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Are we risking too much? Perspectives on risk in farm modelling

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Abstract

Risk and uncertainty have been extensively studied by agricultural economists. In this paper we question (a) the predominant use of static frameworks to formally analyse risk; (b) the predominant focus on risk aversion as the motivation for considering risk and (c) the notion that explicitly probabilistic models are likely to be helpful to farmers in their decision making. We pose the question: for a risk-averse farmer, what is the extra value of a recommendation derived from a model that represents risk aversion, compared to a model based on risk neutrality? The conclusion reached is that for the types of the decision problems most commonly modelled by agricultural economists, the extra value of representing risk aversion is commonly very little.

Keywords: Risk aversion; Farm management; Embedded risk; Modelling methodology

1. Introduction

Farmers face uncertainty about the economic consequences of their actions due to their limited ability to predict things such as weather, prices and biological responses to different farming practices. In recognising this feature of farming, studies addressing risk and uncertainty [1] are common in the agricultural economics literature. Risk is widely seen as an issue of critical importance to farmers' decision making and to policies affecting those decisions (e.g. Anderson et al., 1977; Boussard, 1979; Anderson, 1982; Robison and Barry, 1987).

Like most major areas of academic endeavour, the study of risk in farming has generated a body of conventional wisdom which occasionally is challenged (e.g. Antle, 1983; Leathers and Quiggin, 1991). Our aim in this paper is to criticise some areas of this conventional wisdom concerning the practical incorporation of risk in farm management models. This paper is not another critique of subjective expected utility theory and its various alternatives (e.g. Machina, 1981, 1982; Buschena and Zilberman, 1994). Rather, the focus is on the use of risk models to analyse farm-related problems. Some aspects of the approaches used most commonly in modelling risk are examined and the uses and usefulness of these approaches in agriculture is discussed. A premise of the ensuing discussion is that the appropriate level of detail and sophistication in the modelling of agricultural risks depends on the intended uses of the model. Three such uses are discussed and differences in the appropriate modelling approach are highlighted.

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[1] In this paper we use the terms 'risk' and 'uncertainty' interchangeably to mean 'uncertainty in consequences' (Antle, 1983; Hardaker et al., 1991).

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2. Objectives of farm modelling

The design of a farm model is itself a decision problem involving risk, objectives, and constraints. The choice depends on: (a) the proximity of task deadlines; (b) the availability, quality and cost of data and skilled modellers; (c) the marginal costs and benefits of extra effort to enlarge or complicate the model and (d) uncertainties such as the extent to which the problem or farming system may change during the construction of the model. Further, the choice of modelling technique depends on the objectives of the modeller, which may include: (a) to publish in a refereed journal; (b) to support the government's decision making by predicting either farmer behaviour or changes in welfare in response to a change in, for example, government policy, technology, prices or climate and (c) to help farmers make decisions. In the following sections these objectives are considered in more detail and their relevance to the modelling of agricultural risks is discussed.

3. Publishing

Suppose that the modeller's objective is to publish in an economics journal an analysis of a farm management problem. For many, the solution to the decision problem outlined above is to develop a formal algebraic model of the problem, preferably addressing a topical or emerging issue, with uncertainty represented explicitly. Commonly, the model represents risk aversion as part of the farmer's objective, analytical solutions are derived and formal conclusions distilled from the results.

The requirement for analytical solutions often causes the problem to be simplified substantially, resulting in potentially severe specification errors (Musser et al., 1986; Kingwell, 1996). The modelling framework can be subjective expected utility, for despite its acknowledged limitations (Machina, 1981, 1982; Quiggin, 1982; Schoemaker, 1982; Just et al., 1990), it remains widely used and acceptable to most reviewers and journal editors (Hardaker et al., 1991; Bar-Shira, 1992).

The emphasis on algebraic models is unfortunate because in practice, assessing the impacts of, and optimal responses to, risk is *primarily* a numbers game (Preckel and DeVuyst, 1992). It is rarely possible to generalise about the desirability or otherwise of a particular farming strategy, since the numbers vary widely from one situation to another. For example, yield distributions differ across soil types, regions and crop types (Stanford et al., 1994) and price distributions differ by commodity and data period (Lapp and Smith, 1992). Babcock and Hennessy (1996) note that prices and yields are often assumed to be normally distributed (e.g. Fraser, 1994; Lapan and Moschini, 1994) which simplifies the analysis but is inconsistent with empirical evidence about the skewness of yields (Stanford et al., 1994) and with the non-negativity of yields and prices. Furthermore, the relative importance of price risk and production risk can vary widely between different enterprises, different farming systems and through time (Harris et al., 1974).

Factors such as climate, crop diseases, soil types, crop species, irrigation, marketing policies and technology interact to form and alter the uncertainties of alternative farming practices. Ignoring these multiple sources of uncertainty is essential in an algebraic analysis to ensure tractability, [2] yet it is a specification error which can lead to false conclusions. For example, Pannell (1991) argued that the reputation of pesticides as 'risk-reducing' inputs was based primarily on studies which considered only uncertainty about pest density and/or pesticide effectiveness (e.g. Feder, 1979; Carlson, 1984). If the uncertainties of other factors such as price and potential yield were considered, pesticides could be either risk-reducing or risk-increasing. This argument has been supported in subsequent analyses (Leathers and Quiggin, 1991; Horowitz and Lichtenberg, 1994a, b).

4. Supporting government decision making

If it is accepted that a numerical rather than an analytical approach to modelling is necessary to support government decision making, it still remains necessary to choose the level of detail to be modelled and the modelling technique (Anderson et al., 1977; Hazell and Norton, 1986; Kennedy, 1986). These issues inevitably require judgement over the benefits and costs

[2] Robison and Barry (1987) note: "two random variables ... quickly complicate our analysis, forcing us into numeric rather than analytic approaches" (p. 110).

Table 1
Expected value of annual income ($) from different farming strategies (utility maximising strategies based on absolute risk aversion=3.0×10^{-6})[a]

	Tactical adjustments		Difference	Percentage difference
	Excluded	Included		
Profit maximising solution	153688	168576	14888	9.69%
Utility maximising solution	150060	168038	17978	11.98%
Difference	−3628	−538		
Percentage difference	−2.36%	−0.32%		

[a] Source: previously unpublished output from the MUDAS model (Kingwell, 1994).

of including aspects of the decision problem in the model (Anderson, 1982). The key judgements related to risk are:

- Should the model's time frame be static or dynamic?
- If dynamic, should the model allow for tactical decision making, based on updated information in each time period?
- Should risk aversion be represented?

4.1. Relative importance of representing tactical adjustments and risk aversion

Most studies of risk in economics and agricultural economics have adopted the static framework and included risk aversion in the decision maker's objective function (e.g. Sandmo, 1971; Feder, 1979). In these studies, risk or uncertainty matters, because decision makers endeavour to move away from strategies with relatively high variance of income towards strategies with relatively low variance, if necessary at the cost of some reduction in expected income.

Most farmers would be puzzled that as a discipline we focus so much on this aspect of risk management. For them, the main issue raised by variability of price and production is how to respond tactically and dynamically to unfolding opportunities or threats to generate additional income or to avoid losses (i.e. how to respond to 'embedded risk'). For example, Ortmann et al. (1992) found that the information farmers desire for risk management is largely concerned with defining the expected outcome, not with avoiding risk per se. Such information allows farmers to respond profitably to variations in prices or climate and so is attractive even to 'risk-neutral' farmers, meaning those, whose objective is to maximise expected profit. Perhaps in recognition of this, there is a growing literature that stresses the need to consider the dynamic and tactical features of farming (Rae, 1971; Antle, 1983; Schroeder and Featherstone, 1990; Taylor, 1993).

Several discrete stochastic programming studies have represented both tactical farm management responses and risk aversion (Schroeder and Featherstone, 1990; Featherstone et al., 1993; Kingwell, 1994; Pannell and Nordblom, 1998), allowing the possibility of examining the relative importance of including tactics and risk aversion in the models. For example, Kingwell et al. (1993) found that the expected farm profit in a region of Western Australia could be increased by over 20% through appropriate tactical adjustments of farm plans, while Kingwell (1994) showed that when risk aversion was included in analyses of this farming system, optimal expected profit fell by only 2–6%. The results in Table 1 are from optimal solutions of the same model[3] with or without representation of risk aversion and with or without representation of tactical options. The utility maximising solutions employ a Pratt–Arrow risk aversion coefficient of 3.0×10^{-6} which would be considered extremely high for this region based on published empirical evidence (e.g. Bond and Wonder, 1980; Bardsley and Harris, 1987). The increase in expected profit from tactical adjustments is 10–12%, whereas the reduction in expected profit given risk aversion is less than 3%.

[3] The model is a discrete stochastic programming model of a representative farm. Risk aversion is represented using a method similar to DEMP (Lambert and McCarl, 1985) and UEP (Patten et al., 1988).

Table 2
Certainty equivalent value ($) of the distribution of income from different farming strategies for a risk-averse farmer (absolute risk aversion=3.0×10^{-6})[a]

	Tactical adjustments		Difference	Percentage difference
	Excluded	Included		
Profit maximising solution	130797	143147	12351	9.44%
Utility maximising solution	131912	143597	11685	8.86%
Difference	1115	449		
Percentage difference	0.85%	0.31%		

[a] Source: previously unpublished output from the MUDAS model (Kingwell, 1994).

In examining the relative importance of representing tactics or risk aversion, the most relevant comparison is of certainty equivalent[4] values for the solutions (Table 2). In calculating these certainty equivalents, it is assumed that the farmer is risk-averse (absolute risk aversion=3.0×10^{-6}). The impact of risk aversion is even less than suggested by results in Table 1, with certainty equivalents changing by less than 1%. Compared to the ideal model that includes risk aversion and tactical options, a model which failed to represent tactics would have identified a solution around $12,000 per year less valuable to the farmer. By contrast, the loss of certainty equivalent from accepting a recommended strategy that fails to consider risk aversion would have been only $1000 or less.

While it is acknowledged that presentation of illustrative results does not provide a general proof, it is stressed that:

1. This model represents a farming system with high levels of price and production risk.
2. The results *exaggerate* the importance of risk aversion by using a risk aversion coefficient which is unrealistically high for most farmers in the region.
3. The results are easily explicable (see below) and are consistent with all other numerical examples of which we are aware.
4. The results are consistent with the attitudes of farmers, as mentioned earlier.

[4] The 'certainty equivalent' is the dollar value to a risk-averse person of the risky outcome of an investment. It is less than the expected value of profit or income from the investment due to the deduction of a 'risk premium' which increases with the level of risk and with the person's degree of risk aversion.

Overall, our reading of the available evidence is that the trends evident in Table 2 are, if not general, at least extremely common. The primary reason for the low impact of risk aversion lies in the unresponsiveness of certainty equivalent to changes in farm management within the region of the optimum. This is directly comparable to a classic result in analysis of response to inputs, such as fertilisers. Variations in management practices within the region of the optimum make little difference to the level of net benefits because the profit function is flat near the optimum (Anderson, 1975). Because of this flatness, consideration of complexities such as risk aversion, which only change the optimal strategy by moderate amounts, does not greatly affect farmer welfare. Thus, the argument is not that risk aversion does not affect the farmer's optimal plan, but that the impact of the changes on farmer welfare is small. This is likely to be true for any choice involving a continuous or approximately continuous decision variable (e.g. areas planted, input levels, stocking rates, feeding strategies and investment in futures contracts). It may be less true for large discrete choices such as decisions on purchase of land or large machinery.

Representation of tactical adjustments makes a greater difference to the certainty equivalent because the main benefits of tactical adjustments occur in the extreme years, both good and bad. In these years the optimal management practices are very different to the optimal practices for most years, mainly due to impacts on expected profit, rather than risk. The differences in strategy in extreme years are generally larger than those prompted by risk aversion alone, often to the extent that certainty equivalent is sensitive to the change.

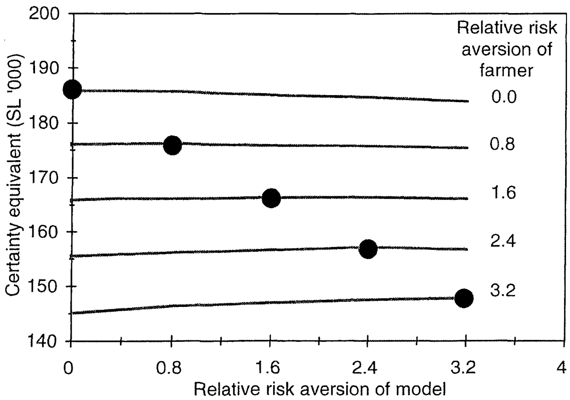

Fig. 1. Certainty equivalent values of income for farmers in north-west Syria based on implementation of whole-farm plans from models representing various degrees of risk aversion. Source: previously unpublished output from the model of Pannell and Nordblom (1998).

To illustrate further the low impact of representing risk aversion on the value of a model's recommended strategy, Fig. 1 shows the consequences of mis-specifying a producer's risk aversion coefficient in a representative farm model in north-west Syria (Pannell and Nordblom, 1998).

Each line in Fig. 1 represents the certainty equivalent value of income for a hypothetical Syrian farmer with a utility function characterised by constant relative risk aversion. The different lines represent farmers with different levels of relative risk aversion (RRA). Moving from left to right along a line corresponds to different combinations of enterprises and practices identified as optimal by models of increasing risk aversion. On each line, at only one point does the risk aversion coefficient of the model correspond to that of the farmer and, at this point, the certainty equivalent value to that farmer of the plan recommended by the model is maximised. All other models recommend a plan of lower value. The most striking aspect of the figure is the flatness of the lines, reflecting that the certainty equivalent value of a farm model's recommended plan is insensitive to the degree of risk aversion used to derive the plan. If a risk-averse farmer implemented a plan which would be optimal for a risk-neutral farmer, the level of potential utility foregone by the farmer would be small. This is made clearer in Table 3, which shows the loss of potential certainty equivalent for various farmers from implementing the recommendations

Table 3
Cost to farmers in north-west Syria, in terms of lost potential certainty equivalent, from implementing the whole-farm plan from a model with a risk-neutral objective function[a]

Farmer's relative risk aversion	Cost of using risk-neutral model (%)
0.0	0.0
0.8	0.056
1.6	0.26
2.4	1.0
3.2	1.9

[a] Source: previously unpublished output from the model of Pannell and Nordblom (1998).

of a risk-neutral model. Not surprisingly, the cost increases with the degree of risk aversion of the farmer. However, even at the highest level of risk aversion (RRA=3.2), the cost in certainty equivalence of ignoring risk aversion is less than 2%. Although, risk aversion coefficients of Syrian farmers have not been estimated, on the basis of other studies in developing countries (e.g. Binswanger, 1980; Antle, 1987) we would expect that for most Syrian farmers the cost of ignoring risk aversion when selecting a plan would be less than 1%. The small value of this cost is even more surprising given that climatic risks faced by Syrian farmers are among the highest in the world (Nguyen, 1989).

Notice that although certainty equivalent is insensitive to farm strategy, it is sensitive to the risk aversion coefficient, as reflected in the distances between the lines in Fig. 1. It is not claimed that risk-averse farmers are little affected by risk. If that were true, the lines in Fig. 1 would lie close together. The argument here rests on the lines' flatness, not their separation. The flatness reflects the empirical result that the feasible and optimal extent of risk avoidance is relatively small.

A third example from a contrasting situation is presented in Table 4 which shows findings for a weed control problem in a region of Western Australia (Pannell, 1995). The model selects optimal herbicide dosages for a representative farm. Even when the importance of risk aversion is exaggerated by assuming perfect correlation between yields on each hectare and by assuming a relative risk aversion coefficient of 3.2, the cost of using a risk-neutral model is less than 1%. For more realistic assumptions it is less than 0.1%.

Table 4
Cost to farmers in Western Australia, in terms of lost potential certainty equivalent, from implementing the herbicide dosage from a model with a risk-neutral objective function[a]

Farmer's relative risk aversion	Cost of using risk-neutral model (%)
0.0	0.0
0.8	0.038
1.6	0.18
2.4	0.46
3.2	0.95

[a] Source: previously unpublished output from model of Pannell (1995).

Some farm modelling studies that consider tactics and risk aversion identify risk aversion as an important influence on farm management (Schroeder and Featherstone, 1990; Featherstone et al., 1993). However, these studies do not ask the question that we have addressed above: to what extent does adjusting farm management in response to risk aversion increase farmer welfare. They also do not address the issue of the relative importance of including tactics versus risk aversion. For example, Featherstone et al. (1993) described a representative Indiana farm and examined optimal capital structures using a discrete stochastic programming formulation. Some of their results are reproduced in Table 5.

Table 5
Owned land and the certainty equivalent of annual return to initial equity for an Indiana farm with 40 or 70% initial debt[a]

	Relative risk aversion	Owned land (acres)			Certainty equivalent of annual return to initial equity (%)
		Year 1	Year 2	Year 3	
40% initial debt	0.0375	800	977	1063	10.4
	0.375	800	818	1064	10.2
	0.75	800	818	1064	10.1
	3.75	800	821	821	9.1
70% initial debt	0.0375	800	954	1069	14.9
	0.375	800	813	1020	14.3
	0.75	806	868	1064	13.7
	3.75	800	800	808	11.8

[a] Debt to assets ratio expressed as a percentage. Initial owned land in Year 1 is 800 acres. Source: Featherstone et al. (1993).

When the farm has an initial debt to asset ratio of 40% risk aversion has little impact on the certainty equivalent of the annual return to initial equity. At an initial debt to asset ratio of 70% risk aversion has a greater effect in reducing the certainty equivalent. However, recall from the earlier results, that it would be a fallacy to think that certainty equivalent being sensitive to risk aversion necessarily implies that a model with risk aversion generates substantially more valuable recommendations than a risk-neutral model. Failure to recognise this fallacy is a cause of some agricultural economists over-rating the importance of modelling risk aversion. Nevertheless, it is true that many studies have found that farm activity selections were affected by the degree of risk aversion (Hazell et al., 1983; Chavas and Holt, 1990; Schroeder and Featherstone, 1990; Kingwell, 1994). There is no paradox here. The explanation lies in the flatness of the certainty equivalent curves, as outlined earlier. Thus, the importance of representing risk aversion depends very much on the objectives of the study. Risk aversion will be relatively more important in studies with an objective of predicting behavioural responses to a change, rather than of assessing welfare impacts or making recommendations to farmers.

Even for predictive purposes, however, there are reasons to believe that representation of risk aversion is not as important as often portrayed in the literature. In some studies, the impact of risk aversion on optimal management is exaggerated by (a) using unrealisticly high risk aversion coefficients; (b) failure to represent farm constraints and technology realistically (Musser, McCarl, and Smith) and/or (c) modelling individual enterprises without considering their degree of correlation with other enterprises or decisions. In some studies, with or without these failings, the impact of risk aversion on behaviour has been found to be low (e.g. Smidts, 1990). Finally, even when risk aversion does truly affect management, its effects may still be small in relation to those of other factors that may be considered for inclusion in the model.

Often, better representation of the biology, production alternatives, technology, taxation ramifications, resource endowments, weather-year and price conditions, and tactical opportunities will yield more valuable information about change at the farm-level than sophisticated inclusion of risk aversion. Overall, we conclude that if a farm management model is to be constructed to predict or evaluate change at the farm-level, then inclusion of risk aversion is often of secondary importance. This is not to deny that farmers are risk-averse (Bond and Wonder, 1980; Antle, 1987; Bardsley and Harris, 1987; Myers, 1989), nor to claim that risk aversion has no impact on welfare or behaviour. Rather, the evidence is that if we wish to evaluate a model by its ability to predict and evaluate change, then in many situations the net benefits of using modelling resources to represent risk aversion are less that the net benefits of using the resources to improve other aspects of the model. This echoes the sentiments of Sonka (1983):

> Our concentration on risk [aversion] as a source of non-profit-maximising behavior may have led us off the main trail. Several factors including production constraints, multiple goals and lack of information could cause farmers to make non-profit-maximising decisions. We should be concerned about assessing the impacts of these factors, not just the presence of risk. (p. 202).

One cost of excluding risk aversion from a farm management model, would be that the model would not give due weight to the risk-reducing benefits of diversification. A traditional view is that diversification is a key risk management strategy (Samuelson, 1967). By generating income from several activities whose returns are not perfectly correlated, a farmer can reduce the overall income variance. Sometimes, the failure to represent risk is cited as a reason why outputs from some mathematical programming models of farms are not as diversified as the actual farms they represent.

However, optimal farm plans for risk-neutral and risk-averse farmers can be similarly diversified (Brink and McCarl, 1978; Kingwell, 1994) since risk aversion is only one of a number of possible incentives for diversification. Reasons for diversification by the risk-neutral farmer include:

1. Non-uniformity of resource quality. For example, on large farms with different areas and types of soil the profitability of crop or pasture alternatives differ according to soil type leading to a mix of enterprises across the farm (Morrison et al., 1986; Kingwell et al., 1992).
2. Resource constraints. In the short run, limits on machinery capacity coupled with yield reductions from later sowing affect the optimal size of cropping programs and may result in a mixture of enterprises. Similarly, labour supply and demand at particular times through the year may preclude a high concentration of other resources in a particular enterprise.
3. Complementarities or positive interactions between enterprises. These include benefits of particular rotational sequences (e.g. nitrogen fixation by legumes, disease control, weed control, soil structure and soil organic matter content), and contributions of crop residues to livestock diets (Pannell, 1987). Hence, the failure of some mathematical programming models to select diversified farm plans is at least as likely to be due to their failure to adequately represent essential biological or physical characteristics of the farming system as their exclusion of risk aversion.

Deterministic whole-farm models, such as MIDAS [5] (Kingwell and Pannell, 1987), which do represent these features can select strategies which are highly diversified, with risk-reduction as an unplanned-for bonus.

Consider, then, the possibility that choosing to build a model without any representation of risk or uncertainty may be optimal when the marginal benefits and costs of modelling effort are fully assessed. The resources saved by not explicitly representing risk can be used to (a) represent other, more important, aspects of the farming system; (b) improve the quality of data in the model; (c) conduct more extensive model testing; (d) apply the model sooner and more often and (e) construct additional versions of the model for different purposes. An additional advantage is that deterministic models are much easier to test and maintain by virtue of their smaller size. Risk and uncertainty may still be considered in any analysis by the use of sensitivity analysis to investigate discrete scenarios of interest (Pannell, 1997).

One situation which may weigh heavily against development of a deterministic model is where the intended audience for the modelling results perceive that explicitly representing risk is of critical importance. In this case, explicit representation of risk, risk aver-

[5] 'Deterministic' models have no explicit representation of probabilities related to risk or uncertainty. Parameters are specified as fixed, best-bet or mean values. MIDAS stands for model of an integrated dryland agricultural system.

sion and/or tactical responses to risk may increase the credibility of the model sufficiently to warrant the effort involved, irrespective of their impact on the value of the results.

5. Aiding farmer decision making

A final reason for constructing a farm model is to aid farmer decision-making. Farmers make numerous decisions against the backdrop of two key objectives. The first is that most farmers wish to stay in farming despite the shocks of price and weather and the changes in policy, technology and social conditions that typify agriculture. The second is that farmers wish to increase their wealth over time. The keys to achieving these objectives are to get right the big decisions, such as those on land purchase, machinery investment and resource improvement (Malcolm, 1994) and to make correct major tactical adjustments (Kingwell et al., 1993).

This conclusion is supported, for Australia at least, by farm survey evidence (Ripley and Kingwell, 1984; Edwards, 1994). The farmers most likely to be under acute financial strain at any time are those who bought land or machinery at the wrong time or at the wrong price or who made significant and incorrect major adjustments to their farm operations. Hence, it is not the everyday or even annual risk management decisions that are likely to crucially affect farm viability. Surprisingly, the important long-run, major decisions are largely ignored in the risk literature, which focuses mainly on decisions about input levels and output portfolios.

In developing models for use by farmers, the question of appropriate complexity and sophistication is central. The reality of farming is complex. Dynamic, stochastic, biological, technical, financial and human factors interact in a way that will probably never be incorporated fully in any mathematical model of agricultural decision analysis. Ironically, however, "the elaborate decision analytical methods such as those espoused in the decision theory and systems literature are not much use in practice in the very complex and uncertain situation of the farm business, whilst the straight-forward farm management budgets are extremely useful" (Malcolm, 1994, p. 21). Patrick and DeVuyst (1995) also emphasise the limitations of sophisticated risk modelling techniques for most farmers, pointing out that there is considerably more risk-related research information available than is being incorporated into extension programs.

The reality of farm management, which farmers understand well, is that, it is better to solve the whole problem roughly than to attempt to solve part of the problem extremely well. The advantage of simple budgeting approaches to farm planning is that, at least at some level, it facilitates consideration of all relevant characteristics of the unique farm business (e.g. enterprise interactions, constraints, personal preferences, attitudes, competencies and experiences). Use of sensitivity analysis to examine discrete key scenarios and identify break-even circumstances are simple but valuable methods of incorporating risk in this decision process, both from the point of view of risk aversion and tactical adjustments. The techniques are unsophisticated and old, yet they provide the farmer with an opportunity to discern the nature and potential impact of uncertainties in a way that promotes sensible management of risk. They can capture sufficient detail, sometimes implicitly, so that the value of the information generated for the farmer is higher than could be generated by a less timely, more partial and more obscure sophisticated risk model.

6. Concluding comments

We are not arguing that farmers are risk-neutral, that farming is free of risk, nor that diversification is ineffective as a risk-reducing strategy. Nor is the paper about the validity of decision theory, subjective expected utility theory or any other technique or theory. We are not arguing against research to understand human behaviour. Rather, the focus of this paper is on the applied usefulness and value of alternative approaches to decision analysis.

A contribution of the paper is to pose a question that appears to have been absent from the literature on risk in agriculture: for a risk-averse farmer, what is the extra value of a recommendation derived from a model that represents risk aversion, compared to a model based on risk neutrality? For many examples, the answer seems to be, very little.

Certainly the study of risk and its implications for farm management is intrinsically interesting, challenging and currently often publishable. However, a critical assessment of the literature reveals that the aspects of agricultural risk most commonly researched and published often are issues of secondary importance in determining how farms are managed. The models and outcomes of much current risk management research are not readily applicable to farmers. There is a need for our discipline to assess the needs of our audiences more carefully.

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