A financial analysis of the effect of the mix of crop and sheep enterprises on the risk profile of dryland farms in south-eastern Australia – Part 1

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Abstract. This study presents a method of simulating longer-term cash flows that reflect the cumulative effects of variation in seasons, prices, enterprise sequences and mixes and other management decisions. It can be used to develop full risk profiles on a whole-farm or individual-component enterprise basis for most dryland farms in southern Australia, at gross margin, profit or cash flow levels. This analysis concentrates on the cash flow implications of these various scenarios because cash flow is the indicator which includes all costs, and therefore demonstrates affordability and the long-term viability of the farm business entity.

This study shows that the role of sheep in the mixed farming enterprise in south-eastern Australia is to reduce the exposure of the business to the relatively high cash flow variability associated with dryland cropping. In all districts studied, sheep have a cost of production about half that of cropping, and crop margins are more sensitive to rainfall variability. Sheep therefore reduce the risk of loss when compared with continuous cropping.

Keywords: Whole-farm planning, cash flow, sheep, crops, risk.

Introduction

The optimum mix of sheep and crop enterprises in south-eastern Australia has been debated for many years, particularly in response to low grain prices and low rainfall years (Francis 2008). There has been little analysis of the whole-farm financial effects of varying the proportion of these enterprises in mixed farming systems in different regions subject to variable levels of rainfall and commodity prices (Mudge 2008; Nguyen et al. 2004). The analysis has largely been conducted at the gross margin level (Lien 2003; Warn et al. 2000) or by optimising the output for single years.

Both these types of analyses ignore the problems of affordability and risk, which are the key problems faced by working managers (Pannell 2006; Stone and Hoffman 2004).

In research, gross margins are the most common measure of the relative impact of various management decisions. However, gross margins usually average about 30 percent of the total costs of running a farm (Clarke et al. 1995; Hutchings 2008), so it is possible for an unprofitable management outcome to show a strongly positive gross margin. As a result, Krause and Richardson (1996) stated that gross margins are inappropriate tools for comparing management outcomes between farms.

This analysis examines the financial impact of the mix of crop and sheep enterprises on the

financial performance of a range of typical farms in southern NSW and Victoria. These farms were chosen to represent the high rainfall and low rainfall extremes of the cropping belt in both states. The scenarios were run over three years, and incorporated a full range of climatic conditions and price levels, together with all farm costs, including fixed and capital costs and owners' salaries. Several measures of financial performance were calculated (at whole-farm and enterprise levels) including gross margin, profit and return on capital. The current analysis concentrates on whole-farm cash flow, as this is the only measure which includes all costs, and which, when accumulated over time, indicates the viability of the business and therefore its ability to invest and grow.

Method

Two representative farms used in the analysis were located in the high rainfall zone (South West Slopes of NSW and Western Victoria) and two were in the low rainfall zone (Riverina, NSW and Mallee, Victoria). The farms selected were chosen to represent the largest areas which local consultants felt could be efficiently operated by one family. A description of the four farms is contained in Table 1, and Figure 1 contains their rainfall profile. The decile spreads for growing season rainfall over the four sites show that the farms could be grouped into two broadly similar high and low rainfall categories.

Simulations involving the cropping of 30 percent, 60 percent and 90 percent of the area of each farm were run for three years, with and without a drought in the second year to simulate climatic variability and over a range of growing season rainfall decile sequences. In all regions included in this study, most farms sow at least 20-30 percent of their area to grazing crops and pastures each year, so that the 30 percent crop scenario represents a typical specialist livestock farm in each region.

These simulations were performed using the MS&A Farm Wizard™, an Excel spreadsheet developed by MS&A (Mike Stephens & Associates) to prepare 36-month financial analyses for their clients' farm businesses. The Farm Wizard was designed to model the long-term, whole-farm, financial impact of management decisions in a risky environment. Input data are drawn from physical and financial records for the subject farm, together with current prices and costs. The model is driven by individual annual paddock use and includes the grazing value of crops and stubbles in the calculation of stocking rate and in the allocation of financial benefits to each enterprise. The modelling of yields and stocking rates is not as sophisticated as for dedicated models such as Yield Prophet (Keating and McCown 2001) and Grassgro (Donnelly et al. 2002). However, the production estimates are considered accurate, and given the uncertainties inherent in the farm production process, lie within acceptable tolerances (see Figure 2).

Outputs include reports on physical and financial performance, together with monthly calculations of net worth and cash flow. The outputs are sensitive to changes in annual growing season rainfall and individual paddock use for each of the three years, and include an estimate of the cost and impact of these changes on the supplementary feed requirements of the livestock. The financial indicators generated by the simulation are shown in Table 2.

Calculation of crop yields

Crop yields were estimated using the French/Schultz method (French and Schultz 1984; Krause and Richardson 1996). Yields assumed a water use efficiency of 75 percent, which is typical of the efficiency achieved by most farmers. Rainfall data were from the Bureau of Meteorology. The Rainman™ software provided total and growing season rainfall. Figure 2 shows that the simple calculation based on growing season rainfall derived by French and Schultz (1984) gives robust predictions of whole-farm wheat and canola yields, with highly significant correlation coefficients ($p < 0.001$) close to 0.9 for both crops. A run of the crop model APSIM (Keating and McCown 2001) produced a lower correlation ($R^2 = 0.57$, $p < 0.02$) with the Riverina farmer's historical whole-farm wheat yields. The original yield model based on the French/Schultz model was used to simulate all yields.

For these simulations, drought was defined as a year of decile 1 growing season rainfall utilised with 75 percent water-use efficiency by crops and pastures.

Calculation of potential and actual carrying capacity

The potential stocking rate (dry sheep equivalents (DSE) per hectare) for the location was estimated assuming a 30 mm growing season rainfall per DSE/ha adjusted downwards by 10 percent to allow for non-productive and sub-optimal management. This procedure was developed by the author following a survey of leading district graziers, and gives a good estimate of district practice for annual pastures over the study area. Virgona (2009) estimated that this value for the potential stocking rate was equivalent to a pasture utilisation rate of 40 percent, which is within the normal range for the area. The stocking rate used for each scenario was set at 75 percent of the simulated potential value for each region in an average year, and this number of sheep was carried in all years by using supplementary feeding to meet the calculated feed energy deficit.

The rotations used in each scenario are shown in Appendix 2. The rotations differed between regions because of variations in climate, soils and district practice. The various paddock uses in each rotation were allocated a crop yield expressed as a percentage of the calculated potential yield and a stocking rate as a percentage of the potential stocking rate, as estimated above. For example, perennial pastures (lucerne in these analyses) were given a potential carrying capacity 10 percent above the potential carrying capacity of annual pastures derived from the growing season rainfall.

Some grazing was also attributed to the cropped area, as follows:

1. Grazed cereals were assumed to have 25 percent of the potential carrying capacity of pasture. This is equivalent to a carrying capacity twice the estimated potential for six weeks, which is within

the normal expected range (Kirkegaard et al. 2008).

2. Cereal stubbles were assumed to have 10 percent of the potential carrying capacity of pasture (Mulholland and Coombe 1979).

3. Pulse stubbles were given a carrying capacity of 20 percent of the potential carrying capacity of pasture.

4. Long fallows were given a carrying capacity of 40 percent of potential to reflect their use for winter grazing.

These figures are estimates of the proportion of a year that these sources of feed energy would maintain grazing Merino wethers at constant bodyweight. Canola crops were not grazed, but recent data indicates that they have considerable grazing potential and could be used to further increase feed availability (Kirkegaard et al. 2008).

The flock modelled for each scenario was a traditional wool sheep flock, with a representative wether portion, and a lambing percentage of 100 percent. The dry sheep equivalent (DSE) rating for each stock type was calculated using NSW Department of Primary Industry tables, adjusted for estimated bodyweight and average growth rate over the year (James and Smith 1994). Pro-rata adjustments were also made for the months grazed (allowing for purchases, sales and deaths).

Farm accounts

The farm accounts for each site were developed using the following process:

1. Consultants in each area provided data on fixed costs. MS&A (Harden) provided the NSW figures, and O'Callaghan Rural Management (Bendigo) provided the Victorian examples.

2. Liabilities for the SW Slopes farm were applied to all farms. These contained a representative mix of vehicle and plant purchases which were considered typical of the costs of a normal farm operation. They also contained a loan of $100,000 for the purchase of an investment property in order to secure the families' retirement options. The major loan item for plant was an airseeder. Its value was adjusted to reflect the probable value of the plant needed to sow the relevant area on each farm, with repayments scheduled over four years.

3. The value of the major bank loan was adjusted to give a constant and representative opening equity of 80 percent for each farm, measured at the 60 percent cropping level. This was done to remove one of the major sources of difference between farm financial accounts, i.e. debt servicing costs.

4. Personal drawings were set at $47,000 per farm family, which is a representative lower-end figure used by consultants in the regions for a family with children.

5. Variable costs associated with each enterprise mix were calculated and added to this basic cost framework.

6. Monthly interest, PAYE tax and GST were calculated for each set of accounts and every scenario.

7. No allowance was made for repayment of core debt.

Table 3 shows an example of an average set of financial accounts for each site generated by the above process. The costs for each farm were adjusted for each scenario to more accurately reflect the full effects on input costs. The costs for the individual drought years were altered to simulate the likely management responses that farmers in each area would make in a dry year, including reducing fertiliser inputs and casual labour costs.

This set of accounts highlights the differences in performance between the four farms in this scenario. There is a large variation in both profit and cash flow across the farms. These differences in accounts occur despite the attempt to synthesise broadly similar sets of farm accounts, and are due to scale effects, operating performance over the three-year period and variation in the original set of fixed costs drawn from farms in each area.

Prices

Prices used in the analysis are shown in Appendix 3, which lists the percentile ranges for the various commodities.

1. Livestock prices were set at the 60th percentile for prices since 1996, to try to obtain a reasonable estimate of current saleyard prices. A flow-on effect of drought is a depression of store sheep and lamb prices at the saleyards. A drop in saleyard prices of 30 percent for the drought year is included in the model.

2. Wool prices were also set at the 60th percentile for 20-micron ewe fleece for the three-year period. The fleece characteristics and average wool prices per kilogram for other sexes and age groups were adjusted to reflect the normal variation that would be expected in a typical Merino flock of this type. Lambs were assumed to be shorn in full wool.

3. Grain prices set new benchmarks during 2007, and were also set at the 60th percentile, adjusted for the recent price spike. In the last two years grain prices have risen approximately 50 percent above expected pre-drought price predictions, and this rise was included in the scenarios that included a year-2 drought.

Results

A subset of the key results of the analysis is shown in Table 4. The values shown in Table 4 relate to a run of three average years (decile 5 growing season rainfall, shown as 5,5,5 scenarios) with and without a drought (decile 1) in the second year (shown as 5,1,5 scenarios). A drought year is included to give an indication of the resilience of the business to risk, and while it over-estimates the long-term frequency of drought (by definition each decile occurs in 10 percent of years), it under-estimates the 70 percent frequency of crop failure experienced in south-eastern Australia since 1997.

Gross Margins

Table 4 shows the impact of enterprise mix on gross margins, cost of production and whole-farm profit in average years (5,5,5) and in a scenario including a drought in the second year (5,1,5). These gross margins are included to provide a point of reference because most previous analysis has focussed on gross margins achieved in average years.

The gross margins show several expected features:

1. The high rainfall sites (SW Slopes and Western Victoria) show higher gross margins for all enterprises both with and without drought, due to higher yields.

2. A one-in-three incidence of drought reduces the gross margins for most enterprises and sites. The SW Slopes mixed enterprises were markedly more affected by drought than in Western Victoria, largely because the Victorian

site had a higher decile 1 rainfall (Figure 1).

3. In the lower rainfall areas, the Riverina farm showed higher crop gross margins than the Mallee. However, the sheep gross margins were similar, largely because the Mallee rotations included a larger area of fallow, which was grazed and compensated for the slightly lower decile 5 rainfall.

4. The comparison between the different enterprise mixes shows that only one of the scenarios has sheep gross margins higher than crop gross margins. This is in the Mallee with the scenario which includes a drought year (5,1,5). In every other scenario, crop enterprise gross margin per hectare exceeds that of sheep.

5. The Mallee gross margins for continuous cropping were lower than for the other scenarios because the variable costs were higher for similar yields.

These gross margins include only 28-46 percent of whole-farm costs for the four sites and therefore do not explain much of the between-farm variation in profitability. A full set of accounts for the 5,1,5 scenario is shown in Table 3.

Table 4 shows that the cost of production, profit and cash flow do not trend linearly with percentage crop for the following reasons:

1. Each enterprise mix is based on a different rotation (Appendix 2).

2. The grazing available from the crops varies with each rotation, and differs with the region and the rainfall received. Consequently the stocking rate differs for each rotation and enterprise mix at each site.

3. The fixed and capital costs are adjusted to reflect the probable effect of the various scenarios on farm expenditure. As a result, the cost structure (cost of production) is different for each site and each enterprise mix.

These factors interact to produce complex and differing effects on the values of each of these benchmarks for each region, rainfall scenario and enterprise mix. These interactions cannot be reproduced in simpler, less dynamic and shorter-term farm financial models.

Cash flow analysis of enterprise mixes

This analysis concentrates on the cash flow implications of these various scenarios because cash flow is the only indicator which includes all costs, and therefore provides an indication of both affordability and the long-term viability of the farm business entity.

Figure 3 shows an example of the 36-month cash flow for the SW Slopes farm at all crop enterprise mixes for average (decile 5) growing season rainfall. The most notable feature of these 36-month cash flows is their saw-tooth shape, which is a consequence of the receipt of most income at or soon after harvest, and after the payment of most variable costs. The variability of the 36-month cash flows decreases as the proportion of crop falls, due to the fact that the sheep enterprise has lower costs, and the timing of sheep income is spread over a larger part of the year. This illustrates one of the major weaknesses of the 100 percent cropping enterprise structure; if harvest fails, then two crops have to be grown with little intermediate income. This makes the business very susceptible to making losses in a drought. Including sheep in the enterprise mix reduces the variability of the cash flow in all seasons, with and without a drought imposed in year 2, as shown in Figure 3. However, this reduction in cash flow variability occurs at the expense of overall cash surplus for all enterprise mixes and scenarios, including a year 2 drought.

This pattern is consistent for all sites. Table 5 shows that the variation in cash flow consistently increases with the percentage crop. Consequently the scale of the loss given a crop failure will also be related to the proportion of crop grown, as evident in the 5,1,5 scenarios for all sites.

Table 6 highlights the variability of returns both between and within sites by comparing the cumulative cash flows for each scenario at each site using continuous cropping on the SW Slopes as the reference site (set at 100 percent). It demonstrates that drawing conclusions about the relative performance of any of these farms, using only average seasons, could be misleading. Furthermore, simple single-factor analysis, which usually drives gross margin analysis, cannot deal with the complexity of the factors that influence farm management decisions of this type. The range of cash returns shown in Table 6 occurs given constant prices, and a limited range of growing season rainfall scenarios. The actual between-farm variability is therefore likely to be even larger, as indicated by the influence of price on cash surpluses.

Effect of price on cash flow

Table 7 shows the effect on cash flow for different sheep and grain prices. The effect of increasing sheep prices from the 10th to the 90th percentile is similar and linear at about $191,000 for the SW Slopes farm and $196,000 for the Western Victorian farm. The effect is more variable in the lower rainfall farms, with the cash margin for the Riverina farm increasing by $178,000 and by $203,500 for the Mallee farm as a result of the price increase. The effect of increasing the price of grain from the 10th to the 90th percentile (corresponding to an increase in the wheat price from $140 to $344/tonne) was to increase the cash surplus by about $700,000 for the high rainfall farms and by more than $1 million for the low rainfall farms. Grain price increases, therefore, had more than five times the impact of increases in sheep and wool price. The effects of the price increases shown are linear because production (and therefore costs) are not affected, and profit is taxed at a constant rate.

Discussion

The outcome of any simulation which models reality by including input variability over time will depend on the *sequence* of the change in the input values, as well as the amount (Mokany 2009). The output after three years of the growing season rainfall decile sequence 1,5,5 will differ from the output following a 5,5,1 sequence, even though the *average* growing season rainfall and yields will be the same.

The number and range of input values to be tested is constrained by the context of the simulation, the technical constraints of the system (agronomy and livestock husbandry) and the resources available (management skill, climate, soils, rainfall, capital and cash). These constraints reduce the potential range of outputs to a small and manageable set of *feasible* options (Lien 2003). The effect of any change in the management system being studied can be measured by the difference between the opening and closing values of resources such as cash, debt and equity, or physical balances such as grain stored or livestock numbers and the trends of these over time.

Optimisation methods are commonly used to resolve complex simulations of management options such as enterprise mix. Such simulations are usually based on one-year

simulations of one set of input values, and commonly only include partial budgets (Janssen and Ittersum 2007). The output from such simulations does not allow for the effects of variability over time, and therefore does not allow for the effects of *sequence* on the cumulative effects on the farm business. Furthermore, optimisation methods do not measure the effect on cash and capital of moving from the current to the recommended optimum position. The costs of such a change may exceed the benefits, and take longer to accomplish than the period over which the set of inputs (such as prices and rainfall), which drive that optimal solution, apply.

The use of long-term, whole-farm financial simulation, driven by established technical production functions, and accompanied by sensitivity analyses, overcomes many of these limitations. It is a transparent process that presents the farm managers with a range of options from which they can select a *best-bet* solution that most closely matches their management goals. Farmers who use such results can therefore make subjective judgements that the solution they have chosen is sufficiently robust to give them the confidence to change their management strategies.

The analysis presented here is inevitably more rigid than real life and only includes the effect of drought on the cash flow for average (decile 5) seasons for each site. Although the MS&A Farm Wizard™ can model the effect of detailed management responses to drought, this was not included at the more general level of the current analysis. This is particularly true of the sheep enterprise, where the model parameters used did not permit the option to sell and replace part or all of the flock rather than to supplementary feed; the analysis did not model the production of silage or hay for drought feed, but only assumed a ration of wheat. This could be changed in future analyses, but was chosen because it is the most common method of supplementary feeding used on mixed farms.

In addition, the standardised nature of these different farm accounts means that the results do not relate to any one farm, but give a broad general indication of the likely outcomes in each of the four regions analysed. In particular, the equity level of 80 percent chosen for the analysis is probably unrealistically high, especially for the low-rainfall farms. However, choosing a lower equity level, or differentiating between sites, may have deflected attention from the core analysis. Furthermore, none of the budgets made any provision for repayment of core

debt, because it was not a component of any of the farm accounts on which this analysis was based. The inclusion of a provision for core debt repayments would have reduced the cash flow for all farms, and increased the spread between the high-rainfall and low rainfall regions. It is worth noting that this analysis did not model a sequence of actual seasons. As a result, the simulated cash flows indicate rather than predict the impact of risk on financial performance; they do not estimate the actual performance of farms in a series of real seasons. The impact of seasonal variability on whole-farm cash flows will be presented in a later paper.

Conclusions

Sheep reduce the variability of cash flow, and so reduce the exposure of a farm to the risks associated with cropping in average seasons. This stabilising effect is more important for the low rainfall farms, which are exposed to higher production risk (due to lower and more variable rainfall) and lower overall operating margins. Any form of diversification of these farm businesses into low-cost, low-risk enterprises or investments would similarly reduce the variability of cash flow.

This analysis shows the importance of including site-specific variability and whole-farm costs in the analysis of the cash flows for different enterprise mixes for any farm. The current analysis is limited to the effect of one year of drought on the performance of farms across these four regions in average (decile 5) years only. This method can be extended across a more complete range of seasonal scenarios and enterprise mixes to calculate a comprehensive risk profile for a range of enterprise mixes in each region. These results will be discussed in Part II of this analysis.

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Appendix 1

Table 1. Capital structure of the representative farms

	SW Slopes	Riverina	Western Vic	Mallee
GSR (decile 5)*	422	275	402	229
Area (ha)	800	2000	750	1800
Value ($/ha)	$4,500	$1,100	$4,400	$1,355
Asset value**	$4.26 million	$2.98 million	$3.83 million	$3.08 million

*Growing Season Rainfall
**Calculated to give an 80 percent opening equity at 60 percent of total area cropped.

Table 2. Financial indicators used

Indicator	Whole farm	Sheep enterprise	Crop enterprise
Gross margin/ha*	N	Y	Y
Profit/ha**	Y	Y	Y
Cost of production/ha***	Y	Y	Y
Costs/income percent	Y	Y	Y
Return on capital	Y	N	N
Return on equity	Y	N	N
Cash flow	Y	N	N

*Gross margin/ha = (Income adjusted for inventory change – variable costs)/area utilised
**Profit/ha = (gross margin – (fixed costs + depreciation))/area utilised
***Cost of production (COP/ha) = total cash costs (including capital and salaries)/area utilised

Table 3. Average three-year farm financial statements (60 percent crop, 60th percentile prices and a drought in year 2)

Financial year July-June	NSW		Victoria	
	SW Slopes	Riverina	Western Vic.	Mallee
Crop Income	322,383	499,140	340,822	346,237
Grain Transfers to Livestock enterprises				
Wool Sheep	112,578	111,500	121,151	112,937
Other farm income	14,705	22,430	22,430	22,430
Farm Income	**449,666**	**633,070**	**484,403**	**481,603**
Non-Farm	8,962	8,962	8,962	8,962
Total Income	**458,628**	**642,031**	**493,364**	**490,565**
Change in Inventory	-7,996	-10,410	-12,704	-11,741
Total Income (Adjusted for Inventory Change)	**450,632**	**631,621**	**480,661**	**478,824**
Chemical	29,031	65,204	27,376	60,914
Contract	16,912	24,896	15,250	16,911
Fertiliser	39,623	87,452	42,107	81,698
Seed	16,467	42,560	16,386	39,760
Supplies & Grain Purchased	0	0	0	0
Other	0	0	0	0
Crop & Pasture Costs	**107,989**	**222,455**	**102,847**	**200,940**
Agistment	6,920	7,174	7,696	7,174
Animal Health & Veterinary	3,700	3,815	4,093	3,815
Fodder	1,591	6,266	2,270	4,405
Freight	0	0	0	0
Purchases	933	0	0	0
Shearing & Crutching	3,750	3,902	4,186	3,902
Other	0	0	0	0
Livestock Costs	**16,894**	**21,157**	**18,245**	**19,297**
Total variable costs	**124,882**	**243,612**	**121,092**	**220,237**
Machinery (incl. depreciation)	105,859	106,548	81,235	111,548
Labour	22,159	5,250	3,600	4,800
Overheads	69,853	58,095	34,200	64,490
Interest	74,835	59,204	74,711	67,068
Fixed Costs	**272,706**	**229,097**	**193,745**	**247,906**
Total Costs (including depreciation)	**397,588**	**472,709**	**314,837**	**468,143**
Profit	**61,040**	**169,322**	**178,527**	**22,422**
Profit (adjusted for Inventory Change)	**53,044**	**158,912**	**165,824**	**10,681**
Drawings	55,087	54,000	53,000	54,000
Tax	-4,160	-792	2,771	-6,301
Drawings & Tax	**50,928**	**53,208**	**55,771**	**47,699**
Profit (adjusted- less drawings & tax)	**2,116**	**105,704**	**110,052**	**-37,018**
Cash Surplus / Deficit	**20,578**	**133,096**	**121,529**	**1,697**

Costs as % total costs		SW Slopes	Riverina	Western Vic.	Mallee
	Crop & pasture	24.1%	42.3%	27.8%	39.0%
	Livestock	3.8%	4.0%	4.9%	3.7%
	Total variable costs	**27.8%**	**46.3%**	**32.7%**	**42.7%**
	Machinery	23.6%	20.3%	21.9%	21.6%
	Labour	4.9%	1.0%	1.0%	0.9%
	Overheads	15.6%	11.0%	9.2%	12.5%
	Interest	16.7%	11.3%	20.2%	13.0%
	Total fixed costs	**60.8%**	**43.6%**	**52.3%**	**48.1%**
	Drawings & Tax	11.4%	10.1%	15.0%	9.2%
	Total costs	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 4. Indicator values for a range of scenarios for all farms

A: New South Wales farms

SW Slopes indicator values, average of three years performance
75% potential yields, 75% potential stocking rate
Decile 5 rainfall, 60% price percentile

Indicator	Rotation	30% crop		60% crop		90% crop	
	Scenario deciles	5,5,5	5,1,5	5,5,5	5,1,5	5,5,5	5,1,5
	Description	Average	Drought yr.2	Average	Drought yr.2	Average	Drought yr.2
Av. wheat yields	t/ha	4.7	3.4	4.4	3.4	4.7	3.4
Stocking rate potential [1]	DSE/ha	13.9	12.7	17.4	15.0		
Gross margin	Crop $/ha	$637	$489	$647	$477	$854	$714
	Sheep $/ha	$357	$299	$457	$402		
Profit	Farm $/ha	$185	$103	$204	$72	$340	$233
	Crop $/ha	$198	$121	$208	$29	$418	$265
	Sheep $/ha	$126	$21	$150	$113		
Cost of Production[2]	Farm $/ha	$544	$483	$604	$548	$685	$582
	Crop $/ha	$767	$540	$789	$705	$872	$772
	Sheep $/ha	$449	$503	$541	$558		
	$/DSE	$43	$48	$41	$43		
Return on Assets %		3.1%	1.6%	3.6%	1.2%	6.4%	4.2%
Return on Equity %		3.7%	1.9%	4.3%	1.3%	7.4%	4.9%
Cumulative cash flow	$	$267,110	$140,306	$316,728	$61,734	$606,310	$415,495

1. Potential stocking rate (DSE/ha) is calculated from the feed available in an average year.
2. Cost of production is calculated by dividing total allocated cash costs by the area utilised.

Riverina indicator values, average of three years performance
75% potential yields, 75% potential stocking rate
Decile 5 rainfall, 60% price percentile

Indicator	Rotation	30% crop		60% crop		90% crop	
	Scenario deciles	5,5,5	5,1,5	5,5,5	5,1,5	5,5,5	5,1,5
	Description	Average	Drought yr.2	Average	Drought yr.2	Average	Drought yr.2
Av. wheat yields	t/ha	2.4	1.7	2.4	1.7	2.4	1.7
Stocking rate potential	DSE/ha	7.2	6.0	9.3	7.9		
Gross margin	Crop $/ha	$303	$229	$294	$200	$390	$198
	Sheep $/ha	$147	$108	$220	$157		
Profit	Farm $/ha	$108	$58	$158	$83	$166	$66
	Crop $/ha	$134	$58	$163	$66	$217	$45
	Sheep $/ha	$65	$22	$100	$55		
Cost of Production	Farm $/ha	$251	$248	$288	$254	$295	$271
	Crop $/ha	$322	$306	$294	$275	$391	$294
	Sheep $/ha	$207	$233	$254	$257		
	$/DSE	$38	$43	$36	$39		
Return on Assets %		7.0%	3.6%	10.9%	5.3%	11.8%	4.4%
Return on Equity %		8.2%	4.4%	12.7%	6.0%	14.1%	4.5%
Cumulative cash flow	$	$508,835	$256,129	$765,934	$399,289	$809,020	$313,069

B: Victorian farms

Western Victoria indicator values, average of three years performance
75% potential yields, 75% potential stocking rate
Decile 5 rainfall, 60% price percentile

Indicator	Rotation	30% crop		60% crop		90% crop	
	Scenario deciles	5,5,5	5,1,5	5,5,5	5,1,5	5,5,5	5,1,5
	Description	Average	Drought yr.2	Average	Drought yr.2	Average	Drought yr.2
Av. wheat yields	t/ha	3.9	3.3	4.2	2.9	3.9	2.9
Stocking rate potential	DSE/ha	11.9	11.9	12.4	11		
Gross margin	Crop $/ha	$713	$756	$677	$594	$666	$582
	Sheep $/ha	$301	$257	$317	$270		
Profit	Farm $/ha	$208	$195	$283	$232	$395	$317
	Crop $/ha	$251	$292	$366	$254	$378	$278
	Sheep $/ha	$114	$83	$61	$94		
Cost of Production	Farm $/ha	$498	$480	$550	$496	$630	$530
	Crop $/ha	$747	$678	$610	$571	$599	$532
	Sheep $/ha	$390	$384	$442	$408		
	$/DSE	$41	$43	$47	$44		
Return on Assets %		3.6%	3.4%	5.2%	4.3%	7.6%	6.0%
Return on Equity %		4.6%	4.3%	6.5%	5.4%	9.4%	7.4%
Cumulative cash flow	$	$325,921	$297,867	$484,630	$364,588	$699,890	$568,475

Mallee indicator values, average of three years performance
75% potential yields, 75% potential stocking rate
Decile 5 rainfall, 60% price percentile

Indicator	Rotation	30% crop		60% crop		90% crop	
	Scenario deciles	5,5,5	5,1,5	5,5,5	5,1,5	5,5,5	5,1,5
	Description	Average	Drought yr.2	Average	Drought yr.2	Average	Drought yr.2
Av. wheat yields	t/ha	1.9	1.4	1.8	1.3	1.8	1.3
Stocking rate	DSE/ha	7.2	7.2	9.6	9.6		
Gross margin	Crop $/ha	$180	$140	$183	$120	$164	$99
	Sheep $/ha	$152	$120	$230	$182		
Profit	Farm $/ha	$44	$6	$65	$10	$22	-$40
	Crop $/ha	-$1	-$49	$24	-$39	-$4	-$73
	Sheep $/ha	$100	$70	$116	$76		
Cost of Production	Farm $/ha	$259	$264	$296	$272	$327	$309
	Crop $/ha	$276	$296	$310	$292	$337	$334
	Sheep $/ha	$244	$266	$257	$278		
	$/DSE	$46	$50	$36	$39		
Return on Assets %		4.7%	2.6%	3.4%	0.2%	1.1%	-2.7%
Return on Equity %		5.6%	3.1%	4.3%	-0.1%	1.5%	-4.7%
Cumulative cash flow	$	$127,282	-$54,143	$243,534	$5,091	$42,350	-$234,546

Table 5. 36-month cash flow surplus (deficit) and range for all sites, 60th price percentile

Season	5,5,5 scenario			5,1,5 scenario		
Site	**30% crop**	**60% crop**	**90% crop**	**30% crop**	**60% crop**	**90% crop**
SW Slopes	$267,110	$316,728	$606,310	$140,306	$61,734	$415,495
Range[1]	*$463,490*	*$367,156*	*$1,137,972*	*$347,189*	*$521,165*	*$905,406*
Western Victoria	$325,921	$484,830	$699,890	$297,867	$364,588	$568,475
Range	*$471,060*	*$723,138*	*$1,169,983*	*$431,276*	*$573,557*	*$986,034*
Riverina	$508,835	$765,934	$809,020	$256,129	$399,289	$313,069
Range	*$730,151*	*$1,187,356*	*$1,407,900*	*$347,189*	*$790,200*	*$924,770*
Mallee	$127,282	$243,534	$42,350	-$54,143	$5,091	-$234,546
Range	*$285,996*	*$624,337*	*$640,916*	*$380,358*	*$573,557*	*$896,892*

1. Difference between the maximum and minimum month-end cash balance for the 36-month period

Table 6. Cumulative cash flow as a percentage of SW Slopes 100 percent crop scenario, decile 5 growing season rainfall, 60th percentile prices

| | 5,5,5 scenario | | | 5,1,5 scenario | | |
| | Cumulative cash flow % | | | Cumulative cash flow % | | |
Site	100% crop	60% crop	30% crop	100% crop	60% crop	30% crop
SW Slopes	**100%**	52%	44%	69%	10%	23%
Western Vic	115%	80%	54%	94%	86%	49%
Riverina	133%	126%	84%	52%	66%	42%
Mallee	7%	40%	21%	-39%	1%	-9%

Table 7: Effect of price on cash flow, 5,1,5 scenario, 60 percent crop

A. High rainfall sites

SW Slopes 60% crop		Crop price percentile			
		10%	30%	60%	90%
Sheep price Percentile	Equivalent ewe price	Equivalent wheat price $/tonne			
		$140	$191	$268	$344
10%	$30/head	-520,819	-335,552	-57,651	220,250
30%	$45/head	-473,065	-287,798	-9,897	268,004
60%	$68/head	-401,434	-216,166	61,734	339,635
90%	$90/head	-329,802	-144,535	133,366	411,267

W. Victoria 60% crop		Crop price percentile			
		10%	30%	60%	90%
Sheep price Percentile	Equivalent ewe price	Equivalent wheat price $/tonne			
		$140	$191	$268	$344
10%	$30/head	-196,231	-20,949	241,976	504,900
30%	$45/head	-147,186	28,096	291,021	553,945
60%	$68/head	-73,619	101,664	364,588	627,512
90%	$90/head	-52	175,231	438,156	701,080

Low rainfall sites

Riverina 60% crop		Crop price percentile			
		10%	30%	60%	90%
Sheep price Percentile	Eqivalent ewe price	Equivalent wheat price $/tonne			
		$140	$191	$268	$344
10%	$30/head	-419,116	-136,414	287,637	711,689
30%	$45/head	-374,455	-91,754	332,298	756,350
60%	$68/head	-307,464	-24,763	399,289	823,341
90%	$90/head	-240,473	42,228	466,280	890,331

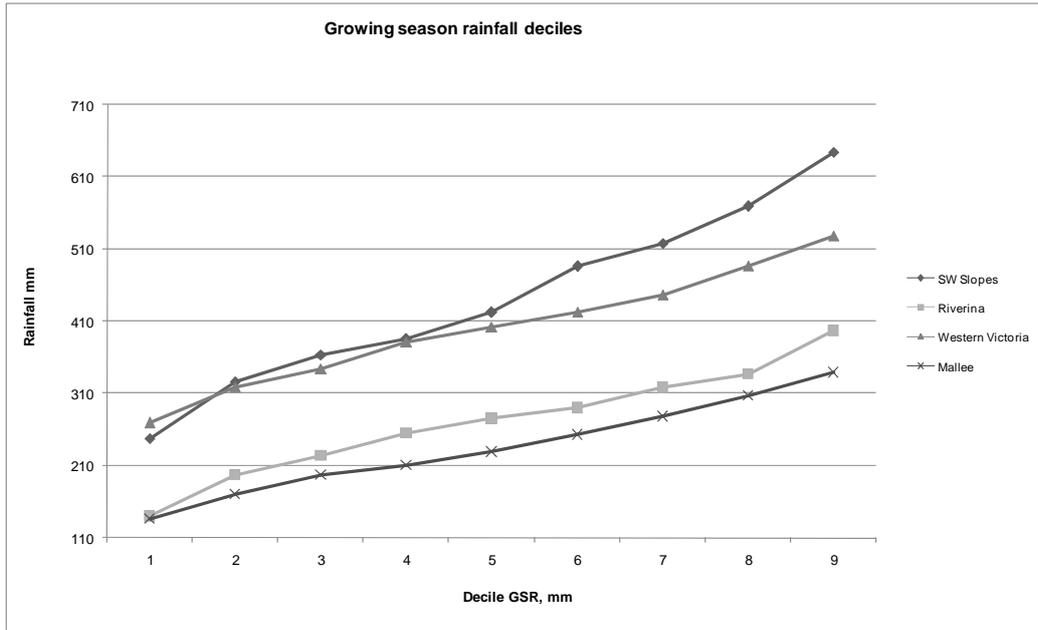| Mallee 60% crop | | Crop price percentile | | | |
| | | 10% | 30% | 60% | 90% |
| Sheep price Percentile | Eqivalent ewe price | Equivalent wheat price $/tonne | | | |
		$140	$191	$268	$344
10%	$30/head	-523,370	-267,500	116,306	500,111
30%	$45/head	-472,478	-216,608	167,197	551,003
60%	$68/head	-396,141	-140,271	243,534	627,340
90%	$90/head	-319,804	-63,934	319,872	703,677

Figure 1. Growing season rainfall deciles

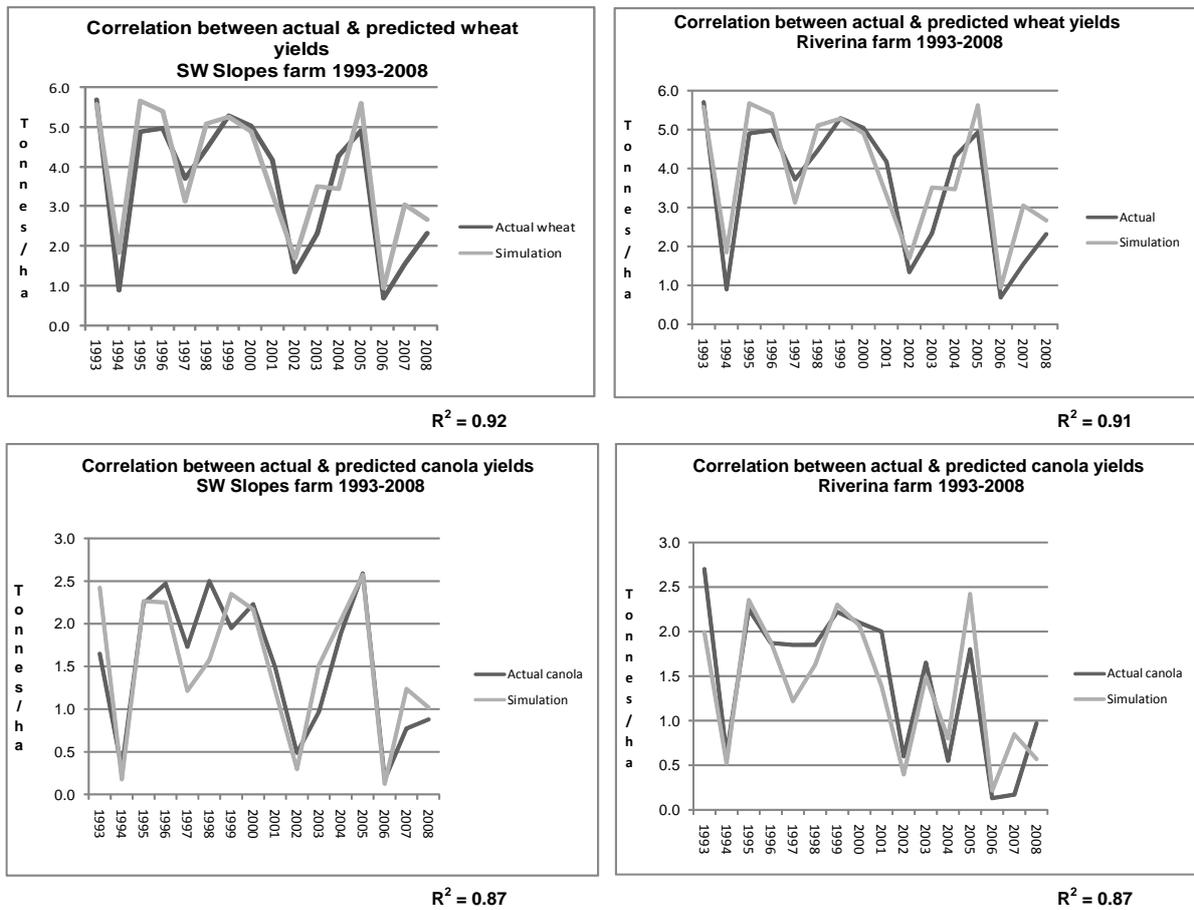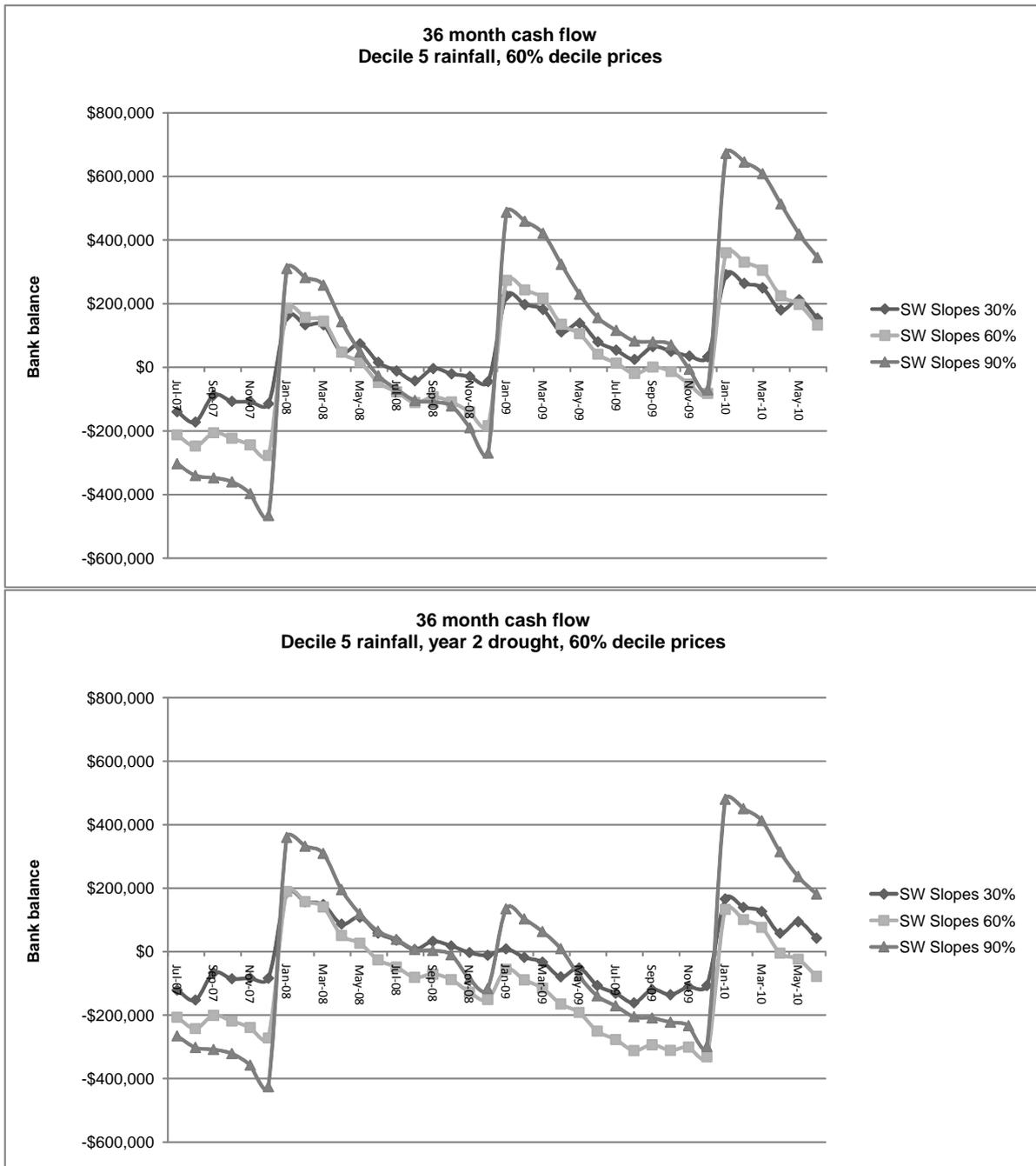Figure 2. Comparison of actual and simulated crop yields

Figure 3. 36-month cash flow for the SW Slopes farm

Appendix 2

Rotations used in different scenarios for each location. The rotation was adjusted to give the requisite enterprise mix for each scenario, and staggered across paddocks to give a stable area sown to each crop or pasture.

SW Slopes	30% crop	60% crop	90% crop
	TT canola	TT canola	TT canola
	Wheat	Wheat	Wheat
	Triticale (grazing and grain)	Triticale (grazing and grain)	Barley
	Lucerne sown	Lucerne sown	Lupins
	Lucerne	Lucerne	Wheat
	Lucerne	Lucerne	
	Lucerne	Lucerne	
	Lucerne		

Riverina	30% crop	60% crop	90% crop
	Wheat	Wheat	Wheat
	Wheat	Wheat	Wheat
	Barley & lucerne undersown	Barley & clover undersown	Barley
	Lucerne	Annual pasture	Long fallow
	Lucerne		
	Lucerne		
	Lucerne		

Western Victoria	30% crop	60% crop	90% crop
	Canola	Canola	Canola
	Wheat	Wheat	Wheat
	Barley & clover undersown	Barley & clover undersown	Barley
	Annual pasture	Annual pasture	
	Annual pasture	Annual pasture	
	Annual pasture	Annual pasture	
	Annual pasture		

Mallee	30% crop	60% crop	90% crop
	Wheat	Wheat	Canola
	Barley & clover undersown	Wheat	Wheat
	Annual pasture	Barley & clover undersown	Wheat
	Annual pasture	Annual pasture	Barley
	Annual pasture	Annual pasture	Lentils or field peas
	Long fallow	Annual pasture	
		Long fallow	

Appendix 3

Prices

1. Livestock prices were set at the 60th percentile for prices since 1996, which give a reasonable estimate of current saleyard prices.

2. Wool prices were also set at approximate the 60th percentile level. However it is difficult to apply a consistent percentile to all age groups and types because of the large variation in wool quality and micron across a typical mixed farming flock. Lambs were assumed to be shorn in full wool.

3. Grain prices have set new benchmarks in the past year, which means that historical records have little relevance. For that reason the recent price ranges for all grains have been divided into 10 equal steps and these used to replace an historical percentile analysis.

The actual prices used in this analysis, and referred to as percentiles, are as follows:

	Percentile Prices								
Crop	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Canola	300	333	367	400	433	467	500	533	567
Wheat	140	166	191	217	242	268	293	319	344
Triticale	125	148	171	193	216	239	262	284	307
Oats	110	131	152	173	194	216	237	258	279
Lupins	160	192	224	257	289	321	353	386	418
Pasture									
Fieldpeas	180	210	240	270	300	330	360	390	420
Fallow									
Barley	130	149	168	187	206	224	243	262	281
Lucerne									

	Percentile Prices								
Sheep	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Ewes - CFA	20.00	28.75	37.50	46.25	55.00	63.75	72.50	81.25	90.00
Ewes	30.00	37.50	45.00	52.50	60.00	67.50	75.00	82.50	90.00
Ewes 1-2yo	30.00	38.75	47.50	56.25	65.00	73.75	82.50	91.25	100.00
Ewes <1yo	25.00	33.13	41.25	49.38	57.50	65.63	73.75	81.88	90.00
Wethers	20.00	27.50	35.00	42.50	50.00	57.50	65.00	72.50	80.00
Wethers 1-2yo	20.00	27.50	35.00	42.50	50.00	57.50	65.00	72.50	80.00
Wethers <1yo	20.00	28.75	37.50	46.25	55.00	63.75	72.50	81.25	90.00
Ram lambs < 1 yo	25.00	31.88	38.75	45.63	52.50	59.38	66.25	73.13	80.00
Rams 1-2 yo	25.00	34.38	43.75	53.13	62.50	71.88	81.25	90.63	100.00
Rams	25.00	34.38	43.75	53.13	62.50	71.88	81.25	90.63	100.00
Ewe lambs	30.00	37.50	45.00	52.50	60.00	67.50	75.00	82.50	90.00
Wether lambs	25.00	31.88	38.75	45.63	52.50	59.38	66.25	73.13	80.00