1	1	2.630	1
105	0	0	1	0	0.523	0
106	0	1	0	0	0.523	0
107	1	1	0	0	2.630	0
108	1	0	1	0	2.630	1

	E	D_A	OI	NFI	RISK	Y_N
109	0	0	0	1	0.523	1
110	0	1	1	1	0.523	0
111	1	1	1	1	2.630	1
112	1	0	0	1	2.630	1
113	0	1	0	0	0.523	0
114	0	0	1	0	0.523	0
115	1	0	1	0	2.630	1
116	1	1	0	0	2.630	0
117	0	1	1	1	0.523	0
118	0	0	0	1	0.523	1
119	1	0	0	1	2.630	1
120	1	1	1	1	2.630	0
121	0	1	1	0	0.523	0
122	0	0	0	0	0.523	0
123	1	0	0	0	2.630	1
124	1	1	1	0	2.630	0
125	0	1	0	1	0.523	0
126	0	0	1	1	0.523	1
127	1	0	1	1	2.630	1
128	1	1	0	1	2.630	1
129	0	0	0	0	0.523	0
130	0	1	1	0	0.523	0
131	1	1	0	0	2.630	0
132	1	0	1	0	2.630	1
133	0	1	1	1	0.523	0
134	0	0	0	1	0.523	1
135	1	0	1	1	2.630	1

	E	D_A	OI	NFI	RISK	Y_N
136	1	1	0	1	2.630	1
137	0	0	1	0	0.523	0
138	0	1	0	0	0.523	0
139	1	1	1	0	2.630	0
140	1	0	0	0	2.630	1
141	0	1	0	1	0.523	0
142	0	0	1	1	0.523	1
143	1	0	0	1	2.630	1
144	1	1	1	1	2.630	1
145	0	1	0	0	0.523	0
146	0	0	1	0	0.523	0
147	1	0	0	0	2.630	1
148	1	1	1	0	2.630	0
149	0	0	1	1	0.523	1
150	0	1	0	1	0.523	0
151	1	1	1	1	2.630	1
152	1	0	0	1	2.630	1
153	0	1	1	0	0.523	0
154	0	0	0	0	0.523	0
155	1	0	1	0	2.630	0
156	1	1	0	0	2.630	0
157	0	0	0	1	0.523	1
158	0	1	1	1	0.523	0
159	1	1	0	1	2.630	1
160	1	0	1	1	2.630	1
161	0	0	0	0	0.523	0
162	0	1	0	0	0.523	0

	E	D_A	OI	NFI	RISK	Y_N
163	1	0	1	0	2.630	0
164	1	1	1	0	2.630	0
165	0	1	1	1	0.523	0
166	0	0	1	1	0.523	1
167	1	1	0	1	2.630	0
168	1	0	0	1	2.630	1
169	0	0	1	0	0.523	0
170	0	1	1	0	0.523	0
171	1	0	0	0	2.630	1
172	1	1	0	0	2.630	0
173	0	1	0	1	0.523	0
174	0	0	0	1	0.523	1
175	1	1	1	1	2.630	0
176	1	0	1	1	2.630	1
177	0	1	0	0	0.523	0
178	0	0	0	0	0.523	0
179	1	1	1	0	2.630	0
180	1	0	1	0	2.630	1
181	0	0	1	1	0.523	1
182	0	1	1	1	0.523	0
183	1	0	0	1	2.630	1
184	1	1	0	1	2.630	1
185	0	1	1	0	0.523	0
186	0	0	1	0	0.523	0
187	1	1	0	0	2.630	0
188	1	0	0	0	2.630	1
189	0	0	0	1	0.523	1

	E	D_A	OI	NFI	RISK	Y_N
190	0	1	0	1	0.523	0
191	1	0	1	1	2.630	1
192	1	1	1	1	2.630	1

Appendix D: Treatment combinations

Replication 1:

Scenario	Block 1	Block 2	Block 3	Block 4
1	11112	12112	21112	22112
2	22112	21112	12112	11112
3	22121	21121	12121	11121
4	11121	12121	21121	22121
5	12212	11212	22212	21212
6	21212	22212	11212	12212
7	21221	22221	11221	12221
8	12221	11221	22221	21221

Replication 2:

Scenario	Block 1	Block 2	Block 3	Block 4
1	11112	12112	21112	22112
2	22112	21112	12112	11112
3	21121	22121	11121	12121
4	12121	11121	22121	21121
5	22212	21212	12212	11212
6	11212	12212	21212	22212
7	12221	11221	22221	21221
8	21221	22221	11221	12221

Replication 3:

Scenario	Block 1	Block 2	Block 3	Block 4
1	11112	12112	21112	22112
2	21112	22112	11112	12112
3	12121	11121	22121	21121
4	22121	21121	12121	11121
5	22212	21212	12212	11212
6	12212	11212	22212	21212
7	21221	22221	11221	12221
8	11221	12221	21221	22221

Treatment factors are listed in the order: A B C D E

Where: A = Debt/Asset ratio (1 = low, 2 = high)
 B = Annual Off-farm income (1 = low, 2 = high)
 C = Annual Net farm income (1 = low, 2 = high)
 D = Index of variation in net farm income (1 = low, 2 = high)
 E = Type of farming (1 = maize, 2 = livestock)