A stochastic spreadsheet model analysing investment options for the development of pasture on beef cattle farms.

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Abstract

The decision to proceed with farm development to increase animal production is complex. Standalone personal computer software to study either the financial or physical aspects of farm development is available, but models which integrate these components and account for the risks associated with the investment are not. A stochastic spreadsheet (Microsoft Excel®) model was therefore developed to predict the profitability, feasibility and risk of pasture development for two case farms: one in southern Brazil and the other near Wanganui in New Zealand. Pasture was developed at different rates for each farm and the model was used to predict the associated physical and financial changes over-time and a probability distribution of the net present values (NPV) of the net operating profit after tax and before interest (NOPAT) relative to the status quo situation. The extra pasture was used solely for increasing beef cattle production. On the Brazilian case farm the development of 2,263 ha at two rates was studied. The continuation of the status quo had first degree stochastic dominance in terms of the NPV over both development rates; it was superior by about NZ$ 46,000 for the 200 ha/y option and ca. NZ$ 110,000 for the 500 ha/y option at a 16% discount rate. However, at a 6% discount rate the 500 ha/y development rate had first degree stochastic dominance in terms of the NPV over both the continuation of the status quo (by about NZ$ 960,000) and the 200 ha/y option (ca. NZ$ 120,000). This indicates that pasture development could proceed profitability if interest rates continue to fall in Brazil as predicted. For the New Zealand case farm the development of 247 ha at 50 ha/y had first degree stochastic dominance over the 25 ha/y (ca. NZ$ 24,000) and continuation of the status quo (ca. NZ$ 208,000) at a 6% discount rate. Pasture development should therefore continue. Stochastic analysis of the pasture development investment options gave a better insight into the likely outcomes for a project, and provides the farmer with more information for making a decision on whether, and how, to proceed with farm development. The model could easily be adapted for studying farm development with respect to other types of livestock enterprises

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Chapter One: Introduction

Declining real returns for livestock products over the past decade and increased financial uncertainty have raised questions about the profitability of farm development for beef production in both New Zealand and southern Brazil. Few studies of farm development in the context of a less regulated and subsidised pastoral agriculture have been reported since the late 1970's, and those that have (e.g. Parker, 1978), generally have not formally accounted for production and price risk.

Computer models have become an important tool for predicting the likely results of on-farm investment. To date, most computer models have concentrated on a marginal analysis of the investment and not accounted for the whole farm system in terms of both physical and financial changes. Marginal analysis does not allow the 'big" picture to be shown of how the project is to be financed or of the farm's cash situation during the years of the development program. In addition, farming is a risky business and uncertainties about expected variation in production and product prices should be accounted for in the results of the investment analysis.

Thus, there is a need to revisit the question of whether farm development is profitable, and to utilise the increased power and flexibility of computers to analyse development options particularly with respect to risk. A computer model was therefore developed to consider the whole farm system. The model needed to reconcile the livestock numbers and production relative to pasture demand and supply, account for changes in costs and income forgone, estimate tax liability and reflect the farm's overall cash position. Risk was formally accounted

only with respect to pasture production and the beef schedule price. These two parameters have a large influence on the outputs for a development program.

1.1. Scope and Purpose:

1.1.1. Objectives and hypothesis

The research reported in this thesis had four main objectives. The first was to select and assess the physical production and financial situation of two case farms. The second was to develop a computer model to describe the physical production and financial situation on the case farms. The third was to use the model to estimate the economic returns, financial feasibility, and risk of pasture development on the case farms. The fourth was to support the farmers' investment decision making by making the information on the probability of outcomes for alternative plans available to them.

The first two objectives were to evaluate the 'typical' production year and assess the impact of current beef cattle prices on the financial position of the farm. The third objective involved the selection of techniques to predict and evaluate the changes on the farm business through the introduction of improved pastures. The fourth was achieved by providing the farmer the information on the results for the development plan. The study hypothesis was that "Farm development for beef production in New Zealand and southern Brazil at 1996 costs and prices is profitable".

In summary, the model was built with the aim of answering the following questions:

- How does the actual farm system works? (status quo situation)
- Is the developed system financially better than the undeveloped one? (profitability)
- How does the farmer proceed form the "undeveloped" to the "developed" situation? (feasibility)
- What is the risk? (stochasticity of critical inputs)