Farm4Prophet: 1. Managing whole farm business risk in Australia

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Abstract
Farm4Prophet is a new whole farm business management tool developed by the BCG (Birchip Cropping Group), in association with leading farmers, CSIRO and farm business consultants. Long term pasture, animal and crop production modelling, using AusFarm, is integrated with whole farm financial projections. Farm4Prophet enables users to assess production and financial performance, and run scenario analyses to predict impacts on profitability and assess risk from changes in farm management practices.

Keywords
Financial management, farm modelling, profitability.

Introduction

Australia's rainfed mixed farming region (49M ha) has a highly variable climate, which results in a level of financial risk three to ten times higher than that experienced by its major competitors (Kimura et al. 2010). Australian farmers receive minimal Government support, and businesses thrive or fail depending on their ability to manage risk. There are currently few tools that enable farmers and other stakeholders to quantify the risks resulting from a strategic change in management. Farm4Prophet (www.farm4prophet.com.au) builds on the Yield Prophet (Hochman et al. 2009) concept of using modelling to test and evaluate farm specific management decisions. Farm4Prophet is available as a web-based product (www.farm4prophet.com.au) and is currently free to use. Farm4Prophet enables users to assess how changes to management practices impact production, financial and natural resource management (NRM) risk. This paper outlines the production and farm business risk component of Farm4Prophet, and the second paper by Mayberry et al. (2017) discusses the Natural Resource Management (NRM) outcomes of proposed management changes.

Methods

Farm4Prophet uses the Sequential Multi-variable Analysis methodology developed by Hutchings and Nordblom (2011), which prepares risk profiles for individual farms derived from multiple iterations of long-term, whole farm financial simulations. Farm4Prophet is an extension of this concept and has six functional components:

1. Production modelling - farm specific soil and enterprise mixes, including crops, forages and livestock, are modelled by AusFarm (Moore et al. 2007) using the most recent 30 years of climate data.
2. Farm income - is calculated from modelled production outputs and randomly selected commodity prices (within the range of lowest to highest price for each commodity over the last 20 years).
3. Financial data - the most recent 5 years of farm costs are used to calculate the average farm input and operating costs, finance costs and family drawings.
4. Cash flow - is calculated for each individual year by subtracting total farm costs from the calculated farm income. Sequences of 10 consecutive years are then used to calculate decadal financial performance inclusive of tax liabilities (based on the five-year averaging taxation rule available to farm businesses).
5. Financial risk - a Monte-Carlo routine with 1000 iterations builds cumulative probability functions (CDFs) based on the decadal (10 year) cash margins (closing minus opening financial balance) for each iteration.
6. Scenario analysis - allows the user to test the long-term effects on cash flow of various management scenarios and compares these with the current performance of the farm.

Cash flow was chosen as the benchmark for two reasons. First, cash flow is the only common indicator which contains all farm costs. Second, the change in the net cash balance drives the change in farm debt, which directly impacts on both the ability and the desire to invest in growth.

The management scenarios currently built into Farm4Prophet include:

1. impact of financial shocks (such as consecutive droughts) through increasing debt
2. impact of very profitable years on reducing debt
3. changing the enterprise mix within a cropping rotation and between crop and livestock
4. purchasing or selling farm land
5. impact of changed interest rates

Additional scenarios may be added following further discussion with farmers and advisers.

Currently farmers and their advisors can use Farm4Prophet (www.farm4prophet.com.au). Setting up a farm requires a good knowledge of soil types and rotations employed on the specified soil types. The financial inputs required are readily accessible by most farm businesses and we recommend to use the previous 5 year averages for input costs, operating costs, finance costs (based on debt), repair and maintenance, contracting costs, leasing costs, wages, drawings. And for the balance sheet: land and machinery value, cash deposits or term debts.

A Case Study Example:

The operation and outputs of Farm4Prophet are demonstrated using information from an owner operated 5000 ha farm located in the Mallee, Victoria. The baseline farming system comprised of three different five year rotations, based on soil type:

1. Sandy clay loam (type 1): canola, wheat, wheat, barley, lentils
2. Sandy clay loam (type 2): wheat, wheat, lentil, barley, field peas
3. Clay loam: medic, medic, medic, wheat, barley

In the model, N was applied in-crop based on simulated crop requirements, to a total of 40 kg N on soil types 1 and 2; and 30 kg N on soil type 3.

The livestock operation consisted of a 1500 ewe self-replacing sheep flock. The ewes and lambs grazed medic pastures over autumn/winter and stubbles over summer/autumn. Livestock were fed barley when simulated body weight reached a critical level. Returns from the flock are based on meat and wool sales.

Results and Discussion

1. Current farm performance:

Financial benchmarks

Costs: Input costs averaged 23% of farm income (guideline is 30%); Machinery and labour averaged 38% of farm income (guideline is 44%); Overheads averaged 8% of farm income (guideline is 9%); Finance costs averaged 19% of farm income (guideline is 10%). These financial guidelines are commonly used by farm management consultants.

Asset and Debt Security

Return on Capital: The farm had a ROC of 10%, which is significantly higher than the guideline of 4%. Equity: Current equity is 43%, which is below the benchmark guideline of between 50 and 75%. The reason for the high level of debt on this farm is/was due to farm succession and the long run of poor seasons. From 2002 to 2015, twelve years had below average growing season rainfall.

Under the existing climate and management system, the farm financial position, measured as decadal cash flow, is under stress, having a 40% probability of operating at a loss (Figure 1).

2. Scenario analysis:

A change in the position of the cash flow curve indicates whether the proposed scenario increases or decreases financial risk (ability to cover costs and financial obligations) (Figure 2). If the curve shifts to the left, the proposed change increases risk; and vice-versa if the curve shifts to the right, the proposed change decreases risk.

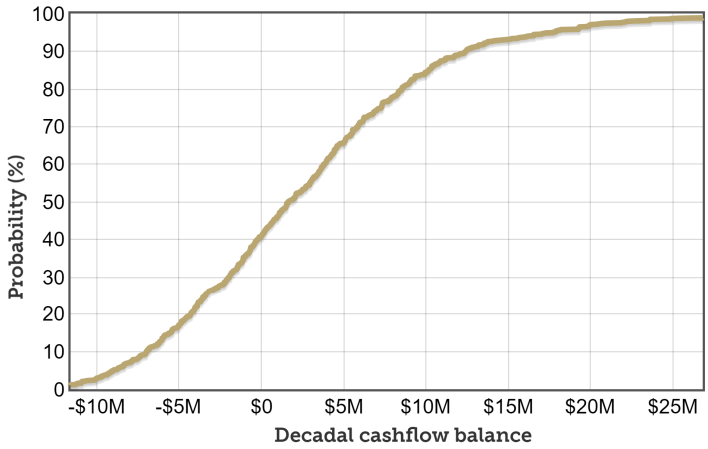

Figure 1. Probability of making a profit or loss over a decade.

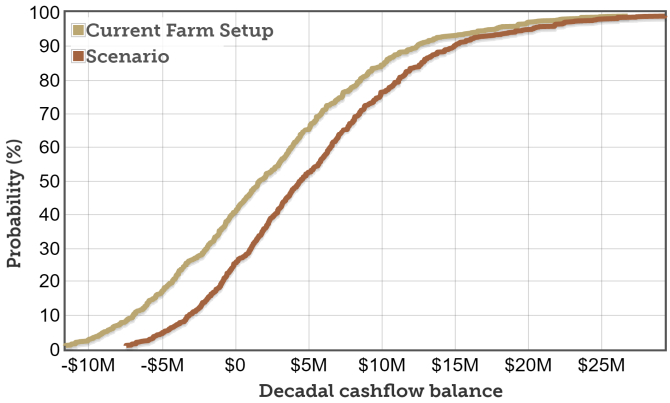

Figure 2. Reducing debt.

For this case study farm, reducing debt from $3M to $1M decreases the probability of operating at a loss from 40% to 25% (Figure 2). Average annual interest paid on the current debt is $300K, with a lower debt level interest would be $100K p.a. The risk of the farm not remaining viable if there were more consecutive financial shocks (i.e. severe droughts) is high. Farm4Prophet can model the impact of changing interest rates on farm viability.

Increasing the area grazed by livestock from the current 80% crop: 20% livestock, to 73% crop: 27% livestock, reduces the risk of making a loss from 40% to 35% (Figure 3). Maintaining sheep in the farm operation is of benefit especially during poor cropping seasons. The balance between how many sheep and how much crop to reduce risk can be modelled in Farm4Prophet.

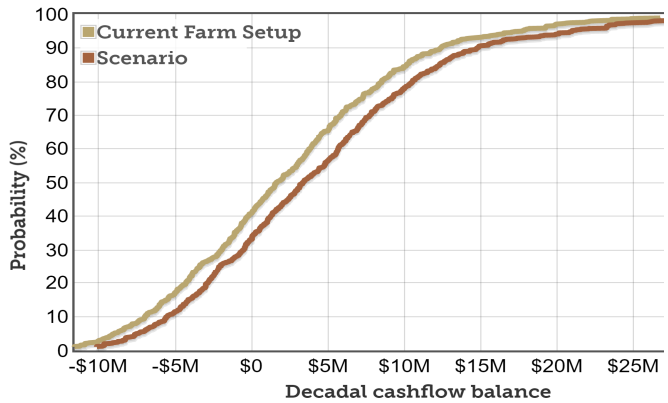

Figure 3. Increasing the proportion of the livestock operation.

If the scenario above (Figure 2) was repeated, but under the same climatic conditions as has been experienced over the last 15 years (2001 to 2015), the farm would not be viable under either livestock intensity scenario (Figure 4). Under the current set-up the farm would only make a profit in 20% of decades, and with an increase in the livestock operation, in 30% of decades. The impact of a long run of poor seasons can be modelled in Farm4Prophet.

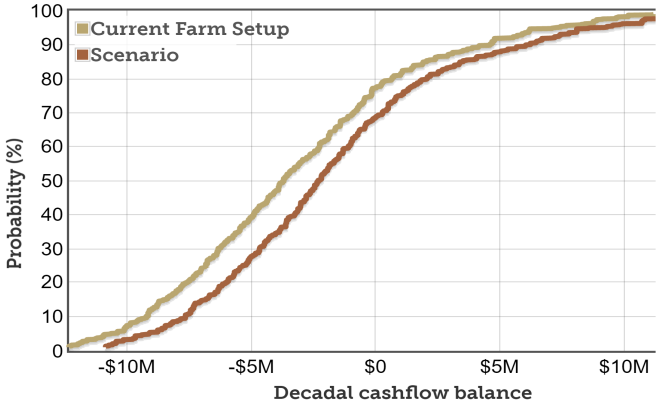

Figure 4. Increasing the livestock operation with a repeat of the climatic conditions over the last 15 years.

Conclusion

Farm profitability is affected by a variety of risks from different sources: production risk (most directly related to weather), market risk (agricultural commodity price volatility), and financial risk (interest rates, ability to borrow due to changed requirement for equity-to-debt ratio). The identification of these risks and the likely impact of a negative outcome on the viability and profitability of a farm is the key output of Farm4Prophet. The program is not designed to eliminate risk, which is impossible in any farm business venture, but to identify the key drivers of risk such that the farm manager can better manage these risks to remain viable, profitable and sustainable. Farm4Prophet is an effective tool for what-if type analysis, the impact of major business decisions can be directly ascertained by the change in the decadal cash-flow curve.

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