TAX SHIELDS: THEIR IMPLICATIONS FOR FARM PROJECT INVESTMENT, RISK AND RETURN

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The recent economic liberalisation process which has evolved in New Zealand has led to the more pronounced reflection of market environments on participants in the New Zealand economy. Farmers have been at the forefront of the procedure and as a consequence they have been expected to take more responsibility for their activities and absorb more of the impact of changes in the markets for their products. This means that the level of risk faced by farmers has increased. In other words, the institutional arrangements and Government policy initiatives which have previously provided for an absorption of much of the risk facing farmers have been removed or modified.

Techniques for incorporating risk in investment decision making must therefore be adopted by farmers and explicit recognition made of the probabilities associated with the success or failure of proposed investments.

Tax procedures have been used by Government as part of the risk amelioration process. The effect of the tax procedures available to farmers has not been calculated or related to the amelioration of risk in any explicit way.

This Research Report presents an analysis of the tax procedures which are and have been available to farmers and expresses the effect of those procedures in terms of the benefit available from use of them, both in monetary terms and in terms of risk reduction. This work represents a further step in the understanding of investment decision making and the impact of Government initiatives on such decisions. The work was financially supported by the Rural Policy Unit of MAFTech and formed a part of a larger study which covered a wide range of risk related aspects.

A C Zwart
DIRECTOR
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We would like to make special mention of Dr Robin Johnson, Senior Policy Consultant with the Rural Policy Unit, whose foresight and enthusiasm provided the impetus for this project. We appreciate the degree of co-operation, persistence and interest accorded us by Dr Johnson.

We are also most appreciative of the efforts of Mrs Jan Clark, the AERU Secretary, who was landed the responsibility of matching the word processing excesses and aspirations of three grown men who should have known better.

Finally, special recognition should go to two men whose actions over a period of fifteen years really provided the basis for this report. We are not sure who (if any) we should thank but the tremendous influences of both Sir Robert Muldoon and Mr Roger Douglas are noted here for posterity.
SUMMARY

Since 1984, New Zealand has undergone a rapid transformation from a highly protectionist economy to one of the most open market economies in the world. This has involved the removal of many incentive schemes and subsidies, a revamp of the taxation system and a transference of much of the responsibility for risk bearing, from the government to the individual. This study focuses on the impact of taxation on farm risk.

The main objectives of this study were to outline recent past and current tax shields available in New Zealand farming and to explore their implications for the nature, expected return and riskiness of farm investments. The study method comprised a combination of a literature review and computer model analysis. The model developed was a 10 year capital budgeting model for a hypothetical case study farm using a LOTUS 123 add-on simulation package called @RISK.

Chapter 2 of the report provides an overview of the reforms to the taxation of agriculture. The most significant of these include:

(1) The replacement of the standard value scheme for valuing livestock for income tax purposes with schemes based on average market values.

(2) The gradual phasing out of tax deductibility of development expenditure in farming.

(3) The deductibility of forestry expenses transferred from time of expense until time of harvest.

(4) Removal of tax concessions to primary producer and marketing boards.

(5) Abolition of investment allowances and special first year depreciation allowances.

Chapter 3 identifies possible sources of tax shields still remaining in agriculture. These relate to anomalies in the provisions regarding the exclusion of 'interest clawback' and tax liability for capital gains on farmland; the valuation of livestock for tax purposes; the provision for Income Equalisation Reserve deposits; the distinction between development and maintenance expenditure; and the distinction between business and private expenditure.

The issue of approaches to evaluating the returns of farm investments is addressed in Chapter 4. Given the nature and size of the typical New Zealand family farm, it is concluded that the most appropriate method of conducting project appraisals is to account for all aspects of taxation, inflation and borrowing within the cashflows and to discount the marginal net cashflows at the cost of equity capital.
Some of the underlying factors affecting the nature and size of tax shield effects are examined in Chapter 5. The principal effect of tax shields is to add value to the farm business. However, their effects are limited by the level of farm income, marginal tax rates, borrower attitudes and the availability of alternative tax shelters. Differences in the degree to which farmers seek to utilise the benefits of tax shields occur due to differences in both risk attitudes and abilities in financial appraisal and planning.

Chapter 6 describes the capital budgeting model developed and details the results of the model analysis. The results indicate that the tax deductibility of interest expenses remains the single major tax shield available to farmers. In addition, the Herd Scheme for livestock valuation is significantly better than the Trading Stock Scheme with rising stock values but is only marginally worse with falling stock values. The model results also showed that in most cases where a farm is in a profit situation, farm investment is more advantageous under the present form of taxation regime than under the pre 1984 regime.

The report concludes by outlining some implications of the study findings for both government policy and farm management. A number of recommendations for further research are also elucidated.
CHAPTER 1
INTRODUCTION

1.1 Background

The post war period leading up to the mid 1980's saw exceptional growth in the level of protectionism of New Zealand industry and, in particular, the agricultural industry. A plethora of subsidies, incentive schemes and tax shields resulted in a situation which, by the early 1980's, was widely acknowledged as being both economically unsustainable and the cause of a huge misallocation of New Zealand's resources. The election of the 1984 Labour Government resulted in some rapid policy changes in an effort to make New Zealand industry more market responsive and more internationally competitive. Many of the existing subsidies and incentive schemes were phased out and moves were made to establish a more equitable taxation regime.

The industry which bore much of the brunt of the initial restructuring was agriculture. The direct effects of the changes to agricultural schemes and policies were accentuated by a number of other simultaneous events occurring. These included;

* a decline in world agricultural commodity prices;
* an escalation of real interest rates;
* an appreciation of the New Zealand dollar;
* a persistence of high inflation rates;
* the stalled restructuring of other industry sectors; and
* a number of natural disasters in various regions.

Within a very short space of time the farming sector was transformed from one of complacent stability, buoyed along by rapidly inflating land prices, to one which was overburdened with debt, facing low to negative returns and wallowing in a sea of uncertainty.

The period of greatest restructuring appears to be over. Some positive outcomes of the government's policies are being seen and farmers have adapted far better to the new environment than many correspondents predicted. However, a more subtle yet most important result of the restructuring process has been the transference of much of the responsibility for bearing risk from the government to the individual farmer. This change has required the development of a new set of skills from farmers and has resulted in a new role for farm consultants and agricultural researchers: risk analysis and management. The focus of farm management and farm management research has shifted from one of pure profit optimisation to one of balancing expected farm returns with appropriate levels of risk acceptance.

Historically, farm management research into the area of risk in farming has concentrated on trying to apply complex decision theory models. These attempts have largely been academic and have
contributed little to applied farm management. With the new emphasis being placed on risk management in farming, farm management researchers have begun to look more closely at approaches to the analysis and management of risk developed within the areas of corporate finance and corporate strategy. These approaches appear to have considerable potential to be adapted for use in applied farm management.

A fundamental principle adopted in the corporate approach to risk is to isolate risk into two separate elements:

* Financial risk, which is the risk faced by the firm as a result of the level of debt.

* Business risk, which is the riskiness of the firm's assets irrespective of the level of debt (Brigham and Gapenski, 1988).

The nature of these types of risk and the application of the corporate approaches to their analysis and management in farming, were the subject of two separate and concurrent studies undertaken on behalf of the Rural Policy Unit of MAFTECH by Martin and Lee (1990) and Newman et al. (1990).

This study focuses on the impact of taxation on farm risk. Taxation can have considerable effect on the level of both business and financial risk, and also on farming returns. For instance, tax shields can be used to lower the costs of doing business (reduction of business risk), or to lower the costs of borrowing (reduction of financial risk). The magnitude of these impacts is also dependent on taxation rates. The definition of tax shield used in this study is given in Section 1.2 below.

1.2 Definition of Tax Shield

It is a feature of taxation in English-speaking countries that there are a large number of terms referring to 'not paying tax', and their meanings change regularly as they acquire inappropriate connotations. For example, in New Zealand at present 'tax incentive', 'tax concession', 'tax expenditure', 'tax loophole', 'tax shelter', 'tax incentive', tax preference', 'tax-aggressive transactions', 'tax planning', 'tax avoidance' and 'tax mitigation' are all used in different contexts.

However 'tax shield' is one term which is not widely used. The accounting dictionaries published by Robb (1986), Estes (1985) and Kohler (1975) do not include references to it. In addition, the term is not discussed by the standard tax reference sources for New Zealand (New Zealand Income Tax Legislation, 1989), Australia (Ryan & O'Grady, 1985), the United States (Sommerfield, Anderson, Brock & Milliron, 1989) and the United Kingdom (Shrubsall & Edwards, 1988).

The term 'tax shield' is generally used in standard finance texts, however, frequently with a specific meaning related to the
financing of investments. Van Horne (1989) describes a tax shield as representing in effect a subsidy paid for the use of debt. When the effects of other ways of reducing tax are discussed, Van Horne (1989) uses another term, 'tax shelter'. Brealey & Myers (1984) discuss a tax shield as a reduction in tax payable as a consequence of borrowing. (There is also a reference to 'tax shields' arising in other ways, e.g. from investment tax credits (Brealey & Myers 1984).

The extended meaning of 'tax shield', which applies to forms of reducing tax other than borrowing, has also been used in some other papers, e.g. Myers (1987) which identifies these as 'non-interest tax shields'; Long & Malitz (1987) which describes them as 'non-debt tax shields' and Johnson (1989).

In this study, the extended definition of 'tax shields' is adopted. This includes both:

1. Tax savings which may occur as a result of decisions to choose particular methods of financing.
2. The wider area of 'non-interest tax shields'.

This term includes tax shelters, defined by Sommerfield et.al. (1989) as 'anything that affords a taxpayer some relief from the full effect of income tax'.

1.3 Project Objectives and Scope

The objectives and scope of this project arise from the historical background to taxation of agriculture. During the period leading up to 1984, in addition to the direct subsidies and production incentive schemes, the proliferation of tax shields available to farmers and the highly progressive rates of personal income tax schedule played a very visible role in stimulating agricultural investment. Much of this investment was for tax avoidance reasons rather than for sound economic reasons.

Since 1984 the Labour Government moved to make the taxation system more neutral with the aim of creating a system "that must neither penalise nor favour investment decisions" (R Douglas, pers. comm., 1985). This has resulted in some major changes to the taxation of agriculture, as attempts have been made to place agriculture on an equivalent taxation basis with other industry sectors.

The main objectives of this study are to outline (recent) past and current tax shields available in the New Zealand farming sector and to explore their implications for the nature, expected return and riskiness of farm investments.

Other aims of the project include:

* to identify anomalies in the mechanics of various tax measures;
to construct a spreadsheet simulation model to evaluate the impact of tax shields on farm investment risk and return; and

to draw conclusions and recommendations regarding the significance of tax shields in agriculture.

The scope of the project is interpreted to include:

(1) Explicit tax shields specific to agriculture.
(2) Explicit tax shields available to all business sectors.
(3) Tax anomalies in agriculture which implicitly provide tax shields.
(4) The role of tax provisions in determining the magnitude of tax shields.

1.4 Study Method

The study method comprised a combination of a literature review and computer model analysis. The major stages of the project are listed below:

(1) Literature review of tax shields, risk and project appraisal issues and their application to the business of farming in New Zealand.

(2) Case study and computer simulation model development.

(3) Systematic model analysis of tax shield impacts of farm investment risk and return.

(4) Development of conclusions and recommendations.

An overview of the New Zealand tax system is presented in Chapter 2. This concentrates on tax measures of particular importance and relevance to farming and primary industry and reviews some of the recent changes in the tax system. Chapter 3 discusses specific tax shields and tax anomalies available to farmers. Chapters 4 and 5 review the literature and theory regarding project appraisal and tax shield effects, with respect to farming risk and return. These chapters provide the theoretical background for the model analysis undertaken. The simulation model analysis and results are presented in Chapter 6 while Chapter 7 notes the conclusions and recommendations arising from this analysis.
CHAPTER 2

AN OVERVIEW OF TAXATION IN NEW ZEALAND AGRICULTURE

Tax incentives have often been used to encourage investment and development in agriculture. Prior to 1984, taxation considerations had a significant influence on investment returns and decisions made in the primary sector. Many tax shelter effects were present and it is widely believed that development was taking place to obtain these benefits rather than for productive reasons.

During the period 1984-89 the government embarked on a process of reform of taxation. Its aims included simplifying the Income Tax Act, broadening the tax base, reducing tax avoidance and improving income tax neutrality between different sectors of the economy. Many of the changes and reforms were of a general nature, not aimed specifically at agriculture, but nonetheless had indirect effects on farmers. Other changes aimed at farmers had only a minor effect. However, there were also a number of reforms that had a significant impact on farming.

In 1984, there were 34 categories of tax expenditure affecting New Zealand agriculture (Lattimore and Wood-Belton, 1986). Two of these categories had in fact already terminated; 22 have since been removed; and a further three categories are currently being phased out. Only six relatively minor tax expenditures of those identified by Lattimore and Wood-Belton (1986) remain in full effect.

The major direct reforms of concern in this study are the changes to the system of livestock valuation and the reform of development expenditure allowances and depreciation. Changes to tax rates may also have had some significant (but indirect) effects through the reduction in deductibility of expenditure with the lowering of the highest marginal tax rate from 66% to 33%.

2.1 Major Tax Reforms Targeted at Agriculture

A number of significant tax reforms were aimed specifically at agriculture. These changes mainly arose from a Consultative Document published in March 1986 and the subsequent report of a consultative committee appointed to examine primary sector taxation. Livestock taxation was particularly addressed by the Consultative Document, as was deductibility of development expenditure. King (1990) lists the following major changes or reforms to taxation of agriculture:

* Livestock valuation for annual income tax purposes.
* Deduction of developmental expenditure for agriculture, horticulture and aquaculture and the
deductibility of expenditure on forestry.

* Repeal of or exemption from constraint, claw back and relief provisions pursuant to the reform listed above.

* Removal of exemptions from assessable income (and income tax free status) of the statutory Primary Producer and/or Marketing Boards and Cooperative Companies, and the introduction of the new imputation tax system applying to these groups.

2.1.1 Livestock Valuation

Prior to the reforms, livestock could be valued for income tax purposes at standard values approved by the IRD. Under the Income Tax Act 1976 livestock were defined as Trading Stock, but could be valued at standard values as an alternative to the inventory valuation rules applying to other businesses. The standard values used were generally low, often 10% or less of the market value of the stock.

It was only when stock were finally disposed of that the difference between book value and market value became assessable as income for tax purposes. In addition, farmers were able to value livestock at the cost of production, market value or replacement value, but few farmers used these options. The reform replaced the standard value system with two options for valuing livestock; namely the Trading Stock Scheme and the Herd Scheme. These are briefly described below. The cost option, of valuing stock at cost of production, market value or replacement prices, was retained and a separate system for 'high-priced' livestock was introduced. A number of minor modifications have subsequently been made to the various livestock valuation schemes.

(1) Trading Stock Scheme

Under the Trading Stock Scheme, livestock are valued at 70% of a three year moving average based on national average market value (NAMV) of the appropriate classes of livestock. Any change in the total NAMV of livestock between the beginning and end of an income year is treated as assessable income or deductible loss in the same manner as other inventory valuation systems. Therefore changes in market value as well as changes in stock numbers may give rise to taxable income.

(2) Herd Scheme

The herd scheme applies to animals held primarily for the production of progeny, wool, milk, velvet or fibre. These stock are treated as capital rather than inventory. Herd livestock are valued at both the beginning and end of each
income year at the full NAMV for the appropriate livestock. Thus fluctuations in the market value of the herd livestock do not affect the amount of taxable income. Only changes in the number or composition of livestock in the herd will affect taxable income.

Farmers can choose to use the Trading Stock Scheme or cost price alternatives to value any stock classes not eligible for the Herd Scheme. Alternatively, the Trading Stock Scheme or the alternatives of cost of production, market value or replacement price can be used to value all livestock classes.

Prior to the 1990 income year, only mature livestock were eligible to be valued under the Herd Scheme.

Examples

The following examples, developed in Burtt and Fleming (1990), demonstrate the differences between the Trading Stock and Herd Schemes.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe hoggets</td>
<td>860</td>
<td>900</td>
<td>$19.20</td>
<td>$16.20</td>
<td>$18.20</td>
</tr>
<tr>
<td>2th ewes</td>
<td>760</td>
<td>700</td>
<td>$27.50</td>
<td>$23.90</td>
<td>$24.90</td>
</tr>
<tr>
<td>3 &amp; 4 yr ewes</td>
<td>1340</td>
<td>1300</td>
<td>$17.40</td>
<td>$12.30</td>
<td>$15.30</td>
</tr>
<tr>
<td>5 &amp; 6 yr ewes</td>
<td>590</td>
<td>600</td>
<td>$13.50</td>
<td>$10.60</td>
<td>$11.65</td>
</tr>
<tr>
<td>Rams</td>
<td>75</td>
<td>60</td>
<td>$136.40</td>
<td>$152.80</td>
<td>$130.30</td>
</tr>
</tbody>
</table>

Note: As the NAMV was started in 1987, the rolling average market value for 1987 is the 1987 NAMV and for 1988 is only a 2 year average.

(1) Trading Stock Scheme

Under the Trading Stock Scheme, all stock are valued at 70% of the rolling average market value.

1989 Closing Tax Values

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe hoggets</td>
<td>900</td>
<td>x 12.27</td>
<td>11043.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2th ewes</td>
<td>700</td>
<td>x 17.19</td>
<td>12033.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 &amp; 4 yr ewes</td>
<td>1300</td>
<td>x 10.00</td>
<td>13000.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 &amp; 6 yr ewes</td>
<td>600</td>
<td>x 7.91</td>
<td>4746.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rams</td>
<td>60</td>
<td>x 91.46</td>
<td>5787.60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Towards Opening Tax Values

Ewe hoggets         | 860       | x 12.74   | 10956.40  |                      |                      |               |
| 2th ewes            | 760       | x 17.43   | 13246.80  |                      |                      |               |
| 3 & 4 yr ewes       | 1340      | x 10.71   | 14351.40  |                      |                      |               |
| 5 & 6 yr ewes       | 590       | x 8.15    | 4808.50   |                      |                      |               |
| Rams                | 75        | x 91.21   | 6840.75   |                      |                      |               |

Equals decrease in taxable income due to changes in livestock $3594.25
(2) Herd Scheme

Under the herd scheme herd animals are valued at 100% of the NAMV and other animals are valued at 70% of the rolling average market value (i.e. under the Trading Stock Scheme).

1988 Closing Tax Values

<table>
<thead>
<tr>
<th>Stock Type</th>
<th>Number</th>
<th>Valuation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe hoggets</td>
<td>900</td>
<td>12.27</td>
<td>11043.00</td>
</tr>
<tr>
<td>2th ewes</td>
<td>700</td>
<td>23.90</td>
<td>16730.00</td>
</tr>
<tr>
<td>3 &amp; 4 yr ewes</td>
<td>1300</td>
<td>12.30</td>
<td>15990.00</td>
</tr>
<tr>
<td>5 &amp; 6 yr ewes</td>
<td>600</td>
<td>10.60</td>
<td>6360.00</td>
</tr>
<tr>
<td>Rams</td>
<td>60</td>
<td>152.80</td>
<td>9168.00</td>
</tr>
</tbody>
</table>

$59,291.00

less Opening Tax Values

<table>
<thead>
<tr>
<th>Stock Type</th>
<th>Number</th>
<th>Valuation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe hoggets</td>
<td>860</td>
<td>12.74</td>
<td>10956.40</td>
</tr>
<tr>
<td>2th ewes</td>
<td>760</td>
<td>23.90</td>
<td>18164.00</td>
</tr>
<tr>
<td>3 &amp; 4 yr ewes</td>
<td>1340</td>
<td>12.30</td>
<td>16482.00</td>
</tr>
<tr>
<td>5 &amp; 6 yr ewes</td>
<td>590</td>
<td>10.60</td>
<td>6254.00</td>
</tr>
<tr>
<td>Rams</td>
<td>75</td>
<td>152.80</td>
<td>11460.00</td>
</tr>
</tbody>
</table>

$63,316.40

Equals decrease in taxable income due to changes in livestock $4025.40

High Priced Livestock

High priced livestock are in a separate class for valuation purposes. "High priced" means that the purchase price is at least three times the previous year's NAMV for cattle, deer and pigs, and four times the previous year's NAMV for sheep and goats. Under the scheme, high priced livestock are subject to an annual depreciation from adulthood over their expected lifetime (provided they have been owned for more than 6 months or have been used for breeding purposes and are more than one year old).

Table 2.1

<table>
<thead>
<tr>
<th>Stock Type</th>
<th>Annual Rate of Depreciation</th>
<th>Scheme Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>25%</td>
<td>4 years</td>
</tr>
<tr>
<td>Cattle</td>
<td>20%</td>
<td>5 years</td>
</tr>
<tr>
<td>Deer - Stags</td>
<td>20%</td>
<td>5 years</td>
</tr>
<tr>
<td>- Others</td>
<td>15%</td>
<td>7 years</td>
</tr>
<tr>
<td>Goats</td>
<td>10%</td>
<td>5 years</td>
</tr>
<tr>
<td>Pigs</td>
<td>33.3%</td>
<td>3 years</td>
</tr>
</tbody>
</table>

Recent Reforms

The Taxation Reform Act (No.6) 1989 has subsequently modified some aspects of the high priced livestock scheme. Livestock purchased for less than $100 will not be valued under the high priced livestock scheme. This essentially removes the likelihood of artificial ceilings being imposed in the sheep industry since only stud animals are likely to be included, and eases the situation with goats which have a low NAMV.

The timing of the first write-down under the high priced livestock scheme has also recently been changed. A new definition of livestock "used for breeding purposes" has been defined for male stock as being used for insemination and for female livestock as being livestock which has given birth. Where high priced livestock have been used for breeding purposes and are more than one year old there is now no six month ownership limit before a write-down can be made.

Some aspects of the Trading Stock Scheme are also affected by the Taxation Reform Act (No.6) 1989. The scheme initially specified a three year write-down period from purchase price to standard values for trading stock for new owners of a livestock type, farmers who significantly expand an existing enterprise, farmers who start a new enterprise or farmers changing from the herd scheme. The whole write-down may now occur in the income year in which the transaction occurs.

Under the initial reforms, transitional assistance was implemented in order to remove elements of retrospectivity and likely hardship in terms of tax payable on large paper incomes from the change from the old, low standard values. King (1989) discusses these provisions in some detail, but essentially they removed any extra tax liabilities arising from the transition to the new schemes. King (1989) also discusses minor legislation changes to redundant clauses of the Income Tax Act 1976 as a result of the new livestock tax system.

The effects of these reforms to livestock valuation, including any anomalies, are also discussed in Chapter 5.

2.1.2 Deductibility of Development Expenditure

Legislation in existence in 1984 gave taxation incentives for primary producers to undertake development. At that time, any capital expenditure associated with the development of land for farming, horticulture, aquaculture or forestry was deductible in full or in part in the year it was incurred. Any unclaimed part of this deduction could be carried forward and claimed in a later income year. Farmers were therefore able to claim immediate tax deductions for expenditures which in other sectors of the economy would have been required to be treated differently, by capitalising and subsequently depreciating them.

Some constraints were imposed upon tax deductibility of capital
expenditure. A limit of $10,000 was imposed on the size of losses from farming which could be offset against income from other sources. Such losses were usually associated with capital development. This constraint was introduced in 1984 to slow the tax driven investment in the primary sector by non land based investors (King 1989). In addition, a clawback provision was imposed applying to any farm land sold at a profit within 10 years of acquisition. Tax deductions claimed for development expenditure and debt servicing were recovered in full at the time of sale.

The reforms instituted from 1984 onwards were aimed at putting agriculture on a similar footing to other sectors. Capital development expenditure deductibility for farmers was changed to a capitalization and depreciation basis, with depreciation rates based on the expected lifetime of the different types of improvement. Some special features remain for agriculture, however. For ease of accounting, capitalised amounts may be pooled into appropriate depreciation groups; no deductions are allowed for loss on the sale or scrapping of a development; and residual capitalization and depreciation allowances are transferred to the new owners on the sale of a property.

The clawback provisions previously in force were also removed (from 12 December 1985), as was the $10,000 limit on deductibility of losses (from the beginning of the 1987 income year). Removal of the interest clawback from sale of farm land may provide a tax shield - this possibility is discussed in Chapter 5.

Transition provisions were made for those farmers committed to development programmes prior to the reforms being announced. These phased out the immediate deductibility of the old system over a period of five years. Table 2.2 shows the percentage of capital expenditure eligible for immediate write-off. The proportion of expenditure not eligible for immediate write-off must be capitalised and depreciated under the new system.

Table 2.2
Deductibility of Capital Expenditure

<table>
<thead>
<tr>
<th>Income Year Ending 31 March</th>
<th>Percentage of Capital Expenditure Eligible for Immediate Write-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>100%</td>
</tr>
<tr>
<td>1988</td>
<td>90%</td>
</tr>
<tr>
<td>1989</td>
<td>75%</td>
</tr>
<tr>
<td>1990</td>
<td>55%</td>
</tr>
<tr>
<td>1991</td>
<td>30%</td>
</tr>
<tr>
<td>1992</td>
<td>0%</td>
</tr>
</tbody>
</table>

2.1.3 Forestry

As discussed earlier, up until 1984 any forestry development expenditure was immediately deductible for tax purposes in the year the expense was incurred. The new regime introduces a requirement for expenses incurred in planting and maintaining a forest to be accumulated in a "cost of forest account" (COFA). This expenditure may not be deducted until the forest is harvested. The regime also combines aspects of the new land development regime previously described with some allowances for accounting simplicity and exemptions for farmers.

Initial land clearance and preparation for forest planting is required to be capitalised and depreciated as for other land development. However the annual depreciation deduction is transferred to a COFA and carried forward to be offset against income realised from the sale of the timber grown. Farmers and horticulturists may claim up to a maximum annual deduction of $7500 for development depreciation annually rather than transfer it to a COFA. This exemption applies to farmer owned production forestry, shelter belts and erosion control plantings.

All other land development costs for forestry are capitalised and depreciated, and the depreciation deduction may be claimed annually. This includes such improvements as roading, fencing, firebreaks and so on. All costs associated with maintaining a forest business are immediately deductible in the year incurred against any source of income. Such costs include rent, rates, insurance premiums, weed and pest control, administrative overheads and so on. All repairs and maintenance expenditure is deductible in the year incurred.

Other costs such as costs of seedlings, planting, releasing, blanking, pruning and thinning must be debited to the COFA and carried forward until revenue from the forest is realised. Again farmers are able to claim an exemption of $7500 per annum to be deducted against other sources of current income.

Since shelter and erosion control plantings are not primarily planted for their future forestry revenue, these are treated as land improvements on farms and horticultural properties and costs over and above the $7500 exemption may be capitalised and depreciated at a rate of 10% DV and claimed as an annual deduction.

2.1.4 Statutory Producer and Marketing Boards

Under the tax regime in place in 1984 a number of organisations were exempt from paying income tax. These included statutory primary producer and marketing boards. The concessions were virtually unique to the primary sector and were repealed with effect from the income year commencing 1 April 1988.

The reform required these organisations to operate under the same tax rules as applied to other corporations in the economy.
However, some of the other statutory powers of the boards, such as sole distribution, export and import rights, have been retained. These issues are the subject of another concurrent study undertaken on behalf of the Rural Policy Unit of MAFTECH (Zwart and Lattimore, 1990).

2.2 Other Tax Measures and Reforms Affecting Agriculture

Besides the major reforms to the taxation of agriculture discussed above, there were a number of other reforms to the taxation of agriculture over the period 1984-1989. In addition, there are some tax measures directed at agriculture which have been retained or only slightly modified. These are discussed in this section.

2.2.1 Investment Allowances and Special First Year Depreciation Allowances

Until the recent tax reforms farmers were entitled to special first year depreciation and investment allowances to encourage modernisation of plant, machinery and some buildings. 20% of the cost of new plant and machinery used for farming was tax deductible in the first year of use. A special first year depreciation allowance of 25% for plant and machinery or 20% for buildings (previously 45% prior to June 1979) was deductible in the year in which these assets were first used in the production of assessable income. These measures were often used in conjunction with the deductibility of development expenditure provisions as the basis for new farm investment, especially in irrigation.

Both the investment allowance and the first year depreciation allowance were abolished under the tax system reforms. The farming investment allowance was terminated from 31 March 1985. The special first year depreciation allowance was terminated as from the end of the 1988 income year so that normal depreciation rates now apply to farm capital investments.

2.2.2 Income Equalisation Scheme

The Farm Income Equalisation Deposit Scheme was designed to facilitate the smoothing of the individual farmer's taxable income. This allows farmers to pay lower taxes over the long term and reduces potential cash flow difficulties arising from the provisional tax payment system. Deposits of income can be made with the Inland Revenue Department in years of relatively high farm income and withdrawn in part or in whole in any of the following four years. Deposits give a lower taxable income in that year while refunds are taxable in the year of withdrawal. A nominal 3% p.a. interest is paid on deposits.

Compulsory refunds are made if a deposit reaches the maximum term of five years. The mandatory minimum deposit period is 12 months.
and the recent tax reforms tightened the exceptions to this rule. If deposited for 6 months or more funds may be withdrawn for planned development or maintenance work, to purchase livestock or to avoid hardship. If deposited for less than 6 months deposits may only be withdrawn for unplanned development, repair work or livestock purchase as a result of an adverse event or to avoid hardship.

2.2.3 Special Farm Ownership Account Rebate

Special farm ownership accounts provided a tax benefit to those saving to buy their first farm. The scheme allowed a tax rebate of $0.45 in the dollar on any increase in savings of up to $5,000 held in a special farm ownership account during the income year. A maximum of $60,000 could be held in the account. If savings were withdrawn and used for purposes other than buying a farm the tax rebate had to be repaid.

This scheme was terminated from 1 August 1986 (Burtt and Fleming, 1989) although existing accounts at that date continue to qualify for the rebate.

2.2.4 Farm Vendor Settlement Finance Scheme

The Farm Vendor Settlement Finance Scheme was introduced in 1978/79 with the objective of encouraging farmers of retirement age to leave finance in the farm when it is sold. Under the scheme an income tax deduction of 50 per cent of the interest earned by the selling farmer on a finance bond or mortgage held by that farmer is allowed.

2.2.5 Income Splitting

There are a number of provisions in tax law which enable individuals with certain classes of income earning assets to split or spread the associated income and taxation liability over a number of family members. Farmers are able to make use of some of these provisions which are not available to wage and salary earners. This effectively provides a form of tax shield for farmers. The use of family partnerships, often including trusts for infants, has long been a common device for splitting income among family members and thus reducing tax liabilities. One spouse may also transfer matrimonial property to the other spouse under the Matrimonial Property Act 1976 without giving rise to a subsequent liability for income tax.

2.2.6 Deduction For Personal/Farm Expenses

Farmers are permitted to take deductions for certain expenditures that have both a farm business and personal living component. In particular, one quarter of total expenditure on the farm dwelling (repairs and maintenance, depreciation, domestic power
and so on) can be claimed. Farmers can also deduct a proportion of car expenses, including depreciation, applicable to business use.

Lattimore and Wood-Belton (1986) note that while some other taxpayers are entitled to deductions for dwelling "rent" and electricity, "the criteria for calculating the deductions in the case of these tax-payers is for the most part more restrictive than for the corresponding deduction applicable to farmers."

2.2.7 Other Minor Tax Reforms Affecting Agriculture

There have been a number of recent minor reforms to the tax system that may affect agriculture; some have no specific effect on farming as opposed to other industries and all are of minor significance. King (1989) lists most of these reforms which are not discussed further here.

2.3 General Taxation Measures Indirectly Affecting Agriculture

Many general taxation provisions not targeted at agriculture nonetheless have an impact on investment decisions in the primary sector and may provide tax shields to farmers. This section discusses measures changed or introduced in the recent tax reforms and other measures which affect agriculture indirectly. It also discusses briefly some potential changes to the tax system with implications for agriculture.

2.3.1 Export Incentives

Export incentives applied to all sectors of the economy. The scheme allowed a tax credit on the total export sales of qualifying goods based on the total domestic value added content of the goods exported. These incentives were phased out progressively over the period 1985 to 1987.

2.3.2 Tax Rates

Table 2.3 summarises the changes to personal tax rates over the period 1984-89. These changes generally had only small direct effects on farm incomes, which were on average at very low levels during this period. However, as the highest marginal tax rate fell from 66% to 33% there was a significant change in the level of deductibility of losses or capital expenditure. The effect this may have had on investment decisions is analyzed later. Company tax rates also fell over 1984-89, from 48% to 28% for New Zealand resident companies.
Table 2.3
Changes to Personal Rates of Income Tax

<table>
<thead>
<tr>
<th>Income Year</th>
<th>Taxable Income ($)</th>
<th>Marginal Tax Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984/85</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 6000</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>6001 - 24000</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>240001 - 25000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>250001 - 30000</td>
<td>45.1</td>
</tr>
<tr>
<td></td>
<td>300001 - 38000</td>
<td>56.1</td>
</tr>
<tr>
<td></td>
<td>Over 38000</td>
<td>66</td>
</tr>
<tr>
<td>1985/86</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 6000</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>6001 - 25000</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>25001 - 30000</td>
<td>45.1</td>
</tr>
<tr>
<td></td>
<td>30001 - 38000</td>
<td>56.1</td>
</tr>
<tr>
<td></td>
<td>Over 38000</td>
<td>66</td>
</tr>
<tr>
<td>1986/87</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 6000</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>6001 - 9500</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>9501 - 25000</td>
<td>31.5</td>
</tr>
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<td></td>
<td>25001 - 30000</td>
<td>37.55</td>
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<td></td>
<td>30001 - 38000</td>
<td>52.05</td>
</tr>
<tr>
<td></td>
<td>Over 38000</td>
<td>57</td>
</tr>
<tr>
<td>1987/88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 9500</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>9501 - 30000</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Over 30000</td>
<td>48</td>
</tr>
<tr>
<td>1988/89</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 9500</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>9501 - 30000</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>30001 - 30875</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Over 30875</td>
<td>40.5</td>
</tr>
<tr>
<td>1989/90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Up to 30875</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Over 30875</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Financial Budget Manual (Various) Lincoln College

2.3.3 Tax Rebates

A number of rebates and deductions have been abolished, including the dependant relative rebate, school fees rebate and life insurance and superannuation deductions. A family support tax credit was introduced to provide relief for low income earners and many farmers may have qualified for this.

2.3.4 Provisional Tax

Provisional Tax is required to be paid in respect of all income which is not taxed through the PAYE system or other source deduction taxes. It is intended to ensure that as far as possible
all income is taxed in the year in which it is earned. Prior to the taxation reforms, two provisional tax instalments were paid, the amount being based on the previous year's income, or where this was inappropriate on an estimate of the current year's income. A penalty was imposed for excessive underestimation of provisional tax.

A third provisional tax instalment was introduced in 1986 and the provisional tax regime was revised in 1988. Under the current system, provisional tax is based on either an estimate of the current year's income or a figure calculated from the previous year's tax liability. It is paid in three instalments, due on the seventh day of the fourth, eighth and twelfth months of the taxpayer's income year. Any remaining tax due (terminal tax) is calculated in the annual tax return and is due on the 7 February for most taxpayers. Where provisional or terminal tax is not paid on time, "additional tax" of 10% is added to the amount payable.

The option to base provisional tax on the previous year's tax is available if current income is expected to be less than $1 million. Provisional tax calculations are based on "residual income tax" for the previous year, which is effectively total tax less PAYE and any other source deductions and tax credits. For individuals with income less than $100,000, the amount of provisional tax due is equal to last year's residual income tax plus 10%. Individuals with income between $100,000 and $1 million can pay provisional tax equal to last year's residual tax (without the 10% uplift). However, these individuals are subject to an interest charge (or credit) on underpaid or overpaid provisional tax. This is calculated at a rate of 10% p.a. on a daily basis on the terminal tax (or refund) due. For companies and other entities with income less than $1 million, provisional tax is equal to the previous year's residual income tax plus 10%. Companies must also adjust the tax payable to new tax rates and are also subject to interest at 10% p.a. on a daily basis on the difference between provisional and actual tax.

All taxpayers with annual incomes of more than $1 million are required to pay provisional tax on their estimated current income. Other taxpayers may choose this option if they wish. If an estimate is used and the provisional tax paid is less than 80% of the actual residual income tax required for the year then a penalty of 10% of the difference between estimated and actual tax is charged. These taxpayers are also subject to interest at 10% on a daily basis on the difference between provisional and actual tax.

2.3.5 Fringe Benefit Taxation

Fringe Benefit Tax (FBT) was introduced in 1985. It is payable on the taxable value of fringe benefits provided to employees. The employer must complete quarterly returns setting out details of benefits granted and the tax payable. From 1 April 1989 the rate of FBT was set at 49% for all fringe benefits, with FBT paid allowed to be deducted as an expense for income tax purposes.
Farmers may have been particularly affected in relation to payment in kind for farm staff.

2.3.6 Goods and Services Tax

Goods and Services Tax (GST) was introduced in 1986 as part of the reform of income tax aimed at broadening the tax base. It is a broad based consumption tax levied at a rate of 12.5% (originally 10%) on virtually all goods and services supplied in New Zealand. Persons or organisations with an annual taxable turnover of over $24,000 must register and charge GST. Regular returns must be furnished to the IRD - the standard period is two months. Farmers, as with many other smaller businesses, have had to adopt more effective systems of recording their business transactions to comply with GST reporting requirements.

2.3.7 Spreading Losses

As with all other provisional tax payers, farmers are able to carry tax losses from one year forward to be offset against income in the following year. During the period 1984 to 1987, a limit of $10,000 was imposed on the amount of loss able to be claimed in any one year for losses arising from farming (and a number of other specified businesses). This limit had the effect of spreading the offset over a longer period of time; for instance, a $50,000 loss would be offset against income in the five succeeding years (assuming profits were generated). Under current tax regulations, the full amount of a loss can be immediately offset against income in a subsequent year.

2.3.8 Potential Changes to Taxation

Although the New Zealand taxation system has undergone significant changes in recent years, particularly since 1984, there are some proposals for further major changes. Some of these proposals, if brought into effect, have implications for agriculture.

In December 1989 the government published a 'Consultative Document on the Taxation of Income from Capital' which foreshadows a number of potential future changes to tax legislation. In particular, it proposed the indexation of a range of financial arrangements and debt instruments so that only the real component of interest income or expense (after accounting for inflation) is assessable or deductible. It also proposed introducing a tax on capital gains. Both these measures clearly have significant implications for investment decisions and returns.

However, the proposals are subject to a lengthy period for public submissions and are likely to be modified considerably. At the time the document was released the Minister of Finance described it as "nothing more than an interesting document which is worthy
of consideration." (Christchurch Star, 20 December 1989). Subsequently the proposals were withdrawn. The Minister of Finance announced that indexation and capital gains tax were "off the agenda" for at least three years (Caygill, pers.comm., 20 March 1990).

The consultative document also includes a brief reference to the treatment of livestock (Consultative Document on the Taxation of Income from Capital, 1989), which suggests that livestock may not need to be treated in the same way as other categories of stock. The proposals include a system of adjusting stock values by reference to the consumer price index; while livestock (in the herd scheme) is already 'indexed' by reference to market price variations.

The new National Government, before it was elected, announced that it would make a number of changes to the taxation of agriculture (MacLennan, 1989). The changes discussed are mainly of a minor nature although they would have some impact on investment decisions. It proposes to amalgamate the Trading Stock and Herd Schemes of livestock valuation and to simplify the production cost scheme for farmers. National Party policy is also to modify deductibility of most maintenance expenditure to a three year depreciation basis. From the point of view of project returns the most significant policy proposal is to alter the deductibility of forestry expenditure so that it is deductible over a three year period in a straight line depreciation.
This section examines tax shields or tax shelters which currently apply to farm businesses. Examples were obtained of potential tax effects on farming decisions which appear to result from anomalies (apparently unintended effects of taxation policy) or from the delivery mechanism working ineffectively, leading to tax advantages or disadvantages for farmers.

We have used publicly available information as much as it was possible to do so. However, the scope of our research did not permit us to establish how widely these factors are known to farmers or farm advisors and whether advantage is taken of them.

3.1 Interest

A direct farm-related tax shield on interest existed until recently under Section 129 of the Income Tax Act 1976. "Interest clawback" applied to land (and certain other assets) sold in excess of cost within ten years of purchase. There is an exclusion for land (or other assets) used primarily and principally in the carrying on of agricultural, horticultural, viticultural or aquacultural business. The provision was withdrawn in July 1990.

The effect of this provision, where it applied, was that the interest previously allowed as a deduction in respect of land is added back to the land owner's assessable income in the year the land is sold. The amount to be included is limited to the lesser of the profit on sale of the land and the total interest deductions (NZ Master Tax Guide, 1989, 1013). The exclusion of farm land from this provision appears to provide a tax shelter for investment in farming land for some investors in some circumstances. Investors contemplating a shorter term of investment than ten years were able to invest in farmland and avoid the risk of becoming subject to interest clawback.

The exclusion of farming land is conditional on the land being used for farming by the taxpayer, or the taxpayer and another person. However it should be noted that this provision as it applies to other land could sometimes be mitigated (Consultative Document on the Taxation of Income from Capital, 1989).

3.2 Land Sale Gains

The income taxation provisions regarding gains on land sales include some provisions which represent tax shields for farming.

There are complex rules for taxation of gains from the sale of land (including improvements) under section 67 of the Income Tax
Act 1976. Gains are taxable where:

- The land was bought with an intention of selling; or
- the taxpayer or an associated person is in the business of dealing in land, is a property developer or is a builder; or
- gains are partly due to a change in zoning; or
- an undertaking for the land to be developed or subdivided was commenced within ten years of the land being acquired; or
- there was significant expenditure in developing land for industrial, commercial or residential purposes.

(Hay & Clark, 1990)

There are several exceptions for land transactions which would otherwise give rise to taxable profit. These include some situations where the land was held for more than ten years; some situations where the land was used as the taxpayer's residence; some situations where the land was used for business; and a number of exceptions relating to farming or agriculture.

These exceptions for farming land appear to be used in practice. For example, there are three cases cited by New Zealand Income Tax Law and Practice (1989) (Bruhns v CIR; O'Toole v CIR; Taxation Review Authority case E42). In each case, the taxable income of the taxpayer depended on whether the lots into which land had been sub-divided were capable of being worked as an economic unit as a farming or agricultural business and were sold primarily and principally for use in farming or agricultural business. If the taxpayers could show this, the gains made would not be taxable (NZ Master Tax Guide 1989).

Thus there appears to be a tax shelter for investment in farmland for subsequent subdivision (or other sales) as opposed to investment in other land.

### 3.3 Investment in Livestock

New taxation rules for the valuation of livestock were introduced from the income year commencing 1 April 1986, largely because the previous standard value system offered a significant tax deferral to livestock owners which was not enjoyed by other traders (according to the Consultative Document on Primary Sector Taxation, 1986). This advantage, it was believed, may have distorted investment decisions. A new standard value system was introduced. It included two options based on average market values, together with an option to value stock at the lower of cost and market value and a separate cost-based scheme for high-priced livestock.
The new standard value scheme however is not completely free from tax shelters and other factors which may distort decisions. Graham (1988b) advised farmers that 'some room exists to save tax, but not as much as in the past'.

3.3.1 The Herd Scheme

The herd scheme provides some tax incentives for investment. Under the scheme, eligible livestock are valued at the beginning and end of the income year at the "herd value", which is 100% of the national average market value of the appropriate livestock as declared by the Inland Revenue Department for that income year. Once in the herd, fluctuations in the market value of the herd livestock do not affect the amount of taxable income.

When stock are purchased, any difference between the cost of the stock and its declared national average market value becomes an adjustment against income for tax.

The 'national average' sometimes varies significantly from the value of particular stock. Where the national average is significantly lower, there is a tax incentive to invest.

e.g.

(1) Dairy cows
MAF Farm Monitoring Report (1989) reported
dairy cow prices in Autumn 1989 were
$700-$800 per head.

The highest National Average Market Value for any class of dairy cow for the 1989 income year was $419.00 (for rising two-year old Jersey heifers). (Inland Revenue Department, 1989).

A farmer (or investor) buying such an animal for $800 and using the herd scheme for livestock valuation would gain an immediate write-off for tax in the 1989 year of nearly $400 or half the cost of the animal. This appears to provide a tax shelter for investment in dairy cows similar to that provided by the old (pre-1987) standard value scheme.

This situation applies to some other livestock categories also:

e.g.

(2) Merino sheep
Merino hoggets: price in December 1988 $42.00
(Lincoln College Financial Budget Manual 1989)
National average market value (Value for tax for herd scheme taxpayers) (IRD 1989) $16.20

(3) Southland Stock
Lorneville sale price for store adult ewes June 1989 $18.00 to $27.50
(NZ Farmer 28 June 1989)
National Average market value (IRD 1989) $12.30
There appear to be two possible explanations of this situation, each of which has different tax consequences.

These are:

(1) **Short Term Factors**

National average market values are established on an income year basis, i.e. for a year ending 31 March. These values are then used by taxpayers with an equivalent accounting year. For farmers, the accounting year is likely to end on 30 June, 31 July or 30 September. If there are significant trends in market prices, a tax shelter opportunity arises. This occurs because farmers can buy stock in the period after 31 March at current market prices, in the knowledge that the "average market value" (for taxation) may be lower than the current price. If there has been a short-term increase in market prices this is likely to be reflected in the following year's national average market values, and may give rise to a tax free gain.

In effect, taxpayers who have balance dates after the announcement of national average market values can take advantage of trends in prices.

In a hypothetical case:

National average market value of cows announced April 1989: $293

Actual price September 1989 (assumed, based on MAF data): $793

A farmer with a 30 September balance date buying cows and valuing them under the herd scheme will be able to deduct $500 for each animal from taxable income. Tax deduction in 1989: $500

If, as a result of an increase in market prices, the 1990 national average market value is higher, the farmer will achieve a tax free gain.

e.g. National average market value of cows announced April 1990: $700

Actual price May 1990: $793

The farmer could sell the same cows and show a taxable gain of only: $93

Simply buying and selling at the same price, and taking advantage of an already existing increase in national average values would reduce his or her taxable income permanently by $407 (per cow).
However, it has been suggested (Graham 1988b) that the national average market value for cows will normally be influenced by the effect of cull cows reducing the market average. (The national average market value for cows is set by MAF on the basis of equal weightings for auction sales and carcase prices). If so, then investment in cows can be expected to provide a continuing tax shelter situation to that outlined in part (2) below. The tax advantage outlined above is nevertheless likely to apply to other categories of stock in some circumstances.

(2) Long Term Factors

For some categories of stock the national average market value can be expected to remain below the actual value of the particular category for the foreseeable future, e.g. Merino sheep, Southland stock or stock which is of higher than average quality. In this case, there is a tax shelter for investment, and an incentive to invest in these classes of stock in preference to others.

The tax shelter in this situation operates in a similar way to the previous (pre-1986) standard value scheme. There is an advantage from investing in livestock, since part of the price may be written off for tax, achieving a tax subsidy on the cost of stock. There is also a contingent liability since eventually farmers ceasing business and selling their stock will be required to pay tax on the difference between "national average market values" for tax and the price for which the stock is sold.

3.3.2 Advantages from the options within the scheme

(1) Choice of Option

It can be argued that allowing taxpayers a choice of several valuation options provides a tax shelter for the farming industry. The alternatives were set up to avoid the administrative difficulty of valuing livestock at cost (Consultative Document, 1986). However, they allow farmers choices not available to other taxpayers, i.e. whether or not changes in the value of an asset (livestock) should be assessable and deductible for tax.

The advantages of choosing the correct option appear to have been recognised by farmers. A survey conducted in 1988 (Clark 1989) showed that 67% of sheep farmers and 64% of cattle farmers had adopted the herd scheme, while 67% of deer farmers and 54% of goat farmers had adopted the trading stock scheme. The choices appeared to reflect a prevailing view that sheep and cattle prices were likely to increase, while the values of deer and goats would fall. (This view was correct for most classes).
2) Switching Between Options

The Consultative Document (1986) recognised that it would be advantageous to be in the trading stock scheme when prices fall, and in the herd scheme when prices rise. (Since the trading stock scheme requires a proportion of changes in stock value to be included in or deducted from income, while corresponding increases or decreases in stock value are not taxable for farmers in the herd scheme). To prevent taxpayers from obtaining the advantages of both schemes, the Consultative Document (1986) proposed that an election to adopt the herd scheme would be irrevocable, unless a taxpayer ceased to own the particular type of livestock for five years. However, in the view of the Consultative Committee, this was an undue restriction on a taxpayer's flexibility of choice.

Under the provisions as they were introduced two years notice was required e.g. notice would be required by 30 June 1990 for a change to become effective in the year ending 30 June 1992. A recent change included in the Income Tax Amendment Act (No 4) 1989 provided that with effect from the 1990 income year, elections to change to the herd scheme may be made within the time in which the return of income is required. This allows taxpayers using the trading stock scheme (or cost price) to wait until after livestock values are released, and then to make a decision whether to switch to the herd scheme.

In some livestock categories market values have recently varied considerably. Some advisers have recently suggested that it may be appropriate for taxpayers to switch to the herd scheme, and gain the advantage of not being taxed on increases in values.

This suggestion has been made because the national average market value of some livestock categories is currently very low (compared to their values in earlier years). The trading stock scheme is usually based on 70% of average market value over three years. The herd scheme is based on 100% of current market value which would in normal circumstances be a higher amount. However, if the current national average market value is less than 70% of the average over the last three years, the value for the trading stock scheme is reduced to current market value. For example:

**Goats: Angora Mixed-age does**

<table>
<thead>
<tr>
<th>Year</th>
<th>National Average Market Value</th>
<th>Standard Value (Herd Scheme)</th>
<th>Standard Value (Trading Stock Scheme)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>176.00</td>
<td>142.00</td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>81.00</td>
<td>81.00</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>16.00</td>
<td>16.00</td>
<td></td>
</tr>
</tbody>
</table>
For this category there has been a rapid decline in market value. In future years, possible falls in value must be smaller (in absolute terms). It may appear advantageous to a taxpayer to switch from the trading stock scheme to the herd scheme, so that, having gained the benefit of tax deductions for falls in value, he or she may now benefit from increases in value which are not subject to tax.

If the option to switch to the herd scheme immediately had been available in 1989, a taxpayer owning livestock in this category could have changed from the trading stock scheme to the herd scheme with no immediate tax consequences. Having switched schemes, any changes in livestock value would no longer be taxable (even though the decline in value in earlier years was deductible).

In 1990, a similar option is likely to be available. Taxpayers who use the trading stock scheme will be able to wait until after the publication of 1990 standard values and national average market values, and then to decide whether to switch to the herd scheme.

There appears to be an advantage in investing in stock whose prices are relatively volatile, since in some circumstances it has been possible to treat declines in value as tax deductible, while increases in value are tax free.

3.3.3 Livestock Valuation: Tax Disadvantages

It is sometimes argued that the livestock valuation requirements provide a disincentive to farmers who invest in expanding their livestock numbers. This situation arises because, in the herd and trading stock schemes, livestock which is retained must be shown in the accounts at an increasing value as it matures and reaches a higher-value livestock class. As a result, income tax must be paid on an unrealised gain in value. (An overall increase in value takes place only if stock numbers being retained represent an increase in the total herd. This situation does not arise where replacement stock are concerned).

However, the disadvantage is not unique to farming, and there are provisions to reduce its effect. In other parts of the tax legislation, there are other requirements for income tax to be paid on unrealised gains. These include the normal requirements to take debtors or trading stock into account. The accrual regime for taxation of financial arrangements also provides a number of examples. In addition, other taxpayers do not have the variety of options which can be used by farmers to reduce the possible disadvantages which may arise.

Provisions to reduce the effects of possible taxation of unrealised increases in value include the 'cost option' which was included on the recommendations of the Consultative Committee (1986) to overcome problems of this nature; and the setting of
the trading stock scheme values on the basis of 70% of market values, which was intended to more closely approximate cost (ibid).

Although the current livestock valuation regime is not as concessionary as the previous system, there are tax shields or tax shelters available in some instances.

3.4 Income Equalisation Reserve Deposits

Income Equalisation Reserve Deposits are paid to the Inland Revenue Department, and may be deducted from current income. The deposits are included in income when withdrawn from the scheme (NZ Master Tax Guide, 1990). These deposits allow primary producers to smooth their assessable income, allowing them to take advantage of lower tax brackets. They also prevent cash flow difficulties which result from the operation of the provisional tax system, particularly as it applies to taxpayers with fluctuating incomes.

This scheme has also been used to obtain other tax advantages. Graham (1988a) explained that in 1988, additional benefits could be obtained as a result in the reductions of the tax rate in 1989 and 1990. Taxpayers with 1988 incomes greater than $30,000 were able to achieve an after-tax return on funds of approximately 25%, by depositing part of their 1988 income (which would have been taxed at 48%) in an Income Equalisation Reserve Account, and withdrawing it in the 1990 income year (when the tax rate would be 33%). The benefits of depositing money in an Income Equalisation Account included the change to a lower rate of tax; the cash flow advantage which resulted from reduced provisional tax; and the availability of terminal tax money for investment. These benefits were available for a one year deposit (e.g. from 30 November 1988 to 30 November 1989). In this situation, where a reduction in tax rates has been announced, the scheme provides a form of tax shelter.

(The scheme includes provisions to prevent the opposite situation, in which farm taxpayers are disadvantaged by an increase in tax rates, from arising (section 185 (3), Income Tax Act 1976)).

The income equalisation provisions allow a risk reduction mechanism for taxpayers in the farming industry (and also in fishing and forestry business) which is not available to other taxpayers. In the special circumstances of a reduction in the rate of tax, it provides a tax shelter.

3.5 Private Expenditure

It is sometimes difficult to distinguish between farm business expenditure and personal expenditure on behalf of the farm proprietor. As a result, farming sometimes provides a tax shelter by allowing personal expenses to be deducted from taxable income.
Lattimore and Wood-Belton (1986) identified dwelling costs (mortgage interest, depreciation, maintenance etc) and domestic electricity expenses as areas of tax expenditure from which farmers benefit. All interest costs and rates, including those which relate to the farm dwelling, are treated as deductible, together with all telephone rental and newspaper subscriptions. In addition, 25% of depreciation on the farm dwelling, 25% of repairs and maintenance to the dwelling and 25% of the cost of electricity consumed by the farming household is allowed as a deduction (NZ Master Tax Guide 1990).

Some other examples of expenses which have an element of personal expenditure but which are deducted in practice are well known. For example, a deduction for depreciation on a swimming pool installed on the farm and "used primarily for fire fighting purposes" is allowed (New Zealand Income Tax Law & Practice 1989).

In addition, there is only a "minimal requirement" to account for farm produce consumed by the farm family (King 1989).

There appears to be a tax shield or tax shelter which applies to these categories of expenditure for farmers.

3.6 Development Expenditure

3.6.1 Existing Tax Shelter

According to the Consultative Document on Primary Sector Taxation (1986) the provisions which then applied resulted in biased investment decisions, and diverted investment into agricultural land development instead of other areas. The provisions which applied (which allowed immediate tax deduction of capital expenditure) are being phased out over the period to 1992.

In the remaining years immediate deduction of land development expenditure is allowed as follows:

<table>
<thead>
<tr>
<th>Income year ended 31 March</th>
<th>1990</th>
<th>1991</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55%</td>
<td>30%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Where balance dates are other than 31 March, the provisions apply for the equivalent accounting year. Thus development expenditure incurred until 30 September 1991 can be tax sheltered to some extent.

King (1990) explained that the phasing out of this scheme also led to distortion - there was a 'sudden acceleration' of some types of development expenditure.

3.6.2 Other development expenditure

In addition, development expenditure which does not take the form of land development expenditure is fully deductible. For
example, it may be to the advantage of a taxpayer to build up a
herd of livestock, or develop an orchard, in order to sell the
assets for a capital gain.

These provisions are in contrast to the revised requirements for
forestry development, under which certain costs will be required
to be accumulated in a Cost of Forest Account and will not be
deductible until the forest is harvested.

In development of a farm business, any land development
expenditure of the categories listed in Section 127 of the Income
Tax Act 1976 would not be immediately deductible. However, other
expenditure related to development (such as interest on capital,
wages of employees, or upkeep of the property) may be fully
deductible. Expenditure such as repairs to existing fencing, or
other development, and application of fertiliser is also fully
deductible.

In practice, it will be difficult to distinguish between capital
expenditure and repairs to existing assets. It is expected that
some capital expenditure could be classified incorrectly as
repairs and maintenance (King 1989) possibly providing a further
tax shelter.

3.7 'Hobby' Farmers

The taxation system as it affects farming provides tax shelters
for part-time 'hobby' farmers in a number of ways. These
shelters arise mainly from matters discussed in two preceding
sections: personal expenditure and development expenditure.

A farmer with income from other sources is in a position to
operate his or her farm with other objectives than producing
income. These may include concentrating on farm development to
produce future capital gains, not current income; or obtaining
a deduction for personal expenditure.

This situation appears to arise in most countries - in the United
States, examples of wealthy 'gentleman farmers' developing cattle
herds or citrus groves, (which may produce no current income)
have been cited (Sommerfield et.al., 1989). In the United
States, the losses which arise can be offset against the
investor's current income, while the capital gain is subject to
preferential tax treatment.

In New Zealand a similar situation applies to some extent.
Despite the phasing out of the preferential treatment of land
development expenditure, an investor may manage a farm property
in such a way as to maximise its capital value while producing
current losses (e.g. by herd improvement, orchard development,
application of fertiliser etc).

There are provisions in the tax law which require that deductions
from income may only be made if they were incurred in gaining or
producing assessable income, or in carrying on a business for the
purpose of gaining or producing income. However, a tax case established that a taxpayer who was employed full-time in work (off his farm), but who also worked on his farm, was entitled to deduct a portion of the outgoings on his farm dwelling, and to be treated no differently from other farmers (NZ Income Tax Law & Practice, 1989, Case K57).

Where recurring losses are made, in some situations, the Inland Revenue Department may be able to disallow the deductions, (on the basis that they have not been incurred in producing assessable income). This provision is used to prevent losses from being offset against other income in cases where it is clear that work undertaken will not result in assessable income. However, Grieve's Case (1984, 6, NZ Tax Cases, Grieve v Commissioner of Inland Revenue) established that the taxpayer's intention to make a profit must be taken into account. This intention may relate to the future, and an intention to make a profit may be sufficient even where there is no realistic prospect of profit.

In similar circumstances, it is sometimes possible for a taxpayer to engage in farm development which will eventually produce a capital gain, but, while the development continues, to produce losses which are deductible against other income.

3.8 Conclusions

There are a number of areas which allow advantages for investment in farming generally, and which are not available for many other investments. For taxpayers in the farming industry, the tax system also provides advantages for particular types of investment (including livestock which is more expensive than average, and some kinds of development expenditure for example). The impact of the various tax shields, concessions and anomalies, under a number of different scenarios, is explored in Chapter 6.
CHAPTER 4

THE APPLICATION OF PROJECT APPRAISAL TECHNIQUES
FOR ASSESSING FARM INVESTMENTS

Much of the recent literature regarding the appraisal of capital investments and risk stems from the area of corporate finance. This chapter examines some of the unique aspects of the typical New Zealand farm business, compared to the corporate type business, and derives a pragmatic approach to farm project appraisal.

4.1 Project Appraisal of Farm Investments

The term 'project appraisal' is used synonymously with the terms 'capital budgeting', 'investment analysis' and 'investment appraisal'. They are all concerned with the economic problem of determining how a limited supply of capital should be allocated to alternative uses. The problem arises in that the expenditure of a capital sum is made now in the expectation of future (and uncertain) benefits. In farming the appraisal of capital projects is of special importance since:

1. Most capital investments involve large outlays in relation to total farm assets (e.g. machinery, irrigation development, etc.);

2. Compared to many other industries farming investments tend to have long lag periods between the initial investment and economic returns (i.e. especially due to biological factors);

3. Once a farm investment decision is made the farmer often becomes 'locked in' to that investment (e.g. conversion to dairying, orchard development, etc.);

4. Many farm investments have low salvage values at the end of their productive life; and

5. Farming operates in a more highly uncertain environment than most industries, largely due to the nature of the market and production risk faced by farmers. This factor combined with the other factors listed above, requires that all of the expected costs and benefits accruing to the project over time should be closely scrutinised.

There are two major areas of investment concern regarding farming projects: financial viability and financial profitability. Each of these is briefly discussed below.

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1The subject of project risk is addressed later in Section 4.2.
4.1.1 Financial Viability

The financial viability of a project is concerned with whether it is possible to obtain sufficient capital to fund the project and also, whether the subsequent cashflows will be sufficient to meet all cost commitments and, in particular, the fixed costs. An important consideration within this area is the question of financial leverage since extra debt repayments may add significantly to the fixed cost payments to be met. This implicitly addresses the question of financial risk. 2

4.1.2 Financial profitability

The financial profitability of a project takes into account all of the benefits and costs associated with the project for a given time period (often the life of the project or some proxy measure incorporating a salvage value) and provides a comparative figure for project ranking according to some given criteria of investment worth. There are a number of different measures of investment worth which have historically been used to assess the profitability of projects. Two of the most widely accepted currently are the Net Present Value (NPV) and the Internal Rate of Return (IRR) criteria. Both of these are based on the use of discounted cashflow analysis.

Discounted cashflow analysis is based on the premise that not only does debt capital have a cost, but that there is a time value cost of using equity capital. The time value cost is dependent upon an individual's perceptions of inflation, future riskiness of the project, alternative investment opportunities and the manager's current level of consumption preference. Cashflows over the designated life of the project are discounted at a calculated discount rate. The discount rate represents the minimum acceptable compound annual rate of return for the project and may be based on the cost of equity capital and/or the cost of debt capital (Weighted Average Cost of Capital), or some other method (e.g. Capital Asset Pricing Model). 3

With the NPV method the cashflows are discounted at an appropriate discount rate and the investment (in the absence of risk) is judged to be acceptable if the present value of the net cash returns exceeds the initial investment outlay (i.e. if the NPV is greater than or equal to zero). With the IRR method, the compound rate of interest that equates the present value of the future cash earnings with the initial investment outlay is

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2 The matter of financial risk is addressed more fully in Section 4.2.

3 The question of the appropriate discount rate is addressed further in Section 4.3.1. In addition, considerable coverage is provided in most financial texts e.g. Brigham and Gapenski (1988), Newman et.al. (1990) and Johnson (1989).
calculated (i.e. the IRR is the discount rate that gives a NPV equal to zero). This IRR is compared with the discount rate. Projects with IRR's equal to or greater than the discount rate should be accepted (Boehlje et al, 1988).

In business practice the IRR method has been much more widely adopted, largely due to its ease of communication with non-financial analysts. However, the NPV method generally provides a more accurate measurement of project profitability; although it can be a difficult concept to comprehend (Brigham and Gapenski, 1988). The NPV criterion has been adopted for this study.

4.1.3 Factors Affecting Project Cashflows and Profitability

A universal principle of project appraisal is that all costs and benefits accruing to the project should be estimated and included as accurately as possible. Apart from the fundamental problem of attempting to predict future events based on present knowledge, there are a number of other factors which can have a significant impact on the cashflows and returns of investment projects. These include taxation, inflation and financial leverage. The first two are largely beyond the control of individual farmers, whilst the third may be, and often is, adjusted by farmers in response to their perception of the current and anticipated levels of risk and return in their operating environment. However, historical observation suggests that farmers often base their investment decisions, at least partly, on taxation and inflation expectations.

A review of the individual effects and suggested cashflow treatment of each of these factors is set out below:

(1) Taxation

Taxation at the micro-economic level is a cash item. Therefore, all tax effects should be calculated and included in cashflows. Particular items of consequence include:

(i) Tax rates - family farms which are operated as sole proprietorships or partnerships (approximately 85 percent of all farms in New Zealand (NZMWB, 1989) are subject to a progressive income tax schedule. With the inherent variability of most farms' annual net incomes, the marginal rate of taxation is difficult to predict. It is possible that, depending upon the year, the marginal taxation rate could be 0, 24 or 33 percent. This could have considerable bearing on the decision to invest and on both the financial viability and profitability of an investment project. However, it should be noted that the subject of tax rates is not as significant now as under the previous highly progressive and narrowly banded regime where the top individual tax rate was 66 percent of income.

The impact of tax rates is generally not so important at
the corporate level. Company income tax rates are set at a flat 33 percent and, for the larger firm at least, it is usually possible to predict the company's marginal tax rate for the appraisal of a particular investment project with some accuracy.

(ii) Tax treatment may differ depending upon the nature of assets or circumstances. For example, depreciation allowances on farm machinery are assessed on a diminishing value basis, whereas buildings are assessed on a cost price basis and livestock for taxation purposes may be valued on either a cost price, trading stock or herd value basis.

(iii) Specific tax shields which lower the costs of conducting the farm business (these have been outlined earlier in Chapters 2 and 3).

Failure to include taxation (and in particular tax shields) in the cashflows will bias the results of the project appraisal (except where the farm business is in a constant loss situation). There are two major reasons for this:

(i) The project's post-tax net cashflow is increased by the value of the annual tax shields available (Modigliani and Miller, 1963).

(ii) The major benefits to farmers of most tax shields are received early in an investment project's life. (e.g. highest interest deductibility on table mortgages, Development Allowance, etc.). Hence when net cashflows are discounted for the period of analysis, the earliest cashflows have the greatest impact on the project's profitability.

These effects are accentuated by higher marginal tax rates.

(2) Borrowing and Financial Leverage

The financial leverage undertaken to finance a farm investment project may have a significant bearing on both the viability and the profitability of the project. Incurring greater levels of debt decreases the annual net cashflows of the project and also implicitly increases the fixed cost commitments by the amount of the debt. The extra burden to fund the additional fixed costs increases the farm business's level of financial risk. This effect may be accentuated with higher debt levels, if higher interest rates are charged by the lending institution to cover the added risk.

The effect of leverage on the project's profitability depends largely on the relative costs of debt and equity capital. The general rules which apply are:
(i) If $K_e = K_d$ then NPV is unchanged.
(ii) If $K_e > K_d$ then NPV is increased.
(iii) If $K_e < K_d$ then NPV is decreased.

where:

$K_e$ = the cost of equity capital.
$K_d$ = the cost of debt capital.

These effects may be illustrated using simple examples. Table 4.1 shows the effect of leverage, under different scenarios of debt and equity capital cost, on a hypothetical investment using a flat loan repaid at the end of three years. Table 4.2 shows the effects of increasing the amount of leverage on the project returns.

### Table 4.1
The Effect of Financial Leverage (FL) on Project Returns

<table>
<thead>
<tr>
<th>Year</th>
<th>FL = 0%</th>
<th>FL = 50% Kd = 8%</th>
<th>FL = 50% Kd = 10%</th>
<th>FL = 50% Kd = 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(1000)$</td>
<td>$(500)$</td>
<td>$(500)$</td>
<td>$(500)$</td>
</tr>
<tr>
<td>1</td>
<td>200</td>
<td>160</td>
<td>150</td>
<td>125</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>160</td>
<td>150</td>
<td>125</td>
</tr>
<tr>
<td>3</td>
<td>1200</td>
<td>660</td>
<td>650</td>
<td>625</td>
</tr>
</tbody>
</table>

NPV

Ke=8%

<table>
<thead>
<tr>
<th>NPV</th>
<th>FL = 0%</th>
<th>FL = 50% Kd = 8%</th>
<th>FL = 50% Kd = 10%</th>
<th>FL = 50% Kd = 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$309$</td>
<td>$309$</td>
<td>$283$</td>
<td>$219$</td>
<td></td>
</tr>
</tbody>
</table>

Ke=10%

<table>
<thead>
<tr>
<th>NPV</th>
<th>FL = 0%</th>
<th>FL = 50% Kd = 8%</th>
<th>FL = 50% Kd = 10%</th>
<th>FL = 50% Kd = 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$249$</td>
<td>$274$</td>
<td>$249$</td>
<td>$187$</td>
<td></td>
</tr>
</tbody>
</table>

Ke=15%

<table>
<thead>
<tr>
<th>NPV</th>
<th>FL = 0%</th>
<th>FL = 50% Kd = 8%</th>
<th>FL = 50% Kd = 10%</th>
<th>FL = 50% Kd = 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$114$</td>
<td>$194$</td>
<td>$171$</td>
<td>$114$</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.2
The Effect of Increasing Financial Leverage on Project Returns

<table>
<thead>
<tr>
<th>Year</th>
<th>FL = 0%</th>
<th>FL = 25%</th>
<th>FL = 90%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>0</td>
<td>(1000)</td>
<td>(750)</td>
<td>(100)</td>
</tr>
<tr>
<td>1</td>
<td>200</td>
<td>163</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>163</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>1200</td>
<td>913</td>
<td>165</td>
</tr>
</tbody>
</table>

NPV
Ke = 10%
249
217
137

NPV
Ke = 15%
114
114
114

NPV
Ke = 20%
0
26
94

The financial literature (e.g. Van Horne (1989) and Brigham and Gapenski (1988)) indicate that the analysis of the profitability of investment projects should be done excluding the cost of borrowing in the cashflows. The theory is that the cost of debt should be accounted for in the cost of capital using the weighted average cost of (long term debt and equity) capital (WACC), and that the investment should be assessed regardless of the way in which it is financed (although the WACC itself necessarily requires some estimation of the financing strategies to be employed). This approach seems reasonable for the larger firm or the corporate situation where new project investment may be a relatively continuous process and there are often many methods of project financing available to the firm. In this situation the financing of each new investment project tends to be undertaken according to a predetermined financing strategy. That is, the firm's debt:equity ratio is maintained at a relatively constant state.

However, this situation does not hold for the typical family farm. Key differences which require that the handling of borrowing in the cashflows for project appraisal in farming be treated differently to those recommended at the corporate level include:

(i) Farm project investment is generally conducted on a very

4A discussion of the cost of capital is contained later in Section 4.3.1.
discrete basis (e.g. purchasing a new header or shifting from cropping to dairying) and often as a matter of necessity rather than the result of scanning the horizon for the next rising star. Hence, the relevant question is not 'which project(s) should I undertake?' but 'should I do it?'

(ii) Unlike larger corporations, farm businesses rarely have a fixed debt:equity policy and farm equity positions are often highly variable.

(iii) The decisions regarding both the level and type of financing are often largely beyond the farmer's control. The amount of financial leverage used is often simply the equity available from retained earnings plus the additional finance which can be borrowed to fund the project. The sources of debt capital are generally restricted to the best terms that the farmer is able to obtain from a very limited number of lending institutions (or private benefactors). The likely amount and terms of borrowing required for a farm investment project is often known with reasonable certainty at the time of project appraisal. Thus, the appraisal is seldom a matter of comparing a number of investment alternatives, each of which could be financed in a number of different ways.

(iv) The cashflow effects of debt servicing charges usually have a major bearing on the viability of farm investment projects and thus are a major factor affecting the decision to invest. Also, the inclusion of debt repayments in project cashflows illustrates both the effects of leverage on project profitability and the taxation and cashflow implications of different loan repayment terms.

Boehlje and Eidman (1984) suggest that to overcome the limitations of the WACC approach at the farm level, two separate appraisals should be conducted; the first to assess the profitability of the project and excluding the debt servicing charges from the cashflows and the second to take the prior cashflows and deduct the debt servicing charges so that the cash viability of the project can be assessed. However, this approach is 'cumbersome', overly time consuming and still doesn't address the effects of financial leverage on project profitability.

(3) Inflation

Inflation has the effect of distorting project costs and benefits. As a general rule, most farm costs can be expected to rise approximately in line with the general inflation price index. Interest rates and required rates of investment returns
are influenced by expectations of future inflation rates. In contrast annual farm commodity price fluctuations often bear little relation to general inflation rates but are more a function of the current world supply and demand situation. However, in the longer run commodity price movements tend to bear some degree of correlation with general inflation trends, since there is a linkage with input prices and consumers' incomes.

Inflation estimates should be included for all costs and prices in a project appraisal, especially where debt capital is being used. Inflation reduces the real cost of debt servicing over time, since debt repayments continue to be made on a fixed nominal amount for the term of the loan. This effect occurs in spite of the fact that interest rates may increase with increasing inflation.

Treatment of inflation in cashflows may be done using either 'nominal' or 'real' dollars. The main requirement is that all factors be treated consistently. A summary chart of how the different factors should be treated is provided in Table 4.3. The only area of discrepancy is how to handle future income tax bands. With real dollar analyses, it is normally assumed that the tax bands are increased with the level of general inflation. This is often not the case, with fiscal drag tending to lower the post tax returns of projects. The tax band problem is conceptually easier to handle using nominal dollars in analyses, although during periods of low inflation it is probably of little consequence.

Table 4.3
Procedures for Incorporating Inflation Into Cashflows

<table>
<thead>
<tr>
<th>Item</th>
<th>Nominal Dollars</th>
<th>Real Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs and Prices of physical goods.</td>
<td>Inflated at expected rate of price increase.</td>
<td>Hold at today's dollar value unless an increase or decline in real value is predicted.</td>
</tr>
<tr>
<td>Debt charges and deferred claims.</td>
<td>Hold as calculated using quoted rates.</td>
<td>Deflate at rate of general inflation.</td>
</tr>
<tr>
<td>Discount rate.</td>
<td>Use interest rate that has inflation rate built into it.</td>
<td>Use interest rate that excludes inflation.</td>
</tr>
</tbody>
</table>
(4) The Combined Effects

The effects of taxation, financial leverage and inflation on both the viability and profitability of farm investment projects are inextricably linked. Both taxation and inflation reduce the costs of borrowing and inflated capital values are, in the main, treated as non-taxable income. Financial leverage can be used to magnify the positive (to the investor) effects of taxation and inflation. A simple example set out below illustrates the potential of the combined effects of the three factors.

Example

An investor with a marginal tax rate of 33 per cent investigates the costs of borrowing investment capital at a quoted rate of 5 per cent above the current inflation rate. Two inflation scenarios are examined:

<table>
<thead>
<tr>
<th>Scenario A</th>
<th>Scenario B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation 7.5%</td>
<td>Inflation 15%</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Interest rate quoted</td>
<td>12.5</td>
</tr>
<tr>
<td>Less Tax</td>
<td>(4.125)</td>
</tr>
<tr>
<td>Less Inflation</td>
<td>(7.5)</td>
</tr>
<tr>
<td>After Tax Real Cost of Debt</td>
<td>0.88%</td>
</tr>
</tbody>
</table>

Conversely, leverage can also increase the riskiness of the project. If product prices fall, then increased debt servicing charges increase the chances that fixed cost commitments cannot be met. In addition, after some point, interest rates charged tend to rise in line with the perceived riskiness of the project by the lenders.5

4.2 Financial Theory and Farm Risk

Financial theory tells us that farm risk may be classified into two broad types; business risk and financial risk.

(1) Business risk

Business risk is the riskiness of the farm's assets irrespective of the level of debt; or more simply, the risk inherent in farming. This includes such factors as price and yield variability, the effects of technological change, the possibility of ill health or death of the farmer and changes in government policy.

Business risk may be further segmented into systematic and

5The subject of risk and its effect on the cost of capital is discussed in Chapter 5.
unsystematic sources of risk. A systematic risk is any risk which affects a large number of assets (or enterprises) each to a greater or lesser degree. For a particular asset, this may be defined as the volatility of the individual asset compared to that of some defined market. Systematic risk cannot be reduced by diversification. Unsystematic risk is a risk that specifically affects a single asset or a small group of assets (Ross and Westerfield, 1988). It follows that this source of risk may be reduced by diversifying into assets which exhibit low or negative covariance of returns with the existing assets.

(2) Financial risk

Financial risk is the risk faced by the firm as a result of the level of debt. It is essentially the risk of being unable to meet prior claims with cash generated by the farm. Financial risk is reflected in the added variability of net cash flows to the owners of equity. Hence, financial risk is affected by business risk and the level of debt servicing, as well as other fixed calls on the cash generated by the farm business (Gabriel and Baker, 1980).

Total risk is a combination, either the sum (Galway and O'Neill, 1987) or product (Barry and Baker, 1984), of business and financial risk. In addition, for all practical purposes, there is no real difference between the terms risk and uncertainty.

4.3 Dealing With Farm Investment Appraisal and Risk

In a world of the second best, the most appropriate method of conducting farm investment appraisals is to incorporate inflation, taxation and the costs of debt capital within the project cashflows and then discount the marginal project returns using the appropriate cost of equity capital. However, accurate objective measurement of the cost of capital is something which has so far eluded financial theorists (and it will continue to do so); and it is even more complicated at the level of the family farm. Yet much of the recent financial literature regarding the incorporation of risk into capital budgeting has centred on methods of determining a risk adjusted discount rate for individual projects. The remainder of this section will provide an overview of two of the most prominent of these approaches, including a brief discussion of their potential for application at the farm level. Finally, an alternative 'simulation' approach for incorporating risk in project appraisals, which was the analytical method adopted for this study, is described.

4.3.1 Risk Adjusted Discount Rate Approaches

The two most widely referenced approaches to developing a risk adjusted discount rate are the Weighted Average Cost of Capital
(WACC) approach and the Capital Asset Pricing Model (CAPM). Other more sophisticated methods (e.g. Arbitrage Pricing Theory and Options Pricing Theory) are also gaining prominence. All of these methods provide an important contribution to the understanding of the factors that ought to be considered in the determination of a discount rate. However, their application at the farm level remains limited. A brief discussion of the WACC and the CAPM follows.

(1) Weighted Average Cost of Capital

In its simplest form the WACC is described by the formula:

\[ K_c = w_d K_d + w_e K_e \]

where

- \( K_c \) = weighted cost of capital
- \( K_d \) = cost of debt capital
- \( K_e \) = cost of equity capital
- \( w_d \) & \( w_e \) = proportions of debt and equity capital respectively in the desired or optimal capital structure of the firm

A basic premise of corporate theory is that the cost of equity capital is always greater than the cost of debt capital. The chief reasons for this are that firstly, the suppliers of equity finance in a business assume considerably more risk than the creditors and secondly, debt capital is tax deductible whilst at least some of equity capital is not.

It is generally assumed that with leverage, the costs of both debt and equity capital rise, at least after a certain point, due to the effects of increased financial risk. Changes in debt costs are largely the result of increased monitoring costs by the lending agency of the firm's performance and behaviour. Van Horne (1989) suggests that the changes in debt costs are likely to be market determined and closely measurable. Changes in equity costs are much more difficult to predict and are much more dependent on managements' attitude to risk, particularly financial risk. Whereas equity costs are assumed to rise at an increasing rate with leverage, the WACC is assumed to rise only after significant leverage has occurred Van Horne (1989). This situation is illustrated in figure 4.1. At first the WACC declines with leverage because the rise in Ke does not entirely offset the use of cheaper debt funds. As a result, the WACC, Ko, declines with moderate use of leverage. After a point, however, the increase in Ke more than offsets the use of cheaper debt funds in the capital structure, and Ko begins to rise. The point at which Ko bottoms out represents the theoretical optimal capital structure of the firm.

At the farm level, although the general form of these relationships could be assumed to hold, there are a number of differences in their practical application and measurability. The first point, noted earlier, is that the family farm business
tends to assess new capital investment projects very much on a discrete and incremental basis and the potential sources of capital are both limited and reasonably well known. Hence, for any current project appraisal, the marginal cost of debt capital can be relatively easily discovered by approaching the likely lending agency. The cost established will be based on the lender's perceptions of the farm's debt:equity ratio, the riskiness of the proposed project and other factors such as the farmer's track record.

In most cases, the cost of farm equity capital will be higher than the cost of debt capital. However, Lee et.al. (1988) suggest that at times the cost of equity capital may equal the cost of long term debt capital, since this would represent a risk free investment of funds for the farmer. In addition, it is possible that at certain times some farmers may have a lower cost of equity capital than debt capital. Such a situation would represent an example of irrational behaviour but is at least partly substantiated by farmer comments that "as long as the costs of debt repayment can be met, then they are willing to invest in a project." The actual rate of an individual farmer's Ke would depend at least partly, on one or a combination of the following factors:

(i) Non-financial goals of the family farm.

(ii) Farmers 'locked in' to particular farming investments and strategies.

(iii) Investment opportunities constrained due to a lack of capital.

(iv) Farmer attitude towards risk and the farm equity position.

(2) Capital Asset Pricing Model

The CAPM is an approach which explicitly attempts to incorporate systematic risk into the determination of the discount rate. It was originally suggested as an alternative to the WACC approach, although it is often now incorporated within the WACC as the cost of equity capital (Brigham and Gapenski, 1988). Its basic formula
is given as:

\[ K_0 = K_{rf} + (K_m - K_{rf})b_i \]

where

- \( K_0 \) = required rate of return on the investment
- \( K_{rf} \) = rate of return on the riskless investment
- \( K_m \) = expected return on the market portfolio
- \( b_i \) = undiversifiable risk on the \( i \)th investment.

The beta coefficient \((b_i)\) is calculated by regressing the historic returns of the asset against that of the market. A major assumption of the approach is that all unsystematic risk can be diversified away. The approach has been most successfully applied to the valuation of stocks, where bountiful historic information exists regarding the returns of both individual stocks and the market, and there is ample scope for diversification.
A number of attempts have been made to apply the CAPM to the determination of discount rates in farming (e.g. Narayan, 1990). However, although the approach is intuitively appealing, it has a number of serious limitations in the practical farming context. These include:

(i) In theory, farmers could diversify away all unsystematic risk by investing in a wide range of lowly correlated assets, both on and off farm. In practice, this is unlikely to occur with farmers being restricted largely to a few and generally positively correlated farming enterprises, with limited scope for substantial off-farm investment.

(ii) Farm project and enterprise type returns tend to be very farm specific, depending upon factors like soils, management, climate, etc. Consequently it is dangerous to evaluate the riskiness and profitability of a specific farm project based on the average returns of the industry (or similar). Therefore, new betas should be estimated for each new farm project but this results in a 'catch 22' situation, since there are often no historic returns for the individual farm in the proposed investment.

(iii) The reliance on historic data for the basis of future decisions also represents a model weakness, as the last six years of farming in New Zealand should tell us. A far better method is to use well researched expectations of future returns which will necessarily be based partly on past experience.

The limitations of both the CAPM and the WACC approaches to quantifying the riskiness of farm investment projects would seem apparent. Indeed, there appears to be little prospect of devising a method of accurately determining a farmer's cost of equity capital. At best, we can only hope to be in the right 'ballpark'. In addition, since the financial viability of farm investment projects are often held to be of greater consequence than pure profitability, perhaps greater emphasis should be placed on the estimation and riskiness of the cash flow components.

4.3.2 A Simulation Approach

In appraising risky investments, we can use simulation to approximate the expected return and dispersion about the expected return for an investment proposal. Simply, it involves developing probability distributions for all risky variables in the capital budgeting model, and then 'running' the model a large number of times, with each variable being drawn randomly from its distribution on each run (iteration) of the model.

The use of simulation analysis to account for risk in capital budgeting is a concept which has been around since the mid 1960's (Hertz, 1964). It also received considerable attention in the farm management literature, especially during the 1970's (eg.
Anderson et al, 1977; and Bell, 1977). However, the adoption of simulation techniques in applied investment appraisal has been relatively low. Some of the major reasons for this included:

(i) A lack of computer technology making such analyses too time consuming, too costly and/or too complicated, even at the corporate level.

(ii) Much of the academic work in this field was also closely inter-related with the area of welfare economics and much of the practicality of the approach became lost in the highly theoretical attempts at utility measurement.

(iii) The academic concentration on mathematical programming and simulation techniques during the seventies often resulted in the modelling process becoming the 'end' rather than the 'means'.

(iv) A lack of statistical understanding by many practitioners and consultants, both in the farming and the corporate sectors. In addition, simulation results provide no clear cut decision rules for project acceptance.

(v) Problems in estimating distributions and relationships between variables used in the models.

Nevertheless, the simulation approach to project appraisal holds considerable appeal and recent computer advances, particularly in the area of user friendly software development, make it much more viable for applied project appraisal. Of particular note is a spreadsheet (LOTUS 123) add-in program appropriately named '@RISK'. This program contains all of the statistical tools required to simulate a risky project, yet all of the routines are provided and it is essentially as easy to use as the basic Lotus 123 spreadsheet. Some of the modelling features incorporated include:

(i) Uncertain cell values may be specified in Lotus 123 using '@' functions. Around 30 distribution types are available.

(ii) Trends may be modelled with uncertainty both within and around the trend.

(iii) Uncertain 'chance' events (eg droughts) may be modelled.

(iv) Dependency relationships between both variables and trends can be modelled using correlations and variable arguments.

(v) User specification of cells for model output.

Using a simulation package (such as @RISK) for farm investment project appraisal has a number of advantages over the conventional single valued model; and it requires very little extra cost, time or expertise. The major problem with single valued models is that they provide no information about the potential riskiness of a project. Although there may be a risk
factor built into the discount rate, it was outlined above that there are serious limitations in the reliability of methods which estimate a risk adjusted rate, and this is especially so at the farm level. Conversely, it is often known with a reasonable level of confidence the range within which farm yields, costs and prices are likely to fall, at least in the short to medium term. There is also considerable information available regarding the degree of correlation between different farm product yields and price trends, and there are many sources of information publishing economic outlooks for many commodity prices, inflation rates, exchange rates, and so on. Thus, by incorporating as much of this type of information as possible into the model, a much better idea of the project risk can be gained.

The simulation approach provides a comprehensive method of dealing with risk (although as with any model, the output is only as good as the data input). Many business risk factors can be accounted for in the cashflows. For instance, distributions placed around yield, price and trend estimates, correlations placed between variables and trends, and probabilities and outcomes placed on chance events account for many of the potential risk sources in farming. The correlation of enterprise returns is of especial relevance in farming where project appraisals are conducted at the whole farm level. In the appraisal of potential farm diversification strategies, proposed enterprises with low to negatively correlated returns with existing enterprises will provide results with overall lowered variability of farm returns. Financial risk may be addressed simply by making changes to the leverage position and analysing the effects on the model output.

Model output can be set up to account for the expected outcomes and the riskiness concerned with both the profitability and the viability of the investment project. The profitability aspect may be represented by the expected NPV and standard deviation of the NPV. If a number of alternative investments (including different financing arrangements) were being appraised then this information could be presented on an Expected Value - Variance graph (Figure 4.2) so that the relative positions of risk and return may be more easily assimilated. However, it is often the question of financial feasibility which is of more importance to farmers. This may be addressed by providing output information of the expected annual NCF's and their standard deviations for each year of the project appraised. In addition, for both the NPV and the NCF's, @RISK provides output statistics regarding the probability that a target level of return is not achieved; a concept which is far more easily understood by the layman than the rather abstract standard deviation.

With the simulation approach, for all practical purposes in farm investment appraisal, the issue of the discount rate assumes less importance. The model provides information regarding the expected NPV and the probability that the target level of NPV (probably zero) will not be achieved; for the given discount rate. Given that the discount rate can be estimated within at least the
'ballpark' range then, in terms of project profitability, there are three possible results:

(1) The project is clearly a winner.

(2) The project is clearly a loser.

(3) The project is a 'question mark'.

In the third case, it is likely that the information about the financial viability of the project, plus other non-financial factors, will have a greater bearing on the 'no or go' decision for the project, than the profitability information. Nevertheless, both the discount rate and the cashflow estimates should be carefully scrutinised and sensitivity analyses of the discount rate and other risky variables conducted.
CHAPTER 5
THEORETICAL ASPECTS OF TAX SHIELDS, FARM INVESTMENT, RISK AND RETURN

This chapter examines some of the theoretical aspects regarding both the implied and the behavioral implications of tax shields on farm investment, risk and return.

5.1 The Implied Effects of Tax Shields On Farm Investment, Risk and Return

The principal effects of tax shields on the farm business are that they lower the costs of doing business. It is logical that the rational farmer would invest in such a way so as to capitalise on the economic benefits of the tax shields available. For instance, the use of tax deductible debt to finance new investments has advantages over equity financing from retained earnings which is sourced from tax paid profits. However, there are obviously limits to the value of tax shields to the farm business. A discussion of some of the issues follows.

5.1.1 Direct Effects on Investment Returns

As long as the farm is in a profit situation, tax shields lower the costs of doing business and therefore increase the profitability of investment projects. In essence, the government pays a subsidy for farmers to pursue certain investment strategies (e.g. debt financing, farm development, etc). Annual post tax net farm income is increased by the total amount of the current year's tax shields claimed. The present value of tax shields to the farm business is given by:

$$\sum_{t=0}^{n} \frac{T_s \cdot V_{st}}{(1+k)^t}$$

where

- $T_s$ = marginal tax rate
- $V_{st}$ = value of the tax shields in year $t$
- $K$ = project's cost of capital

It follows that the utilisation of tax shields for investment projects will add value to the farm business (Van Horne, 1989). In theory, the value of the farm is:

Value = Value if of farm unlevered + Value of non interest + Value of interest tax shields (Equation 1)

tax shields

This situation is illustrated in figure 5.1
Figure 5.1 Value to the Firm of Tax Shields

Where:

- \( VL \) = Value of levered firm with tax shields
- \( V_{NI} \) = Value of firm with non-interest tax shields
- \( V_{NS} \) = Value of firm with no tax shields

Using this simplistic approach, adapted from that of Modigliani and Miller (1963), it would pay the farmer to pursue investment strategies solely on the basis of tax shelters. Although observation of farmer investment patterns during the recent period of high agricultural subsidisation would suggest that tax shields may have had considerable bearing on some farmers' investment decisions, there are obviously practical limits to the extent of the tax shield influences. Otherwise we would see, for instance, farmers pursuing strategies of 100 percent debt financing.

5.1.2 Factors Complicating the Effects of Tax Shields

It is important to note the difference in the two forms of tax shield shown above in equation 1. Non interest tax shields reduce the costs of doing business irrespective of the level of debt, whereas interest tax shields reduce the costs of doing business in direct proportion to the level of debt. This is analogous to government measures to reduce business risk and financial risk.
respectively. Consequently, by pursuing certain types of investment projects and by utilising tax deductible debt capital, farmers can theoretically reduce their overall exposure to risk. A further difference between the tax shield types is that the non interest tax shields tend to be much more discrete and are set largely by the general nature of the investment project (e.g. farm development or machinery purchase), although such factors as project scale have an effect. Interest tax shields, on the other hand, are much more flexible and farmers are more able to adjust their degree of leverage in accordance with the benefits of the tax shields.

A major reason why farmers don't maximise their potential use of tax shields is due to the level of uncertainty surrounding their effective utilisation. Also, as leverage increases, the firm reaches a point where the expected costs of financial stress and reduced flexibility begin to outweigh the benefits of the tax shield. Some of the factors involved are listed below.

(1) **Low or negative incomes**

If net farm income is consistently low or negative then the benefits of all tax shields are reduced or even eliminated. The increased use of debt capital in such a situation would have the effect of increasing the level of financial risk.

Thus it is likely that in the whole farm context, the financial viability of a project will always have a greater bearing on the investment decision than purely taxation reasons. In addition, it is only those farms which are making a reasonable profit that are able to capitalise to any great extent on this form of government subsidisation. This was especially so prior to the recent economic liberalisation when the most wealthy farmers were able to claim back 66 cents for each eligible dollar spent (as compared to a maximum of 33 cents now). This in itself raises a massive question regarding the equity of government policies.

(2) **Bankruptcy**

If the farm should go bankrupt and liquidate, the potential tax savings associated with the debt would stop altogether. The possibility of bankruptcy increases at an increasing rate above some threshold level of debt (Kraus and Litzenberger, 1973). As a result, the expected cost of bankruptcy increases in this manner and would be expected to have a corresponding negative effect on the value of the firm and its cost of capital (Van Horne, 1976). Lenders (and other creditors) bear the ex post cost of bankruptcy, but they will probably pass on the ex ante cost to the farmers in the form of higher interest rates (Haugen and Senbet, 1978). This relationship has certainly been evidenced in New Zealand farming over the last five years.
as rural lending institutions have moved to set interest rates for individual farmers in keeping with their perceived level of borrowing risk.

(3) Other Shelters

Another argument, originally postulated by De Angelo and Masulis (1980) is that farmers have ways other than tax shields to shield income (e.g. the use of options and futures contracts). It is conceivable that if earnings in a given year are sufficiently low, these other shields may entirely use up the earnings at hand. In addition, the non interest tax shields could usurp the benefits from interest tax shields with increasing leverage. De Angelo and Masulis reason that as a company takes on more debt, it increases the probability that earnings in some years will not be sufficient to offset all of the tax deductions. Some of them may be redundant, including the deductibility of interest. While this argument has merit, it is mitigated to some extent by the provisions for the spreading of farm losses and the income equalisation scheme. In addition, the number of tax shelters available to farmers has been greatly reduced over the last five years and as a result, the tax redundancy argument is now less compelling.

(4) Marginal tax rates

Uncertainty about the marginal rate of taxation of the farm business may also influence the degree to which farmers utilise tax shields. Variable farm incomes and progressive tax scales make it difficult to predict the amount of tax which may be shielded. This factor would be accentuated by the uncertainty associated with the numerous changes in tax schedules which have occurred over the last five years, and which are predicted to change even further with the recent election of a new National Government. Table 5.1 illustrates how the highly progressive tax structure pre 1985 magnified the effects of tax shields compared to the structure in place today. It demonstrates the impact on those who borrowed heavily in response to pre 1985 policies, and who have been hit hard by the combined effects of increased interest rates, reduced tax rates and low product prices.
Table 5.1
Effect of Tax Rates on Tax Shields:
example of a $10,000 interest deduction

<table>
<thead>
<tr>
<th>Net Taxable Income ($)</th>
<th>84/85 Tax Rates</th>
<th>89/90 Tax Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal Rate</td>
<td>Tax Claimed</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>$</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5000</td>
<td>20</td>
<td>1000</td>
</tr>
<tr>
<td>10000</td>
<td>32</td>
<td>3200</td>
</tr>
<tr>
<td>25000</td>
<td>45.1</td>
<td>4510</td>
</tr>
<tr>
<td>35000</td>
<td>56.1</td>
<td>5610</td>
</tr>
<tr>
<td>45000</td>
<td>66</td>
<td>6600</td>
</tr>
</tbody>
</table>

5.1.3 The Combined Effects

A major effect of the uncertainty and stress factors outlined above is to constrain the opportunities for increasing the value of the farm business through the use of tax shields. As the farmer either increases spending to capitalise on the non-interest tax shields and/or increases leverage to capitalise on the interest tax shields, a point is reached where the costs of uncertainty, financial stress and reduced flexibility begin to outweigh the benefits of the tax shields (Pringle and Harris, 1987). This effect is illustrated in figure 5.2 for interest tax shields, where the tax shield effect is shown by the straight line. As leverage increases, the uncertainty associated with the interest shield comes into play. At first the diminution in value is slight. As more leverage occurs tax shield uncertainty causes value to increase at an ever decreasing rate and perhaps eventually to turn down (Van Horne, 1989). These effects lead us to a new equation of the value of the firm:

\[
\text{Value of firm} = \text{Value if unlevered} + \text{Value of non interest tax shields} - \text{Value lost through non interest tax shield uncertainty} + \text{Value of interest tax shield} - \text{Value lost through interest tax shield uncertainty}
\]

The last four factors combined give the present value of the tax shields to the farm business. The greater the uncertainty associated with the shields, the less important they become (Van Horne, 1989). Similarly, the uncertainty and stress associated with interest tax shields limit the amount by which the firm's cost of capital is reduced by the tax deductibility. Bishop et al. (1988) suggest that there is a compensatory mechanism acting between debt return and equity return. As the leverage of the
farm business is increased beyond a certain point, the lenders begin to demand higher rates of interest to compensate for the increased levels of risk. This transfers the burden of distress costs to the farmers, who thus also require a higher return on their equity to compensate for the greater financial risk.

**Figure 5.2 Value of the Firm with Income Taxes and Tax Shield Uncertainty**

It is likely that the full marginal benefits of the interest tax shields may be obtained at low levels of debt. However, after a point, as the debt:equity ratio increases, the benefits from the tax shields would get increasingly smaller, due to both the risk averseness of the farmer and the actions of the lender. This effect is illustrated in figure 5.3 where the lines depicting the costs of capital with interest tax shields and uncertainty converges towards the lines excluding tax shields.
Figure 5.3 Tax Shields, Risk and the Cost of Capital

Rate of Return

KΘ
KΘ Tax Shields
KΘ
KΘ Tax Shields
KΘ
KΘ Tax Shields
KΘ
KΘ Tax Shields

Leverage D/E

5.2 The Effects of Tax Shields on Investment Behaviour

The previous section outlined some of the reasons why farmers do not maximise their potential use of tax shields available to them. These were largely because of the increased riskiness associated with higher rates of investment spending and financial leverage and also due to the risk aversion of farmers. However, individual farmer investment behaviour and utilisation of available tax shield subsidies differs markedly. Some of the reasons for this are discussed below.

1) Risk Attitudes

Farmer tolerance levels and ability to manage different amounts of risk vary markedly between individuals and depend on a range of personal characteristics (such as age, family status, etc). A farmer who is less able to tolerate a higher level of risk is normally said to be more risk averse than one who can operate with a higher level of risk; and they operate on a lower risk constraint than the latter. The idea that farmers tend to operate on or near their level of risk constraint (Young, 1979) indicates that if there is a marked change in their exposure to risk, then some readjustment of the farm business is likely to occur.
This would apply equally to either increases or decreases in risk exposure (Featherstone et al., 1988). This may explain some of the recent farm investment behaviour in New Zealand. Prior to 1984, government policies drastically reduced the relative level of risk faced by farmers. In addition to the various direct (non-tax) subsidies and incentive schemes available to farmers, there were a plethora of tax shields offered. The risk reducing effects of the tax shields were accentuated by the highly progressive income tax schedule and a high inflation rate. It is possible that farmers may have (intuitively) found themselves operating with a lower level of risk than they were capable of tolerating and this may have encouraged them to increase their levels of business and/or financial risk in relation to their operating environment (Martin and Lee, 1990). Logically, increased returns for an acceptable level of risk could be maximised by capitalising on the available tax shields. This may explain why, with negative real post-tax interest rates and a very low business risk environment, many farmers were extremely highly leveraged at the time of deregulation. Similarly, it would also explain why, in the five years post-1984, most farmers have concentrated on lowering their debt:equity ratios and decreasing their exposure to business risk.

A further point which arises from the above discussion is that many farmers are (or were) tactical planners rather than strategic planners, and base(d) their long term decisions more on short run rather than on long run considerations. If indeed this is the case, then this would tend to increase the level of farm investment and the utilisation of tax shield subsidies. This would occur because, especially under the old tax regime, the greatest level of shield occurs in the earliest years of investment projects. However, it is also possible that if farmers hold expectations of high long term capital gain in farming, as has historically been the case, then they may be willing to assume greater levels of business and/or financial risk in the short term, by undertaking investment projects in the expectation of long term capital profits. This would imply that more efficient farm investment decisions could be made if government policy changes were signalled to farmers well in advance of their implementation.

(2) Irrational Behaviour

Economic and financial theory is based on the assumption of the rational decision-maker. Thus, in relation to the discussion in Section 5.1.2 above, farmers would maximise their utilisation of tax shields, subject to the associated costs of uncertainty and financial stress. A further implied assumption is that these costs are both measurable and are known with reasonable certainty by the farmer. In reality, neither of these assumptions fully holds, although the degree to which they do occur varies markedly between individuals.
In a survey of New Zealand farmers, Newman et al (1990) asked respondents to list how they would use a similar amount of money arising from three different sources. Theoretically, the responses for all three sources should have been similar. However, they were quite different. Table 5.2 shows that the respondents placed a higher priority on productive investment from farm related income, but they were much more discretionary when it came to income from non-farm and 'chance event' related income. In these instances, the respondents were behaving irrationally. They were, at least partly, divorcing their decisions regarding the expenditure of the money arising from 'windfall gains' from the realities of their level of overall farm risk.

Table 5.2
Farm Source of Income and Priority of Use

<table>
<thead>
<tr>
<th>Source of Income</th>
<th>Priority of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings from a good year farming</td>
<td>(1) Replacement of productive assets</td>
</tr>
<tr>
<td></td>
<td>(2) Debt reduction</td>
</tr>
<tr>
<td></td>
<td>(3) Off-farm investment</td>
</tr>
<tr>
<td>Winnings from a lottery</td>
<td>(1) Non-productive expenditure</td>
</tr>
<tr>
<td></td>
<td>(2) Debt reduction</td>
</tr>
<tr>
<td></td>
<td>(3) Off-farm investment</td>
</tr>
<tr>
<td>Money from inheritance</td>
<td>(1) Debt reduction</td>
</tr>
<tr>
<td></td>
<td>(2) Off-farm investment</td>
</tr>
</tbody>
</table>

Tax shields also constitute a form of windfall gain to farmers in that they provide a direct benefit unrelated to the normal rewards from the sale of produce. Hence, it follows that farmers may invest irrationally in order to obtain the perceived benefits of the tax shields available to them. This behaviour may be accentuated when the potential gains from the tax shields are large, and the magnitude and availability of them is widely communicated to farmers such as during the early 1980's.

The psychological basis of this form of behaviour appears to have been well learnt and applied in the highly competitive car sales industry. After the dismal failure of a marketing ploy by the Volkswagen Company in the USA to reduce the price of its cars by $1000 each, Iacocca (Fortune, February, 1990) stated: "You would assume $1000 price cuts across the board would be meaningful. We (the Chrysler Corporation) just put our best stuff on sale by offering a guaranteed rebate of up to $1000, and it was
unbelievable. People knocked down the doors to get $1000 off mini-vans...." This serves to illustrate the point that farmers may invest in an irrational manner in order to obtain what they see as a 'free lunch'.

5.3 The Effects of Tax Shields on Farm Investment Type

Tax shields (and other forms of farm investment incentive and subsidy) may have a distorting effect on the types of farm investment undertaken. In particular, it is possible that tax shields would encourage investment in land and other capital assets as opposed to labour.

Although the wage cost of labour is fully tax deductible, there are many other hidden costs which are not fully accounted for (e.g. costs of hiring and firing, including redundancy payments, and Accident Compensation Commission charges). Conversely, not only are the interest and working expense costs of capital items fully deductible but, depending on the nature of the item, farmers are or have been able to claim other tax deductions against capital expenditures (e.g. depreciation costs, investment allowance and development allowance). The effect of these additional shields has been to decrease the ownership costs of capital items relative to the costs of hiring labour.

A similar situation exists regarding investment in farm land. Although there is no direct tax shield on the purchase of land, the costs of land development and debt repayments associated with land ownership have traditionally received varying degrees of tax shield effect. However, farm land is able to be sold with little or no tax charge on the capital gains. These potential tax shield benefits to investors in farm land are accentuated during periods of high inflation. Their impact on farm investment would be to restrict the flow of capital to other forms of investment, based on productive returns rather than on the unproductive returns of capital gain.

This chapter has discussed some of the underlying factors which may affect farmer investment strategies and their utilisation of available tax shields. Most of the factors are extremely 'farmer specific' and are largely unmeasurable, although they do help to provide a general understanding of the likely farmer responses to potential changes in the tax regime. The following chapter adds a further dimension to the understanding of the effects of tax shields on farmer investment behaviour, by quantifying the tax shield benefits under a range of case study farm investment scenarios.
CHAPTER 6
MODEL ANALYSIS AND RESULTS

The previous chapters have outlined some theoretical aspects of the effects of tax shields on farm investment, risk and expected return, and have provided an overview of the taxation situation in New Zealand agriculture. The purpose of this chapter is to quantify the farm risk and return effects of a number of apparent tax shields which have been, or are, available to New Zealand farmers.

6.1 Model Description

The analytical approach was to develop a ten year capital budgeting model of a case study farm. The model was used to evaluate both the financial viability and the financial profitability of a number of different farm investment and taxation scenarios, in terms of both expected return and risk. A thorough explanation of the model methodology and assumptions is contained in Appendices 1 and 2.

6.1.1 Model Features

The model was developed on a whole farm basis, with a range of deer and sheep development scenarios being compared to a no development (sheep only) scenario. All borrowing, taxation\(^1\) and inflation factors relating to the developments were incorporated within the cashflows (in real $1990), with the marginal net cash flows for each investment scenario being discounted at the cost of equity capital. The advantage of this approach is that it allows the specific effects of each tax shield analysed, under different borrowing and development strategies, to be accurately measured.

Model construction was undertaken using LOTUS 123 and a LOTUS add-on simulation package called @RISK. @RISK allows the incorporation of risk into the model by enabling probability distributions and correlation coefficients to be specified for spreadsheet cells instead of fixed values or formulas. Simulations may be performed in which values are randomly drawn from the appropriate distribution at each iteration for each affected cell. For this analysis, 100 iterations were conducted for each simulation run.

\(^1\)For modelling simplicity it was assumed that taxation is paid in the year in which it is incurred. Although the provisional taxation system has significant within year cashflow implications for farmers, it was felt that for a long term analysis using annualized budgets, the effects would be inconsequential.
6.1.2 The Case Study Farm and Factors Analysed

The case study farm is a hypothetical "Class 6" South Island finishing breeding farm based on the representative data from the New Zealand Sheep and Beef Farm Survey (NZM&WBES, 1989) and the New Zealand Farm Monitoring Report (MAFTech, 1989). The farm is mainly on hill country, with a grazing area of 350 hectares and carrying approximately 3000 stock units, or 8.6 stock units per hectare. The farm currently runs only sheep, with the crossbred ewes averaging 110 percent lambing (survival to sale) and 5.0 Kg wool per ewe. Twenty five percent of ewe hoggets are kept, and surplus lambs are sold through the summer and autumn period, either in finished or forward store condition. It is assumed that the farm business is run as a sole proprietorship.

The model analysis involved the evaluation of three different farm development types:

(a) Deer Diversification

Red deer hinds, killing 15 month stags and selling surplus weaner hinds. Two strategies were looked at:

(i) Fast development - 60 ha developed for deer and all necessary stock purchased in the first year.

(ii) Slow development - 15 ha per annum developed for deer over four years. A deer shed is built at the start of development and deer numbers are built up over the development period.

(b) Sheep expansion

The existing flock is expanded by retaining greater numbers of ewe hoggets.

The case study farm situation and development situations selected are somewhat simplified and generalised from what an actual farm system may be. For instance, different cropping policies which may be followed with each development type were excluded, although differences in supplementary feed costs were included. However, the purpose of the modelling exercise was not to assess the returns to particular farm development types per se, but rather to assess the relative differences under various fiscal and financial scenarios.

The specific tax shields and related factors evaluated using the model were:

(a) Deductibility of interest on borrowing.

(b) Herd versus Trading Stock livestock tax schemes.

(c) Deductibility of development expenditure and special first year depreciation allowance.
(d) Spreading of tax losses.
(e) Across the board tax regime changes.
(f) The impact of different discount rates.

In addition, depending upon the nature of the tax item being analysed, the following factors were adjusted:

(a) Tax regulations - tax shields were evaluated at their pre-liberalisation, present, or proposed levels.
(b) Product prices - prices were included at either expected levels, or adjusted either upwards or downwards above that.
(c) Stock numbers - total farm stock numbers were either held constant or increased.
(d) Borrowing leverage - development borrowing was included at either 0, 50 or 100 percent of development costs and existing farm mortgages varied between $0, $130000 and $200000.
(e) Income tax rates - tax rates were included at pre-liberalisation rates, with tax bands adjusted for inflation, and present rates.

Further details on the amount and nature of the changes is included in Appendix 2.

6.1.3 Treatment of Risk and Return

The aim of the model was to quantify the impact of tax shields on the return and riskiness of farm investments. The approach was based on the premise that the desirability of a farm investment may be measured by its impact on the level of whole farm expected return and the variability of expected returns. These values can be estimated using the following general formulas:
(a) Expected income

\[ E = \sum_{i=1}^{n} x_i e_i \]

(b) Standard deviation of expected income

\[ V = \sum_{i=1}^{n} \sum_{j=1}^{n} r_{ij} \sigma_i \sigma_j x_i x_j \]

where,

- \( e_i \) = expected value for enterprise \( i \)
- \( x_i \) = number of units of enterprise \( i \)
- \( \sigma_i \) = standard deviation of the per unit expected value for enterprise \( i \)
- \( r_{ij} \) = correlation coefficient of the per unit values of enterprises \( i \) and \( j \).

The application of these formulae within the model provide the basis for addressing the questions on the impact of tax shields on both business and financial risk.

Business risk was accounted for within the model by placing probability distributions around all values and trends. In addition, the non-systematic portion of business risk was implicitly incorporated within the model by including correlation coefficients for many important production and product price variables. Hence, the correlation effect of deer development compared with bull beef development would be to lower overall farm risk, since deer returns have historically been less correlated with sheep returns than beef returns.

The impact of tax shields (especially of interest deductibility) on financial risk was assessed by evaluating set scenarios under different levels of borrowing leverage. These varied from zero existing mortgage and development borrowing to a $200,000 existing mortgage and 100 percent development borrowing.

6.1.4 Model Output

The model output includes values to account for both the viability and the profitability of farm investments. The
viability is approximated by the expected annual post-tax net cash flows (NCF's) and their measures of variability, for the 'with development' situation. Profitability is represented by the expected NPV and its measures of variability, of the marginal post-tax net cash flows accruing from the project. The total output values calculated for each investment scenario analysed are listed below:

(a) For 'without development' situation
   (i) Expected annual post-tax NCF's
   (ii) Standard deviation of expected NCF's
   (iii) Probability that each NCF will be less than $0

(b) For 'with development' situation
   (i) Expected annual post-tax NCF's
   (ii) Standard deviation of expected NCF's
   (iii) Probability that each NCF will be less than $0

(c) For the marginal situation
   (i) Expected NPV
   (ii) Standard deviation of expected NPV
   (iii) Probability that the NPV will be less than $0

Since there were a large number of scenarios analysed and because the sheer bulk of the output data rapidly became unwieldy, the discussion of the model results in the text has been limited to only the most significant aspects. For instance, the risk appraisal measures discussed are limited to the expected values and the probabilities that values will be less than zero, for the 'with development' NCF's and the NPV's.

6.2 Model Analysis Results

This section presents some of the main results from the simulation model runs and analyses the key implications of these results. Model output for runs relating to the issues discussed below are tabulated in Appendix III.

One difficulty with analysing the tax shield effects of various tax regimes is a result of the way in which the computer spreadsheet models were set up. As noted above, the net present value calculated for each model run is that of the marginal cashflows of a with development scenario minus a without development scenario. Both with and without scenarios are evaluated under the same taxation regime so that tax shield
effects are not identified. However, mean cashflows for the individual development scenarios under different tax structures are available so that it is possible to compare differences in these cashflow streams and to manually estimate the net present value of these differences. This approach was used to estimate the tax shield effects discussed in this section.

6.2.1 The Effects of Tax Deductibility of Interest

Three alternative tax treatments of interest were analysed using the capital budgeting model. These ranged from full deductibility of all interest payments to nil interest deductibility, with a third possibility being that only the real component of interest (after allowing for inflation) was deductible. This latter case reflects one of the reforms proposed in the Consultative Document on the Taxation of Income from Capital. Currently, all interest paid on farm mortgages and seasonal finance is tax deductible. Comparing the full deductibility case to the nil deductibility case therefore provides an estimate of the tax shield inherent in the present tax structure.

In addition to these different tax treatments for interest, three levels of existing mortgages were compared: nil mortgage, a $130,000 mortgage and a $200,000 mortgage. The standard, or base case, development scenario was for a "fast" deer development financed with 50% leverage and having a $130,000 existing mortgage. Nil leverage (i.e. development financed by farm equity) and 100% leverage scenarios were also examined.

Tables 6.1 and 6.2 below show net cashflows for the base case deer development scenarios, probabilities of these cashflows being positive in each year, and the overall net present value of the development project, over and above expected returns under the current farming system. The tax shield effects, obtained by comparing the cashflow streams under full tax deductibility of interest with the nil deductibility case, for both current and old tax rates, are shown in Figure 6.1.
Table 6.1  
Cashflows and Probabilities of Loss for Fast Deer Development  
(Present Tax Rates)

<table>
<thead>
<tr>
<th>% Interest</th>
<th>100%</th>
<th>REAL</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deductible:</td>
<td>100%</td>
<td>REAL</td>
<td>0%</td>
</tr>
<tr>
<td>YEAR</td>
<td>NCF</td>
<td>P(NCF&lt;0)</td>
<td>NCF</td>
</tr>
<tr>
<td>0</td>
<td>-91949</td>
<td>100</td>
<td>-92117</td>
</tr>
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<td>1</td>
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<td>32588</td>
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<tr>
<td>10</td>
<td>130936</td>
<td>0</td>
<td>128269</td>
</tr>
</tbody>
</table>

Marginal NPV: 22141 27 19071 31 18891 31

Note: Fast Deer Development, $130,000 Mortgage, 50% Development Borrowing, Present Tax Schedule

NPV shown is not NPV of cashflows in table, but of marginal increment from with development over without development.
Table 6.2
Cashflows and Probabilities of Loss for Fast Deer Development
(Old Tax Rates)

<table>
<thead>
<tr>
<th>% Interest Deductible:</th>
<th>100%</th>
<th>REAL</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NCF ($)</td>
<td>P(NCF&lt;0)</td>
<td>NCF ($)</td>
</tr>
<tr>
<td>YEAR</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>-91949</td>
<td>100</td>
<td>-92014</td>
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<td>120897</td>
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Marginal NPV

<table>
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<th></th>
<th>10934</th>
<th>5887</th>
<th>1425</th>
<th>55</th>
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</table>

Note: Fast Deer Development, $130,000 Mortgage, 50% Development Borrowing, Old Tax Schedule
NPV shown is not NPV of cashflows in table, but of marginal increment from with development over without development

Figures 6.2 and 6.3 present some further analysis of the tax shield implicit in the tax deductibility of interest payments. In Figure 6.2 the tax shield effects of the current and old tax rates are shown under the assumption of 100% development borrowing. The tax shield effect of real interest only being deductible, for the base case run, is shown in Figure 6.3.

Analysing the results of the possible combinations of debt, leverage and tax deductibility leads to some general observations. Firstly, it can be seen from Figures 6.1, 6.2 and 6.3 that the tax shield effect of interest deductibility is significant. The present values of the tax shields shown in Figure 6.1 (using a real post-tax discount rate of 4%) are $44009 for current tax rates and $69117 for the old tax rates. Even if only the real component of interest is deductible, as foreshadowed in the Consultative Document, the tax shield is still significant. In this case the shield has a present value of $32558 at present rates and $50146 at old rates, under the assumptions regarding inflation and interest rates used in the model. Figure 6.3 illustrates these effects. It is clear from these observations, and from examining Figures 6.1 and 6.2, that the higher marginal rates under the "old" tax schedule provided even greater tax shields than apply at present rates of tax.
The tax shield effect appears to be greatest in year three of the development scenario, and to subsequently decline gradually. The peak in year three is due to the fact that a tax loss is generated in the first year of development and part of this loss is carried forward to year 2. Tax liabilities, and hence the effect of the interest deductibility tax shield, therefore have reduced importance in these years. Two main factors cause the tax shield effect of interest deductibility to decline from year three onward. Firstly, inflation erodes the benefits of interest deductibility since the amount of interest paid on a fixed sum reduces in real terms over time. And secondly, the interest component of mortgage repayments declines over time so that less interest is paid in later years in nominal terms as well.

What is the impact of these tax shield effects on the profitability aspect of project appraisal? Fast deer development under a 100% deductibility of interest regime had a NPV of $22141 compared to $18891 under a nil deductibility regime at current tax rates. Therefore, the deductibility of interest payments
would probably not have influenced an investment decision based on NPV alone - at least in a static situation, with no change to the tax situation, the decision would be to undertake development in either case. Consideration should also be given to the effect of interest deductibility on the expected cashflows from the proposed investment. As Tables 6.1 and 6.2 illustrate, interest deductibility improves projected cashflows, making the development more viable.

Tax deductibility of interest is also likely to influence the level of debt farmers are willing to bear. Interest deductibility would be expected to favour projects with greater levels of debt financing involved. The results of the simulation model runs suggest that this is indeed the case. Where a "fast deer" development is financed solely from borrowing, the tax shield effects calculated are higher than in the base case, where only 50% of development is financed from borrowing. The present value of the tax shields shown in Figure 2 for the 100% development borrowing case are calculated as being $57395 at current tax rates and $88053 at old tax rates. A comparison of Figures 6.1 and 6.2 illustrates the impact of increased financial leverage on the tax shield.
A final aspect of the model results relates to the effect of tax shields on risk. The results indicate that the downside risks of development are slightly reduced by deductibility of interest. For the base case, the probability of a negative NPV was 27% with 100% of interest payments deductible and 31% for both the real and nil deductibility cases at current tax rates. In individual years, as Table 6.1 shows, deductibility of interest reduced the probability of negative cashflows. Similar results are observed for the case where development is financed wholly by borrowing (Figure 6.2). The probabilities of negative NPVs were 6% for 100% deductibility, 5% for real deductibility and 7% for nil deductibility. Although the greater level of borrowing increased the probability of negative cashflows compared with the base case, interest deductibility still had the effect of reducing the risks of development.

The effects of the interest deductibility shield on "slow" deer development were also investigated. As would be expected, the value of the shields was less than for the "fast" development case since less borrowing was required to finance the development and the costs are spread over a greater period of time. This suggests that interest deductibility may encourage faster development, which in turn may lead to a greater exposure to
downside risk. Figure 6.4 shows the tax shields calculated for slow deer development under both old and present tax rates.

![Graph showing Value of Tax Shields, Slow Development](image)

Figure 6.4 Value of Interest Deductibility for Slow Deer Development

6.2.2 Livestock Valuation for Taxation Purposes

The capital budgeting model was used to compare the herd and the trading stock schemes for livestock valuation. These are the two most commonly used schemes in practice, although some farmers use the cost of production method. It was decided not to incorporate the cost of production method in the analysis due to time and resource constraints.

In general it was found that there was very little difference between the herd and trading stock schemes under the scenarios considered with the model. Under the base "fast deer" development scenario, the herd scheme had a mean NPV of $22141 while the mean NPV calculated using the trading stock scheme was $22947. It should be recalled that these NPV's represent the difference between development and no development, both under the same tax regime. The present value of the difference in cashflows under the two options gives an indication of which scheme has greater tax advantages for farmers. For the base case, the herd scheme
had a present value $701 greater than the trading stock scheme. This figure represents the tax advantage of the herd scheme over the trading stock scheme under the basic model assumptions.

If all product prices (including stock values) were assumed to increase over the simulation period, the present value of cashflows under the herd scheme was $27295 higher than the trading stock scheme. Where prices were assumed to decrease over the model period the trading stock scheme had the greater cashflows - a difference of $1838 in present value terms. Figure 6.5 graphically presents the difference in cashflows for the two valuation systems (i.e. herd scheme cashflows - trading stock scheme cashflows) for the range of price assumptions modelled.

Similar results were obtained for a "slow deer" development scenario, and for development by increasing sheep numbers only. No analysis was undertaken to compare the schemes under a static or no development situation.

Figure 6.5 Cashflow Differences for Livestock Valuation Schemes
These results suggest that in the medium to long term farmers contemplating development may be advised to use the herd rather than the trading stock scheme. There is a clear tax advantage under the herd scheme when prices are rising over a period of time. Conversely, the trading stock scheme has the advantage when prices are falling. However, this advantage is only slight. This may be because with lower stock values there is less absolute difference between tax liabilities under the schemes. If prices are stable there is little to choose between the schemes.

The conclusion drawn from this analysis is that if farmers have reliable information about future prices there may be some benefits to be obtained by swapping between schemes. However, in the absence of accurate information about future prices it would seem logical to favour the herd scheme.

The tax shield benefits of the livestock valuation schemes discussed here refer purely to differences in tax liabilities between identical enterprises under the two valuation options. As was discussed in Chapter 3, there may be other tax shields inherent in the nature of the schemes themselves which may also influence farmer preference for one or other scheme.

6.2.3 Deductibility of Development Expenditure

In the past, special development and first year depreciation allowances were available to farmers undertaking development expenditure. The first year depreciation allowance has been dropped, and the development allowance is in the process of being phased out at present. These allowances are discussed more fully in Chapters 4 and 5. Three different tax treatments for development expenditure were compared using the simulation model:

(a) a 100% development allowance and a 20% first year depreciation allowance

(b) a 55% development allowance in year 1, a 30% development allowance in year 2, and no first year depreciation allowance

(c) no development allowance or first year depreciation allowance (capital expenditures are capitalised and depreciated)

The tax shield effects were calculated as the net difference in development cashflows between the scenarios with development allowances and the nil development allowance case, (c). Table 6.3 presents the cashflows for the model runs using the current tax rates under the range of assumptions regarding development allowances. The net tax shield effects of the two levels of development allowance are shown in Figure 6.6.
Table 6.3
Cashflows and Probabilities of Loss for Fast Deer Development with Development Allowances at Present Tax Rates

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<th>Development Allowance</th>
<th>100% Present</th>
<th>Nil</th>
</tr>
</thead>
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<tr>
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<td>%</td>
</tr>
<tr>
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<td>-91971</td>
<td>100</td>
</tr>
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<td>4</td>
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<td>3</td>
</tr>
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Marginal NPV: 22531 31 22141 27 19419 30

Notes: 50% development borrowing, present tax rates, herd scheme for livestock valuation, $130,000 existing mortgage assumed in all cases.

The present value of the tax shield effect of a 100% development allowance and 20% first year depreciation allowance was calculated as $3534 (i.e. the present value of the cashflows depicted in Figure 6.6). This was reduced somewhat to $2645 in the case where there is no first year depreciation allowance and the development allowance is being phased out. In both cases, positive tax shields were calculated over the first few years of the development and negative values over the later years. This reflects the fact that higher (absolute) levels of depreciation can be claimed in later years when no development allowance is claimed in the initial years. However, as the positive present values of the shields show, these later depreciation gains are more than offset by the tax benefits of claiming the allowances.

Another point to note is that in the first two years of the project, the development allowance does not appear to have a great impact on cashflows. This is because there is a tax loss in the first year, in spite of the positive cashflow. The development allowance (and depreciation allowance) are non-cash expenditure items which reduce tax liability but have no direct impact on cashflow. Effectively the development allowance is carried forward to later years as a tax loss.

It is interesting to note from Table 6.3 that although the development allowance improves the mean NPV of the development
6.2.4 Spreading of Tax Losses

The ability to carry forward tax losses from one year to offset against income in a subsequent year represents a form of tax shield. Particularly when undertaking a costly development, it may have an impact on farm decisions.

Tables 6.4 and 6.5 present the development cashflows for a fast deer development under the present and old tax rates respectively. In both tables cashflows are those under the standard development scenario ($130,000 existing mortgage, 50% development borrowing, present development allowance etc). Three possible loss spreading regimes are considered. The first regime reflects the current situation, with all losses able to be spread forward to later years. A second option considered is that of a $10,000 maximum on the amount of loss able to be offset against income in any year. In order to calculate the tax shield effects of these regimes, the third option is a nil spreading regime under which no losses may be carried forward.
Figure 6.7 Value of 100% Loss Spreading
<table>
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<tr>
<th>Amount of Loss Spread</th>
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<tr>
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<td>P(NCF&lt;0)</td>
<td>P(NCF&lt;0)</td>
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Marginal NPV 22141 27 19897 35 11085 40

Notes: 50% development borrowing, present tax rates, herd scheme for livestock valuation, $130,000 existing mortgage assumed in all cases.
Table 6.5

Cashflows and Probabilities of Loss for Fast Deer Development

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<th>NCF %</th>
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Marginal NPV: 10934 39 12699 37 -2132 56

Notes: 50% development borrowing, old tax rates, herd scheme for livestock valuation, $130,000 existing mortgage assumed in all cases.

As can be seen from Tables 6.4 and 6.5, the ability to spread losses does add significantly to the NPV of the project. This is especially so under the "old" tax rates, where in the absence of loss spreading the NPV is negative. Spreading losses in this case makes the difference between accepting and rejecting the development.

It is also interesting to note that the option of limited spreading has a slightly higher NPV than the 100% spreading option under the old tax rates. This probably reflects the highly progressive nature of the old tax scales. The maximum limit on spreading of losses in any one year means that tax losses are spread over a longer time period with this scheme. Under the old tax scales even small reductions in taxable income can give relatively large reductions in the marginal rate of tax.

Figures 6.7 and 6.8 show the net tax shield effects calculated from the above cashflows. At current tax rates, the ability to fully spread losses has a present value of $14207. As with the
tax shield effects examined in the earlier sections, the taxable loss incurred in the early years of the development means that the greatest benefits occur from year 2 onwards. The $10,000 ceiling on loss spreading has the effect of deferring the tax shield from early to later years, with the net tax shield calculated having a much more even pattern over the investment period. The present value of the shield with the $10,000 limit is $10,351 at present tax rates. Again, due to the higher marginal tax rates, the old tax rates give a greater tax shield effect as the figures show.

6.2.5 Tax Regime Changes

A number of model runs were undertaken to compare the old tax system with the current system and a possible future regime. The "old" system in this case included not just the old tax rates but also the old allowances for development and first year depreciation. The "possible" regime assumed present tax rates with only the real component of interest being tax deductible. Table 6.6 presents the results for the fast deer development scenario under the standard borrowing and mortgage assumptions.

The three regimes were compared over the usual range of leverage
levels (0%, 50% and 100%). Stock prices for deer and sheep were varied, with runs simulating large increases and decreases in price, as well as with the standard assumptions.

Figure 6.9 graphs the annual difference in cashflows under the present and old regimes with 50% leverage and for a range of price levels. In virtually all cases the current system had the highest NPV and annual cashflows, followed closely by the proposed system, with the old regime clearly lowest. This result applied over a range of leverage levels and indicates the impact of the much higher marginal rates of tax under the old system. Although the higher tax rates were offset by the extra allowances this still did not put projects in as good a position either in terms of profitability (NPV) or viability (annual cashflows) as under the current tax regime.
Table 6.6
Cashflows and Probabilities of Loss for Fast Deer Development
Comparison of Tax Regimes

<table>
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<th>Tax Regime</th>
<th>Old</th>
<th>Present</th>
<th>Proposed</th>
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<td>100</td>
<td>-91949</td>
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</table>

Marginal
NPV 7262 45 22141 27 15372 38

Notes: 50% development borrowing, herd scheme for livestock valuation, $130,000 existing mortgage assumed in all cases.

6.2.6 Discount Rate

The use of different discount rates does not in itself constitute a tax shield. However, the selection of an appropriate discount rate is a debatable issue (refer to Chapter 5). The effects on project appraisal of using different discount rates were examined using the simulation model.

Table 6.7 shows the effect of different discount rates on the NPV calculated for the standard fast and slow deer development scenarios. Probabilities of a negative NPV are also given. It can be seen that the effects of altering the discount rate are similar for both scenarios, with mean NPVs always having the same sign and similar probabilities for both fast and slow deer at a given discount rate.

Clearly, NPV is sensitive to the discount rate used. This suggests that some care must be taken to select the most appropriate discount rate in project appraisal of farm investment decisions. This reinforces the importance of conducting a sensitivity analysis of the discount rate when performing project appraisals.
Table 6.7
Effect of Discount Rate on Project Profitability and Viability

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<th>Discount Rate</th>
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<tr>
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<td><strong>Slow Deer:</strong></td>
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Notes: The "standard" development assumptions of 50% development borrowing, herd scheme for livestock valuation, $130,000 existing mortgage were used in all cases.
CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The purpose of this study was to examine the role of tax shields in New Zealand farming since the beginning of economic liberalisation in 1984. Of particular interest were their effects on the type and magnitude of farm investment, risk and project returns. A review was made of the literature regarding the nature of taxation changes related to agriculture during this period, the theory regarding the effects of tax shields on farm investment and risk and also, suitable procedures for conducting project appraisals of farm investments. A farm investment simulation model was developed in order to quantify some of the tax shield effects.

The literature findings provide some interesting insights into the existing tax situation in New Zealand agriculture and also help to explain both the explicit and implicit effects of tax shields on farm investment, risk and return. The simulation model is too crude, at this stage, to be used in evaluating specific taxation strategies designed to maximise the benefits of tax shields. However, it does provide some very useful information regarding the general effects of a number of different types of tax shields available in farming. The modelling exercise also helped to isolate a number of areas where further research is required.

The major conclusions which can be drawn from the study are set out below.

7.1.1 Major Remaining Tax Shields

Since 1984 the Government has moved to reduce tax advantages to particular industries. Consequently, many previous tax shields have either been removed or are in the process of being phased out. The major tax shield remaining, which is not unique to agriculture, is the tax deductibility of interest costs on borrowing. Although its potential effect has been reduced with the reduction in income tax rates, tax deductibility of interest can significantly increase the returns from, and decrease the riskiness of farm investments. This effect is most pronounced in the initial years of an investment project. In addition, the interest deductibility shield may, in conjunction with other forms of tax shield, distort the nature and timing of farm investments. For instance, it may encourage faster development, or more development and greater debt levels, than may otherwise occur and thus, expose farmers to greater levels of risk. The amount to which this may occur would be in response to each farmer's own perceived level of risk tolerance. It may also assist in encouraging farmers to invest in capital goods and land in preference to hiring more labour.
There also remain a number of areas which appear to act as specific tax shields for expenditure in farming. These remaining tax concessions and tax anomalies are summarised below:

(1) Interest

There are specific provisions which allow that 'interest clawback' did not apply to farm land sold within ten years. These provisions provided a tax advantage for investment in farmland. This applied particularly for an investor planning an investment for less than ten years, in which a capital gain was anticipated and which was financed by borrowing.

(2) Land Sale Gains

The Income Tax Act allows gains on sale of agricultural land to be tax free, in circumstances where gain on other land would be taxed. They provide an advantage for investment in agricultural land in comparison with investment in other land, and in comparison with other investments.

(3) Livestock Valuation

In certain circumstances the livestock valuation requirements allow a tax shelter for investment in livestock. A tax deferral can arise because the value at which stock is required to be accounted for is lower than the actual value of the stock in some cases. In addition, under some circumstances the livestock valuation regime may operate to allow declines in value to be deducted from assessable income, but for corresponding gains to be tax free (providing the taxpayer switches between valuation schemes at the appropriate time).

These effects add to the advantages of farming as an area for investment. In addition, the operation of the livestock valuation regime provides greater tax advantages for investment in livestock which is more expensive than average. This factor may influence buying decisions by farmers.

(4) Income Equalisation Reserve Deposits

The existence of this scheme provides another advantage for investment in the agricultural industry which does not apply to other investments.

In addition, for farmers, this scheme provides an alternative investment which under certain circumstances is more attractive than other forms of investment.
(5) Private Expenditure

The ability to deduct some expenditure which might otherwise be non-deductible (for instance, interest or rates on a farm residence) provides a tax shield for the agricultural industry. In addition, some forms of expenditure (such as swimming pools) may be considered more advantageous than alternatives available to a farmer.

(6) Development Expenditure

The taxation requirements concerning development expenditure are directly concerned with investment.

At present, the immediate deduction for land development expenditure is still being phased out. These provisions provide a direct tax incentive for land development prior to 1992. In addition there are tax advantages in the immediate deductibility of other forms of development expenditure.

Both effects provide an advantage for farm investment compared to other investment; and encourage particular types of investment.

(7) Hobby Farmers

The ability to deduct items of personal expenditure or development expenditure provides some tax advantages for hobby farmers. These factors may provide an incentive for investing in a hobby farm, or for developing it, in preference to other investments.

7.1.2 Factors Complicating the Effects of Tax Shields

The immediate effects of tax shields on farm investment risk and return are not always readily apparent. The most obvious influencing factor is the level of the marginal tax rate which is a function of both the current government taxation policy and the level of annual net farm income. This last factor may itself be manipulated by either carrying tax losses forward or by depositing surplus income into the Income Equalisation Scheme (both of which constitute a form of tax shield in themselves).

A further complicating factor is the effect of inflation on asset values, costs and prices over time. For instance, the real cost of borrowing is decreased over time due to the effects of both tax shields and inflation. However, the real value of land and some other capital assets are maintained and their returns from sale are largely non-taxable.

The effect of tax shields is to add value to the farm business but the extent to which they (particularly interest tax shields)
are utilised is determined partly by the farmer's attitude to risk regarding the ability to generate a sufficient level of cashflow and also, by lending institutions' perceptions of the risk involved in lending to the farmer. As borrowing increases, the financial risk of the investment increases and this drives up the required returns on both debt and equity capital. In addition, the potential gains from a particular tax shield source may be negated by the effects of other tax shields and subsidies. Nevertheless, there is some evidence that some farmers may seek to utilise tax shields to an irrational level in order to capitalise on what they see as windfall gains.

7.1.3 The Appraisal of Farm Investments

The most appropriate method of conducting project appraisals of farm investments is to account for all aspects of inflation, borrowing and taxation within the cashflows and to discount the marginal net cash flows at the cost of equity capital. This method provides the advantage of quantifying the effects of leverage on investment returns and also, shows the actual cash profile resulting from the investment over time. A pragmatic approach to estimating the cost of equity capital is to use the 'expected return that the farmer would obtain on the investment that they would most likely invest in if they do not invest in this one'. Other approaches (eg. the WACC and the CAPM) developed at the corporate level provide some useful insights into the nature of the cost of capital in the presence of risk, but their application at the farm level is considered to be limited. A useful approach to accounting for risk in investment appraisal is to incorporate simulation procedures within the investment model.

7.2 Policy Implications

There are a number of implications for government policy which can be drawn from the study. Some of these are outlined below.

7.2.1 Equity of Tax Shields

The benefits accruing from tax shields are greatest for those on the highest marginal tax rates and/or those who are (or employ) shrewd tax planners, although the inequity has been somewhat reduced with the compaction and lowering of the previous highly progressive income tax scale. Nevertheless, tax shields still constitute a subsidy for the most wealthy farmers. If the argument is followed that the productive response to economic signals is most significant from such farmers then tax shields may form a logical approach to encouraging farm investment (if indeed farm investment should be encouraged by governments at all!). Otherwise, more direct forms of incentive would be more appropriate.
7.2.2 Misallocation of Resources

It was mentioned above that tax shields may encourage investment into land and capital intensive items rather than into the employment of labour. In a time of high unemployment and a declining rural population, this is an area which needs to be addressed.

7.2.3 Signalling of Policy Changes

During the period prior to economic liberalisation many of the nations top farmers, in response to government policies of high inflation, low real interest rates, and a plethora of both tax and non-tax incentive and subsidy schemes, committed themselves to high levels of development and indebtedness. With the rapid changes post-liberalisation, it is these very farmers who have often been the most severely disadvantaged. This implies a responsibility of government to clearly signal it's farm policy intentions well in advance of any proposed major changes.

7.2.4 Proposed Deductibility of Real Interest Only

In principle, the previously proposed changes to the tax deductibility of interest to include only the real element above the rate of inflation appeared a positive move. This approach would help to decrease any distortions in the use of factors of production favouring the use of capital over land and labour. However, it was considered to be very difficult to enforce in practice.

7.2.5 Capital Gains Tax

At present the interest costs of debt on land and many of the costs associated with land development are tax deductible. Yet the returns from the sale of land are essentially tax free. A similar type of situation also exists with the building up of stock numbers. Although the situation has been ameliorated to some extent with the reduction in inflation and income tax rates, this is still an area which warrants closer scrutiny at the policy level.

7.3 Farmer Implications

Obviously all of the policy items mentioned above have implications for farmers. But there a number of other implications emanating from this study which bear mention. These are discussed below.
7.3.1 Planning Horizons

The events over the past six years indicate that many farmers (and consultants) were basing their long term investment decisions largely on short term considerations (eg. available tax and other incentives and subsidies and, inflation and interest rates). If we can benefit at all by the hindsight of this period (including the sharemarket events), then it is from the lesson that farmers must adopt a longer run strategic approach to their investment decision making. Implicit within this is the need to look at the basic underlying fundamentals and the sustainability of the factors involved.

7.3.2 Rationality of Decision Making

Although many astute farmers undoubtedly used tax shields to their advantage, observations suggest that many other farmers invested irrationally, largely to capitalise on the perceived benefits of tax shields (and other incentives) rather than for economic reasons. The fact is, farmers will never recoup the full dollar spent for tax shield reasons. There is a clear need for the true benefits and costs of investment projects to be objectively assessed. This implies the need for the increased adoption of project appraisal techniques.

7.3.3 Tax Planning

There are still a number of both intended and unintended tax shields available to farmers and there probably always will be. Careful planning and utilisation of these shields can yield considerable financial benefits to farmers. However, it must always be remembered that tax legislation has a long history of often unpredictable changes and that reasons of tax avoidance should never form the basis of farm investment.

7.4 Recommendations For Further Research

There are a number of areas which may warrant further research. The most apparent of these are to investigate the remaining anomalies still existing in the taxation system and to explore more fully the policy implications of tax shields outlined above. It could also be useful to conduct a behavioral study of farmer investment decision-making and their basis for utilising tax shields and other forms of subsidies and incentives.

A further research area (possibly related to those mentioned above) which could provide much useful information would be to refine the investment model used in this study and to explore the implications of various types of tax shields in more depth. For instance, the livestock tax section of the model could be extended to incorporate the cost option for livestock taxation and, to allow for the transfer between options on an annual basis. The results of such a study would have considerable benefits both at the farm management level and at the government policy level.
REFERENCES


APPENDIX I
MODEL METHODOLOGY

I.1 @Risk

@Risk is an add-on to the spreadsheet package, Lotus-123. Effectively, it adds commands to the spreadsheet enabling probability distributions to be specified for spreadsheet cells instead of fixed values or formulas. Values drawn from these distributions can be manipulated by the spreadsheet package in the same way as formulas. Simulations may be performed in which values are randomly drawn from the appropriate distribution at each iteration for each affected cell.

Individual spreadsheet cells, or ranges of cells, may be specified as "output ranges". On the completion of a simulation run it is possible to obtain summary statistical information about the values calculated for each spreadsheet cell in the output range. This information is based on the values calculated at each iteration of the simulation.

It is possible to specify "correlation coefficients" between related variables such as wool production and lambing percentage. This ensures that when values are drawn from probability distributions for which correlation coefficients have been specified they will be related and not completely independent.

I.2 Capital Budgeting Model

A ten year capital budgeting model of a case study farm was developed using Lotus-123 and @Risk. Details of the assumptions made regarding the farm, including the probability distributions used, are given in Appendix 2. A range of deer and sheep development scenarios were compared with a no-development (sheep only) scenario. The marginal net cash flow of the development scenario could thus be obtained, and a net present value of the development project calculated for the 10 year budgeting period.

Each simulation analyzed the difference between a development scenario and the sheep only scenario. The @Risk output ranges of main interest were the net present value and the respective cash flow streams of the scenarios. Each run was simulated for 100 iterations. Results presented for each scenario included the mean, standard deviation and probability of a negative result for NPV and year 0 to 10 cashflows. The mean NPV gives an indication of the expected return of the scenario while the standard deviation is a measure of risk.

As the aim of the analysis was to assess the impact of tax shields on risk and investment appraisal, a range of tax effects were considered. Section 6 of Appendix 2 discusses the range of tax effects examined using the model.
APPENDIX II
MODEL ASSUMPTIONS

The capital budgeting simulation model is based loosely on a representative "Class 6" South Island finishing breeding farm (NZMWBES, 1989). The assumptions used in the model are drawn mainly from MAFTECH Farm Monitoring Reports, NZMWBES Sheep and Beef Farm Surveys, Lincoln University Financial and Technical Budget Manuals and numerous professional opinions.

The farm is mainly on hill country, with a grazing area of 350 hectares and is carrying approximately 3000 stock units (SU's), or 8.6 SU's per hectare. The farm breeds its own replacements and is representative of approximately 16 percent of all New Zealand sheep (and cattle) farms.

The farm currently runs only sheep, with the crossbred ewes averaging 110 percent lambing (survival to sale) and 5.0 kg wool per ewe. Lambs average 1.3 Kg wool each. Twenty five percent ewe hoggets are kept, and surplus lambs are sold through the summer and autumn period, either in finished or forward store condition.

To avoid complications in the interpretation of what is farm income, the farm business is assumed to be run as a sole proprietorship. Some casual labour is employed, and most feed is made on the property.

In order to capture uncertainty and risk many of the model parameters were specified in terms of probability distributions rather than fixed values. Both normal and triangular distributions were used. The modelling package used, @Risk, drew values from these distributions at each model iteration.

Correlations between important variables were also included. This helps to ensure that the model provides sensible and consistent output from each iteration. The assumptions used in the model construction are set out below.

II.1 Base Farm Data

<table>
<thead>
<tr>
<th>Effective Area</th>
<th>350 hectares.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocking Rate</td>
<td>Approximately steady state at 3000 SU's (8.6 S.U./ha). An allowance was made for inter-seasonal stocking rate variability for each class of stock by drawing the closing stock numbers from a triangular distribution at from 30 percent below, to 15 per cent above, the expected stock numbers for each year.</td>
</tr>
</tbody>
</table>
II.2 Scenarios Analyzed

Existing "Without Development" Situation Sheep Only
Crossbred ewe flock breeding own replacements. 25 per cent of ewe hoggets are kept.

Possible "With Development" Situations

(a) Deer Diversification

Red deer hinds, killing fifteen month stags and selling surplus weaner hinds. Two scenarios were looked at:

(i) Fast development - 60 ha developed for deer and all necessary stock purchased during the first year of analysis.

(ii) Slow development - 15 ha developed for deer per year over four years. A deer shed is built at the start of development and deer numbers are built up over the four year development period.

(d) Sheep Expansion

The existing flock is expanded by retaining greater numbers of ewe hoggets.

II.3 Physical and Production Data Assumptions

(a) Sheep Lambing %

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>(survival to tailing)</td>
<td>90</td>
<td>113.4</td>
<td>120</td>
</tr>
</tbody>
</table>

Deaths%

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Hoggets</td>
<td>2.5</td>
<td>3.7</td>
<td>5.5</td>
</tr>
<tr>
<td>2 th ewes</td>
<td>1</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>4 th ewes</td>
<td>1</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>6 th ewes</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4 yr ewes</td>
<td>2.5</td>
<td>3.7</td>
<td>5.5</td>
</tr>
<tr>
<td>5 yr ewes</td>
<td>3</td>
<td>5.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Rams</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Wool Production per animal (Kg)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs</td>
<td>1</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Other sheep</td>
<td>3.5</td>
<td>5</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Prime lambs shorn (%) 40 50 60

Hay required/SU wintered (bales) 1 2 3

* 40% lambs and 50% cull ewes sold to store, the remainder to works.
(b) **Deer**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fawning %</td>
<td>75</td>
<td>86</td>
<td>97</td>
</tr>
<tr>
<td>Deaths %</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Velvet Production/stag(Kg)</td>
<td>1.5</td>
<td>2.3</td>
<td>3</td>
</tr>
<tr>
<td>Feed required/SU wintered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay (bales)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Grain (Kg)</td>
<td>6</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

**Selling weights (Kg)**
- Cull hinds: 48
- 15 mth stags: 58
- Cull stags: 80

Weaner hinds sold to store, the rest to DSP.

(c) **Calculation of Livestock Numbers**

For each livestock scenario, closing livestock numbers were drawn from a triangular distribution. Purchasing and selling numbers are calculated from the opening numbers and after allowing for variable birth and death percentages.

II.4 **Economic Data Assumptions**

**Income**

(a) **Sheep**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs ($/hd)</td>
<td>25</td>
<td>28</td>
<td>31</td>
</tr>
<tr>
<td>MA Ewes ($/hd)</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Wool ($/Kg)</td>
<td>5</td>
<td>5.5</td>
<td>6</td>
</tr>
</tbody>
</table>

(b) **Deer**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind fawns ($/hd)</td>
<td>200</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>Stag fawns ($/hd)</td>
<td>150</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>R1yr hinds ($/hd)</td>
<td>350</td>
<td>500</td>
<td>650</td>
</tr>
<tr>
<td>M A hinds ($/hd)</td>
<td>200</td>
<td>230</td>
<td>260</td>
</tr>
<tr>
<td>R2Yr stags ($/hd)</td>
<td>300</td>
<td>350</td>
<td>400</td>
</tr>
<tr>
<td>M A stags ($/hd)</td>
<td>375</td>
<td>425</td>
<td>475</td>
</tr>
<tr>
<td>Velvet ($/kg)</td>
<td>200</td>
<td>250</td>
<td>300</td>
</tr>
</tbody>
</table>

**Expenses**

(a) **Sheep**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Purchases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2th rams ($)</td>
<td>250</td>
<td>300</td>
<td>350</td>
</tr>
<tr>
<td>Animal health ($/SU)</td>
<td>1.2</td>
<td>1.35</td>
<td>1.5</td>
</tr>
<tr>
<td>Shearing costs ($/SU)</td>
<td>2.3</td>
<td>3.3</td>
<td>4.3</td>
</tr>
</tbody>
</table>
| Cartage ($/hd sold)
| Lambs               | 1.5 | 1.8      | 2.1  |
| Ewes                | 2.2 | 2.5      | 2.8  |
(b) Deer

<table>
<thead>
<tr>
<th>Stock Purchases ($/hd)</th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA hinds</td>
<td>350</td>
<td>500</td>
<td>650</td>
</tr>
<tr>
<td>R1Yr stags</td>
<td>200</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>MA stags</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
</tr>
<tr>
<td>Animal health ($/SU)</td>
<td>2.5</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Velveting (&amp;/stag)</td>
<td>16</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Cartage ($/hd sold)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fawns</td>
<td>5.3</td>
<td>7.3</td>
<td>9.3</td>
</tr>
<tr>
<td>Mature deer</td>
<td>8.5</td>
<td>10.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Deer shed ($/stag)</td>
<td>9000</td>
<td>11000</td>
<td>13000</td>
</tr>
<tr>
<td>Total deer fencing ($/1990)</td>
<td>60000</td>
<td>65000</td>
<td>70000</td>
</tr>
</tbody>
</table>

(e) General Farm Costs & Expenses

<table>
<thead>
<tr>
<th>Item</th>
<th>Low</th>
<th>Expected</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages ($)</td>
<td>5000</td>
<td>5500</td>
<td>6000</td>
</tr>
<tr>
<td>Weed &amp; pest ($)</td>
<td>1400</td>
<td>1600</td>
<td>1800</td>
</tr>
<tr>
<td>Fertilizer &amp; lime ($)</td>
<td>9000</td>
<td>12000</td>
<td>13000</td>
</tr>
<tr>
<td>Vehicles ($)</td>
<td>9000</td>
<td>11000</td>
<td>13000</td>
</tr>
<tr>
<td>Electricity ($)</td>
<td>1300</td>
<td>1800</td>
<td>2300</td>
</tr>
<tr>
<td>Hay ($/bale)</td>
<td>2</td>
<td>3</td>
<td>4.5</td>
</tr>
<tr>
<td>Grain ($/Kg)</td>
<td>0.2</td>
<td>0.22</td>
<td>0.24</td>
</tr>
<tr>
<td>Repairs &amp; maint. ($)</td>
<td>3500</td>
<td>4500</td>
<td>5000</td>
</tr>
<tr>
<td>Administration ($)</td>
<td>9500</td>
<td>3000</td>
<td>3500</td>
</tr>
<tr>
<td>Insurance &amp; ACC ($)</td>
<td>2500</td>
<td>3000</td>
<td>3500</td>
</tr>
<tr>
<td>Rates ($)</td>
<td>3500</td>
<td>4000</td>
<td>4500</td>
</tr>
<tr>
<td>Depreciation (General farm) ($)</td>
<td>7500</td>
<td>8500</td>
<td>9500</td>
</tr>
<tr>
<td>Base seasonal interest charges ($)</td>
<td>3000</td>
<td>4000</td>
<td>5000</td>
</tr>
<tr>
<td>Existing farm mortgage</td>
<td>110000</td>
<td>130000</td>
<td>150000</td>
</tr>
</tbody>
</table>

(e) Other Economic Data

* Farm Costs - from a present rate of 7% p.a., inflation is modelled to reduce by an expected one third of the current years rate over the next three years. This will bring the expected inflation rate to around 2% by 1993, which corresponds with the Reserve Bank Governor's contract with Government. From 1993 onwards, the expected rate is held constant. Uncertainty is incorporated by drawing actual values from a normal distribution (around the expected trend) with a SD of 0.5 and then multiplying this by a further within year factor of ND (1,0.05)
**Mortgage Interest Rates** - these are held at inflation plus an expected 9% for the first three years and then reducing by 0.5% in each of the ensuing years. Actual values are drawn from a normal distribution with a SD of 0.5.

**Seasonal Interest Rates** - these are included at an expected level of 3% above the mortgage interest rate. Uncertainty is incorporated by drawing the premium from a triangular distribution ranging from 2% to 4%.

**Sheep Price Inflation** - sheep prices are assumed to increase by 5% p.a. over the next three years, with this increase dropping by 1% p.a. over the following three years from whence prices will move in line with general inflation. Price values are drawn from a normal distribution with a SD of 3% p.a..

**Deer Price Inflation** - deer prices are assumed to be stagnant for the next three years and then to move in line with the rate of general inflation. Values are assumed to be normally distributed with a SD of 5% p.a..

**Wool Price Inflation** - wool prices are assumed to be static for the next three years and then to move in line with the rate of general inflation. A SD of 3% p.a. is used.

**Velvet Price Inflation** - velvet prices are assumed to increase in line with the rate of general inflation. A SD of 10% p.a. is used.

**Existing Farm Mortgage** - it is assumed that the existing farm mortgage has fifteen years to go on an equal annual reducing principal basis, with interest paid on the outstanding amount. In addition, it is assumed that any additional borrowing for development is incorporated within the terms of the existing mortgage.

**Seasonal Finance** - in addition to an assumed base seasonal finance charge, seasonal finance costs are also incurred on 50% of any negative annual net cash flow.

**Selling Charges** - all stock sold to store incur a 5.5% commission charge. Deer sold for slaughter also incur Game Industry Board and Meat Inspection charges.

**Cartage** - assumed costs are based on 90 km travel for all stock bought and sold.
Taxation allowances for development expenditure were included at the following rates:

- Year 1 (1990) 55%
- Year 2 (1991) 30%
- Year 3 (1992) onwards - 0.

Salvage Value - the marginal benefits of the developments at the end of the ten year period of analysis are based on the market value of the improvements. They are assumed to be:

- stock; increase in the total market value of all closing stock numbers at the end of the year ten, (i.e., stock with development minus stock without development, multiplied by year ten market values).

- deer shed; the nominal value of the shed at year ten after depreciation of 2.5% C.P. per annum.

- deer fences; the nominal value of the fences at year ten after depreciation of 5% per annum.

Discount Rate - (Cost of Equity Capital) - included as the post-tax seasonal interest rate with a SD of 1.0%.

National Average Market Values for Stock - these are calculated from the product prices, with the assumption that the ratio between product prices and NAMV's remains relatively constant over time.

Goods and Services Tax - all costs and prices are included exclusive of GST. Although GST may have significant influences on intra-seasonal cashflows, its impact on the longer run risk and profitability of farm project is marginal.

Personal income tax bands - these start at current (1990) levels and are inflated annually at the expected CPI rate.

Development borrowing - borrowing to finance development is allowed for. This covers deer shed and fencing costs, and initial stock purchases for development. From 10% to 100% of development costs may be borrowed. This is assumed to be added to existing mortgage commitments.
II.5 Correlation Coefficients

The following correlation coefficients are contained within the model.

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<thead>
<tr>
<th>Variables</th>
<th>Degree of Correlation</th>
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<td>Fawning % - Lambing %</td>
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</tr>
<tr>
<td>Sheep deaths % - Lambing %</td>
<td>-0.7</td>
</tr>
<tr>
<td>Deer deaths % - Lambing %</td>
<td>-0.6</td>
</tr>
<tr>
<td>Sheep Nos - Lambing %</td>
<td>0.7</td>
</tr>
<tr>
<td>Deer Nos - Lambing %</td>
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<tr>
<td>Ewe price - Lamb price</td>
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<tr>
<td>Deer price - Lamb price</td>
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<tr>
<td>Wool price - Lamb price</td>
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<tr>
<td>Velvet price - Lamb price</td>
<td>0.1</td>
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<tr>
<td>Wool production - Lambing %</td>
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<tr>
<td>Velvet production - Lambing %</td>
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<tr>
<td>Lambs shorn - Lambing %</td>
<td>0.5</td>
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</tbody>
</table>

A correlation coefficient of:

+1.0 indicates that the variables are perfectly positively correlated;

0 indicates that there is no correlation between the variables; and

-1 indicates that the variables are perfectly negatively correlated.

II.6 Model parameter changes

For evaluating the investment outcomes under differing scenarios a number of parameters were varied. Each parameter is discussed briefly below.

(a) Tax Rates

Two sets of tax rates were used in simulation runs: the present (1989-90) tax rates and the "old" tax rates based on inflating the tax bands as at 1985-86 to present dollar values. These are given in Table II.1 below.

(b) Livestock valuation for tax purposes

The model was simulated using either the herd or the trading stock schemes for livestock valuation. It was assumed that no high valued livestock were purchased or run. Where the herd scheme was used, all herd animals were valued under the herd scheme and non-herd animals (e.g., hoggets) were valued under the trading stock scheme.
Table II.1
Marginal Tax Rates Used in Simulation Runs

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<tr>
<td>24%</td>
<td>20%</td>
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<tr>
<td>Above $30,875</td>
<td>$8,300 - $34,500</td>
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<td>33%</td>
<td>33%</td>
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<tr>
<td></td>
<td>$34,500 - $41,500</td>
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<tr>
<td></td>
<td>45.1%</td>
</tr>
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<td></td>
<td>$41,500 - $52,500</td>
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<tr>
<td></td>
<td>56.1%</td>
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<td>over $52,500</td>
</tr>
<tr>
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<td>66%</td>
</tr>
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</table>

Note: The old (1984-85) tax rates were obtained by inflating the then tax bands to present dollars.

(c) Deductibility of interest

Under present tax law mortgage and seasonal interest payments are tax deductible. This was the case modelled in most simulation runs. However, two further cases were also considered; namely nil interest deductibility and real interest deductibility. Under the nil deductibility case, no interest payments were tax deductible while under the real deductibility assumption only the real portion of interest, after accounting for inflation, was assumed to be tax deductible.

(d) Development allowance and first year depreciation

As discussed in Chapter 2, previous tax concessions for agriculture included a 100% development allowance and a 20% first year depreciation allowance for capital development expenditure on buildings. These allowances were modelled in some scenarios. The present situation was also modelled - nil first year depreciation allowance and a phasing out of the development allowance (55% in year 1, 30% in year 2 and 0% subsequently). A further case was also considered in some runs; namely nil development allowance.

(e) Expected product prices

The expected product prices are determined in the capital budgeting model by the trend assumptions described in section 4 (e) above. These essentially forecast changes in prices to be related to inflation plus a random disturbance term. Allowance is also made for current knowledge and predictions over the first few years of the budget spreadsheet.

In some simulation runs these assumptions were varied to examine the impact of much higher (or much lower) than expected prices on project viability. In these runs,
product prices were increased (or decreased) by 10% above (below) the standard forecast levels.

(f) Expected inflation

Inflation, as described in Section 4(e) above, is expected to fall to about 2% by 1993 (year 3) and remain relatively constant over the ten year planning horizon used in the capital budgeting exercise. A number of simulation runs varied this assumption to examine the impact of higher inflation levels on NPV.

(g) Existing mortgage level

The existing mortgage level is determined by a triangular distribution with a low of $110,000, a high of $150,000 and a "most likely" value of $130,000. This assumption was varied for some runs to analyze the impact of debt levels on project appraisal and risk. Nil debt (no existing mortgage) and high debt (a triangular distribution with low of $180,000, high of $220,000 and expected value of $1000,000) runs were also made.

(h) Proportion of development expenditure financed by borrowing

Various simulations were conducted with nil, 50% and 100% of development expenditure assumed to be borrowed (i.e. added to the existing mortgage).

(i) Livestock Numbers

The effect of increasing the farm's carrying capacity was investigated. To do this, total stock units were assumed to increase by 5% in each of the first three years of the model period to a level 15% above the standard base stock levels.

(j) Base Run

The "base run" case assumed the following levels and values for each of the parameters discussed above:

- Present tax rates
- Herd scheme for livestock valuation
- Full deductibility of interest payments
- Existing development allowance (i.e. 55% in year 1, 30% in years 2) and no first year depreciation allowance.
- Standard inflation forecasts (as described in Section 4(e))
- Existing mortgage with an expected value (triangular distribution) of $130,000
- 50% of development expenditure financed by borrowing

A series of simulation runs were performed varying these parameters for the various development scenarios.
APPENDIX III

SUMMARY OF RESULTS

This Appendix contains tables summarising the key results reported and discussed in Chapter 6.
### Table III.1
The Effects of Tax Deductibility on Project Cashflows

Example Scenario: Fast Deer Development, $130,000 Existing Mortgage and 50% Development Borrowing

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Marginal

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Marginal

NPV 22141 27 19071 31 10934 39 5887 48 1425 55
Table III.2
The Effects of Tax Deductibility of Interest on Project Cashflows

Example Scenario: Fast Deer Development, $100,000 Existing Mortgage and 100% Development Borrowing

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### Table III.3

**The Effects of Tax Deductibility of Interest on Project Cashflow**

**Example Scenario:** Slow Deer Development, $100,000 Existing Mortgage and 50% Development Borrowing

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**PRESENT TAX SCHEDULE**

- 100% REAL
- 0% DEDUCTIBLE

**OLD TAX SCHEDULE**

- 100% REAL
- 0% DEDUCTIBLE
Table III.4
The Effects of Tax Deductibility of Interest on Project Cashflows

Example Scenario: Slow Deer Development, $100,000 Existing Mortgage and 100% Development Borrowing

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## Table III.5
The Effects of Livestock Tax on Project Cashflows

Example Scenario: Fast Deer Development, $130,000 Existing Mortgage and 50% Development Borrowing

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### Table III.6
The Effects of Livestock Tax on Project Cashflows

Example Scenario: Slow Deer Development, $130,000 Existing Mortgage and 50% Development Borrowing

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Table III.7
The Effects of Livestock Tax on Project Cashflows

Example Scenario: Sheep Intensification, $130,000 Existing Mortgage

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**Table III.8**

The Effects of Development and First Year Depreciation Allowances on Project Cashflows

Example Scenario: Fast Deer Development, $100,000 Existing Mortgage and 50% Development Borrowing

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113
Table III.9
The Effects of the Spreading of Losses for Tax Purposes on Project Cashflows

Example Scenario: Fast Deer Development, $130,000 Existing Mortgage and 50% Development Borrowing

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### Table III.10
The Effects of Tax Regime Changes on Project Cashflows

**Development:** Fast Deer at present expected sheep and deer price movements.

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**Marginal NPV**

-38472 | 100 | -23758 | 75 | -29056 | 76 | 7262 | 45 | 22141 | 27 | 15372 | 38 | 51419 | 10 | 67511 | 6 | 61129 | 5
Table III.11
The Effects of Tax Regime Changes on Project Cashflows

Development: Fast Deer with sheep and deer price movements at expected + 10%.

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Marginal NPV: 11784

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## Table III.12
The Effects of Tax Regime Changes on Project Cashflows

Development: Fast Deer with sheep and deer price movements at expected MINUS 10%.

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