

**THE IMPACT OF COMPULSORY CROP INSURANCE ON
THE FARM BUSINESS: CASE STUDIES IN THE
TASMANIAN APPLE INDUSTRY.**

A dissertation submitted in partial fulfilment of the requirements of the Degree of
Master of Economics

Francis A. Bright

Department of Agricultural and Resource Economics, University of New England,
Armidale, New South Wales.

November 1995

DECLARATION

I certify that the substance of this dissertation has not already been submitted for any degree and is not being currently submitted for any other degree, and

I certify that, to the best of my knowledge, any help received in preparing this dissertation, and all sources used have been acknowledged in this dissertation.

Francis Bright
Hobart, Tasmania
November 15, 1995

ABSTRACT

Crop insurance is a risk reduction strategy available to farmers to minimise the financial impact of climatic variability on the yields of crops. There has been much debate and research since the late 1940s on the preconditions needed for crop insurance markets to develop and barriers to their development. Much of the literature deals with crop insurance of broadacre crops. There has been little work done on insurance of perennial tree crops such as apples.

The Tasmanian apple industry has had a compulsory crop insurance scheme running since 1982. The scheme covers all climatic events beyond the control of the grower. All growers who produce more than 20 tonnes of apples must insure their first grade fruit. The insurance benefit and base premium are fixed per carton irrespective of variety grown.

This study was conducted using a case study approach with three co-operating apple growers. The study involved stochastic budgeting of the farm business over a ten year time horizon. The main objective of the research was to analyse the impact of the compulsory insurance scheme on the financial performance of the farm businesses.

The author found that growers were better off by insuring their apple crops under the Scheme than having no insurance. As well as the monetary impact of the Scheme, there were important qualitative issues that reinforced the financial impacts of the Scheme for each case study grower. The conclusion of this research work is that for the three case study farmers, crop insurance has positive impacts on the operations of the farm business and is the preferred risk reduction strategy used by the growers.

By undertaking this work the author has increased the knowledge surrounding crop insurance of perennial tree crops in Tasmania.

TABLE OF CONTENTS

DECLARATION	ii
ABSTRACT.....	iii
LIST OF TABLES	ix
LIST OF FIGURES	ix
ACKNOWLEDGEMENTS.....	x
 CHAPTER 1	
INTRODUCTION	
1.1 INTRODUCTION	1
1.2 THE CASE FOR CROP INSURANCE IN TASMANIA	1
1.3 CHANGES IN THE INDUSTRY	3
1.4 RATIONALE FOR THE STUDY	4
1.5 AIM OF THE STUDY	5
1.6 RESEARCH OBJECTIVES	7
1.7 OUTLINE OF THE STUDY	8
 CHAPTER 2	
CHARACTERISTICS OF THE INDUSTRY	
2.1 INTRODUCTION	10
2.2 THE TASMANIAN APPLE INDUSTRY.....	10
2.2.1 Size and Location	10
2.2.2 Production and Value of the Industry	12
2.2.3 Characteristics of orchard production	14
2.2.4 Costs of production	14
2.2.5 Saleable fruit, markets and prices	15
2.2.6 Gross Margins of Varieties	16
2.2.7 Changes in the Nature of the Risks Faced by Growers	17
2.3 CROP INSURANCE IN THE TASMANIAN APPLE INDUSTRY	18
2.3.1 Significant Events in the industry.	18
2.3.2 Hail Insurance.....	20
2.3.3 Crop Insurance 1967	21

2.3.4 Issues for Consideration for a New Crop Insurance Scheme	23
2.3.5 Competitive Advantage of the Tasmanian Apple Industry.	23
2.4 THE CURRENT SCHEME	24
2.4.1 Fruit Insured.....	25
2.4.2 Premiums	25
2.4.3 Insurance of Occurrences.....	26
2.4.4 No payment of Claims	26
2.4.5 Claims Exceed the Premiums Paid	27
2.4.6 Payouts	28
2.4.7 Payout premium ratios	30
2.5 CONCLUSION	31

CHAPTER THREE

THE THEORY OF CROP INSURANCE

3.1 INTRODUCTION	32
3.2 FEATURES OF CROP INSURANCE SCHEMES	32
3.2.1 The Aim of Crop Insurance.....	32
3.2.2 Participation in Insurance Schemes	33
3.2.3 The Social Good Aspect of Crop Insurance	34
3.2.4 Development and Administration of Crop Insurance Schemes	35
3.2.5 Actuarial Basis for Insurance	36
3.2.6 Adverse Selection.....	38
3.2.7 The Basis of Policies: Area Yield versus Actual Production History	39
3.2.8 Moral Hazard and Changing Management Practices.....	39
3.3 OPERATIONAL PROBLEMS IN THE CURRENT INSURANCE SCHEME	41
3.3.1 The Premium as a Proportion of Variable Costs	41
3.3.2 Problems with Payout	41
3.3.3 Set-up of Insurance Schemes	42
3.3.4 The Role of TAMA	42
3.3.5 The Compulsory Nature of the Scheme.....	43
3.4 CONCLUSION	43

CHAPTER 4

DATA

4.1 INTRODUCTION	44
4.1.1 The Case Study Growers	44
4.1.2 Lack of Apple Economics Data.....	45
4.2 THE MODELLING APPROACH	45
4.2.1 The @RISK Program	47
4.2.2 Stochastic Dominance.....	47
4.2.3 Generalised Stochastic Dominance.....	48
4.3 CLIMATIC DATA AND ASSUMPTIONS	50
4.3.1 Climatic Occurrences	50
4.3.2 Using the Weather Occurrences in Modelling.....	51
4.4 FARM CHARACTERISTICS	54
4.4.1 Location	54
4.4.2 Size	54
4.4.3 Type of Business.	55
4.4.4 Overhead Costs	55
4.5 ORCHARD CHARACTERISTICS.....	55
4.5.1 Varieties	55
4.5.3 The Cost of Other Risk Reduction Strategies	56
4.5.5 Machinery Required.....	57
4.6 PRODUCTION DATA.....	58
4.6.1 Varieties	58
4.6.2 Packout of Varieties	58
4.6.5 Prices Received	59
4.5.6 Processing Information and Prices Received	60
4.5.6 Destinations of Fruit in the Processing Markets.....	60
4.5.7 The Growing Costs.....	61
4.5.8 Insurable Fruit and Premiums Paid.....	62
4.6 CLAIMS MADE UNDER THE FRUIT CROP INSURANCE SCHEME	62
4.6.1 Effect on Premium Paid per Carton for Hail and Frost Damaged Fruit	62
4.6.2 Effect of a Claim on Total Insurable Fruit	63
4.6.3 The Impact of Claims on Modelling	63
4.7 CONCLUSION	64

CHAPTER 5

MODELLING AND DISCUSSION OF RESULTS

5.1 INTRODUCTION	65
5.2 THE SPREADSHEET MODEL	65
5.2.1 The Simulations	65
5.2.2 Seed Generator.....	66
5.2.3 Time Horizon	66
5.3 RESULTS	66
5.3.1 Format of Results	66
5.3.2 Graphical Representation	66
5.4 CASE STUDY ONE SIMULATION RESULTS	67
5.4.1 Stochastic Dominance.....	71
5.5 CASE STUDY TWO SIMULATION RESULTS	71
5.4.1 Stochastic Dominance.....	75
5.6 CASE STUDY THREE SIMULATION RESULTS	76
5.6.1 Simulation Results Using Climatic Data based on Grower Perception	79
5.6.2 Stochastic Dominance.....	82
5.6.3 Insurance Coverage - The Proportion of Variable Costs Recovered	83
5.7 LIMITATIONS OF THE SIMULATIONS RUN	84
5.7.1. The Distributions Used	85
5.7.2 Threshold Values for Insurance Claims	85
5.7.3 Hail and Frost Damage Only	85
5.7.4 No adjustment of Variable Costs.....	86
5.7.5 Conclusion Regarding Problems in the Simulation Results	87
5.8 SIMULATION RESULTS CONCLUSION	87

CHAPTER 6	88
-----------------	----

DISCUSSION AND CONCLUSION	88
---------------------------------	----

6.1 INTRODUCTION	88
6.2 THE QUALITATIVE ISSUES OF CROP INSURANCE	88
6.2.1 "Sleeping Better at Night"	88
6.2.2 Voluntary Insurance	89
6.2.3 Other Risk Reduction Methods	90
6.2.4 Conclusion of the Non -Monetary Implications	92

6.3 GENERAL CONCLUSIONS	93
6.3.1 Modelling	93
6.3.2 Reduction of Growers' Financial Losses and Income Variability	93
6.3.3 Risk Reduction	93
6.3.4 Scale of Operation	94
6.3.5 Varietal Mix in Orchard Areas	94
6.3.4 Limitations of the Scheme.....	95
6.4 CONCLUSION OF RESEARCH RESULTS.....	95
6.5 FURTHER RESEARCH AREAS	96
 APPENDIX 1	
THE CROP INSURANCE SCHEME REGULATIONS.....	98
 APPENDIX 2	
GROWER DISCUSSION PROFORMA	100
 APPENDIX 3	
SUMMARY OF CLIMATIC DATA.....	105
3.1. INCIDENCE OF FROST EVENTS AT DPIF's GROVE RESEARCH STATION	106
3.2 SUMMARY OF HAIL DATA FOR 1957-1993 FOR GROVE RESEARCH STATION	107
 APPENDIX 4 : STRUCTURE OF THE SIMULATION MODEL USED	109
 GLOSSARY OF TERMS.....	121
 REFERENCES	124

LIST OF TABLES

Table 2.1	Characteristics of the Tasmanian Apple Industry in 1982,1988 and 1993.....	11
Table 4.1	Damage Estimates from Frost and Hail Events - Percentage of Yield Affected	53
Table 4.2	Proportion of Orchard under Four Varietal "Families"	56
Table 4.3	Yield of Varieties in Cartons per Hectare	58
Table 4.4	Packout Percentages for the Case Study Growers	59
Table 4.5	Expected Prices Received per Carton of First Grade Fruit	59
Table 4.6	Percentage of Damaged Fruit Diverted to the Juicing and Canning Markets.....	61
Table 4.7	Growing Costs per Carton of Fruit Grown	61
Table 5.1	Simulation Results for Case Study One	68
Table 5.2	Simulation Results for Case Study Two.....	73
Table 5.3	Simulation Results for Case Study Three.....	77
Table 5.4	Simulation Results for Case Study Three - (using personal damage parameters)	80

LIST OF FIGURES

Figure 2.1	Tasmanian Apple Production 1964-1993.....	13
Figure 2.2	Variable Costs of Production for Four Selected Varieties.....	15
Figure 2.3	Insurance Payouts 1982-94	28
Figure 2.4	The Payout Premium Ratios 1982-94.....	31
Figure 5.1	CDF for NIAT of Case Study One	79
Figure 5.2	CDF of Cumulative Cash Position for Case Study Two.....	70
Figure 5.3	CDF for NIAT of Case Study Two	74
Figure 5.4	CDF of Cumulative Cash Position for Case Study Two.....	75
Figure 5.5	CDF for NIAT of Case Study Three	78
Figure 5.6	CDF of Cumulative Cash Position for Case Study Three	79
Figure 5.7	CDF for NIAT of Case Study Three - (using personal damage parameters)	81
Figure 5.8	CDF of Cumulative Cash Position for Case Study Three - (using personal damage parameters).....	82

ACKNOWLEDGEMENTS

In my undertaking of this research topic first and foremost I would like to thank my wife, Sue, for putting up with not having a husband for the past 9 months; late nights, no weekends camping or fishing and increased stress levels do take its toll. Thank you to her for her support, love and tolerance of my "pig-headed" dedication toward the completion of this dissertation.

Thank you also to my supervisor, Dr Roderic A. Gill, at the Centre of Agricultural and Resource Economics for his supervision, advice and direction in the preparation of this research. The trout are waiting Rod.

To my colleagues at DPIF, thank you for your ideas, discussions and points of contact. Special thanks to Barry Rowe for his support and offer of help and John O'Loughlin with whom I discussed many concepts of apple economics.

Thank you to Tim Reid, President of the Tasmanian Apple and Pear Growers Association, and the Tasmanian Government Insurance Office's Cecil Bannister for providing me with information on the operations of the compulsory crop insurance.

Finally thank you to the co-operating case study growers who were willing to give me information on which the development of a simulation model depends. Without this co-operation, a study of this type does not exist or remains a theoretical discourse on a practical problem. Thank you again.

Francis Bright

November 1995