A Stochastic Budgeting Analysis of Three Alternative Scenarios to Convert from Beef-Cattle Farming to Game Ranching

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Abstract

The main objective of this paper is to evaluate the profitability and financial feasibility of three alternative scenarios to convert from beef-cattle farming to game ranching. The analyses acknowledge the importance of quantifying the probability of failure or success when making investment decisions. Risk is incorporated into a standard net present value analysis using risk simulation. De-trended historical auction prices of live game and on-the-hoof prices of weaner cattle were used to quantify price variability. The stochastic net present value analyses indicate that game ranching is more profitable than cattle farming. Although an investment in a limited number of common game species is financially feasible, the cash flow analysis indicates a decreasing probability of making more money with game when annual cash flows are compared to those generated by means of cattle farming. Both the high-value game species scenarios are financially unfeasible during the first five years. These infeasibilities stem from a high probability of not covering instalments to finance game purchases, the extent to which these instalments are not covered, and the high probability of shortfalls in consecutive years.

Keywords: Game ranching, profitability, financial feasibility, risk simulation

1. Introduction

According to Taljaard (2003) approximately 70% of South Africa's total area of 1.2 million km^2 is suitable only for extensive livestock production, of which the local game industry forms an integral part. Du P Bothma (2005) reckons that almost one third of the country's potential grazing land is utilised by game and game-related activities. Today, increasing numbers of livestock farmers (possible interested in switching from cattle farming to game ranching or *vice versa*) are concerned with the relative profitability of game and other domestic livestock enterprises (mainly cattle, sheep and goats).

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Several research studies have been done to evaluate the profitability of game ranching (Barnes & De Jager, 1995; Behr & Groenewald, 1990; Brand, 1984; Cloete *et al.*, 2007). Barnes and De Jager (1995) acknowledge the importance of price variability on profitability measures, and conducted sensitivity analyses on game auction prices. According to Lien (2003) a sensitivity analysis is not an appropriate method of conducting a risk analysis, since no indication is given with respect to the probability of the occurrence of a specific price realisation. Selley and Wilson (1997) indicate that decision-makers prefer information on the probabilities of success or failure of specific strategies for decision-making purposes. Several researchers (Lien, 2003; Smith, 1994; Upadhyay & Young, 2005) advocate the use of stochastic budgeting procedures as an appropriate technique to evaluate the risk associated with investment decisions. Lien (2003) demonstrates the practical use of stochastic budgeting procedures to evaluate alternative production and investment decisions on a dairy farm. Equity at the end of the last planning period is used as a performance indicator to evaluate the financial feasibility of the alternatives. However, Upadhyay and Young (2005) argue that simulation studies, such as those relying on performance indicators at the end of the planning period, are inappropriate when it comes to evaluating investment risk if the decision-maker is averse to fluctuations during the simulation period.

The main objective of this paper is to evaluate the profitability and financial feasibility of three alternative scenarios to convert a 240 large stock unit (LSU) beef-cattle farm in the Northern Cape Province (NCP) into a game ranch, while explicitly taking price risk into consideration through stochastic budgeting procedures.

2. Case study farm and scenario definitions

The research results of this case study are based on an actual farm located approximately 50 km south of Kimberley in the NCP. Given the large number of "new entrants" into the game industry in the region, the principal decision-maker of the case-study farm wanted to know whether it would be feasible to convert to game ranching in a case where investment capital is limited. The farm consists of 3 500 ha of mixed habitat, mainly a combination of dolerite slope Kalahari bushveld (258 ha), Kalahari swarthaak thickets (1 071 ha), Kimberley sandveld open savannah (200 ha), and Kimberley sandveld woodland (1 971 ha), making it suitable for most game species. The habitat of the specific case study farm allows an optimum carrying capacity of 208 LSU and 512 browser units (BUs) when farming with game. For cattle farming, the optimum carrying capacity amounts to 240 LSUs. The difference between the carrying capacity of game and cattle is due to their different grazing habits (i.e. the browser ability of game, for example).

The production system used on the cattle farm is an extensive cow-calve (weaner calf) production system – i.e. weaner calves (aged approximately 7 months) are the main product sold from the beef cattle enterprise, with older and unproductive cows and bulls sold as by-products. In order to convert the cattle farm into a game ranch, the only major infrastructure required would be 24 km of game fences, requiring an average investment of R30 000 per km, totalling R720 000 for the ranch as a whole. The assumption is made that no other major infrastructure would be required for the purposes of this case study, as hunting rights for both biltong and trophy-hunts would be subcontracted to hunting outfits on a concession basis. Thus, the major costs with regard to game ranching are allocated to production, capturing and marketing activities.

Three alternative scenarios to convert the beef cattle farm into a game ranch were evaluated. These scenarios differ with respect to the amount of capital required to purchase game, and therefore the composition of the game species on the farm. Scenario 1 assumes that the money (R1 million) generated from cattle sales is used to purchase game. The investment in the necessary infrastructure (fences) is financed over a 15-year period. The composition of species for this scenario does not include any high-value game. Scenario 2 is identical to Scenario 1, with the exception that more game with more or less the same game species composition is purchased and that the additional capital requirement (R850 000) is financed through a five-year loan. The amount of capital borrowed in the case of Scenario 3 is increased to R3 million to allow the purchase of high-value game species, including sable antelope (*Hippotragus niger niger*), roan antelope (*Hippotragus equines*) and Cape buffalo (*Syncerus caffer*). The specific composition of the game species for all three scenarios is based on an ecological model, as discussed by Cloete *et al.,* (2007), and the preferences of the principal decision-maker of the case study farm.

3. Procedures

The results of the profitability and feasibility analyses are generated using a stochastic net present value model. In the following three sub-sections the construction of the enterprise budgets for 16 alternative game species, and a beef cattle production unit of 240 LSUs is discussed firstly. Secondly, the enterprise and capital budgets are fed into the net present value model to evaluate the profitability and financial feasibility of alternative strategies to convert from beef cattle to game farming. Lastly, the procedures to incorporate price risk into the analyses through the use of risk simulations are discussed.

3.1 Enterprise and capital budgets

The beef cattle enterprise budgets signify a weaner cattle production system that is representative of the actual case study farm. This production system is typified by an 80% weaning percentage and a breeding material replacement rate of 15%. Variable costs included in the enterprise budget are: feed, dose, vaccination, veterinary, labour, diverse, and marketing costs. Diverse and marketing cost was calculated as 1% of the total variable cost and 7.5% of the gross value of production respectively. With regard to the game production system, gross margins were calculated within species-specific enterprise budgets by dividing the gross production values into different sources of income. Income in the case study consists of (i) live auction sales, (ii) trophy-hunting, and (iii) biltong-hunting. Income through livestock auctions amounts to 81% of production, with 12% and 7% respectively being generated from biltong and trophy-hunting. In the case of high-value game scenarios, live auctions will account for 93% and trophy-hunting for 7% of the income, since in this case the species are typically too expensive for biltong-hunting purposes. Variable costs allocated to the individual game species were based on information generated from local game farmers and include feed, capturing, medical (tranquilisers), veterinary, labour, marketing and diverse costs, with marketing and variable costs calculated on the same basis as in the cattle enterprise budget. These variable costs were allocated among the different enterprises (species) based on LSU. The principal decision-maker was of the opinion that fixed overhead costs would remain relatively constant between the cattle farm and the game ranch. The opinion is based upon his interaction with other farmers who had made the transition to game ranching, as well as other experts personally involved in the game industry. The analyses therefore assume that the overhead costs – excluding marketing costs – will remain similar. Prices for both income and expenditure were taken as those prevailing in the local market during 2005 and were kept constant.

The species-specific enterprise budgets are then combined into a whole farm budget where a net cash flow (NCF) for the ranch is calculated. The same was done for the cattle production system. NCF was discounted over time to account for the time value of money. The difference between the cumulative discounted benefit and cumulative discounted costs equals the NPV. Since real prices were used, the discount rate had to be in real terms. (This measurement is used because it provides a monetary value of the estimated returns, facilitating comparison between cattle and game ranching.)

3.2 Profitability and financial feasibility model

Boehlje and Eidman (1984) argue that the first step to take when evaluating capital investments is to determine whether the investment will be profitable. Profitable alternatives are defined as investments that will generate enough money so that the present value of the after-tax income stream is greater than the initial investment. Profitable alternatives are then evaluated further to determine the financial feasibility of the investment when foreign capital is required. Financial feasibility is evaluated each year within the planning horizon and is used to determine whether the investment will generate enough money annually to cover the payments associated with borrowed capital. The calculation procedures used in the profitability and financial feasibility model are based on the work of Boehlje and Eidman (1984).

The following equations were used to calculate the profitability and annual cash flows of the alternatives:

$$NPV = \sum_{t=1}^{T} \left(RATNI_t - INV_t \right) / \left(l + r \right)^{t-1} \quad (1)$$

where:

$RATNI_t$ .... real after-tax net income in year t

INV_t .... capital investment in year t

r real risk-free discount rate (8%)

Special care was taken to calculate income taxes more realistically. The investment in fences and game was deducted from the taxable income in year one, resulting in a large loss. In this analysis of profitability, a loss in any year was carried forward to the following years as an income tax deduction until such a loss was fully deducted. More specifically, RATNI was calculated as follows:

$$RATNI_t = CI_t - CE_t + T_t - TI_t * tax \quad (2)$$

$$TI_t = \left(CI_t - CE_t + T_t - D_t - I_t \right) \quad if \quad TI_{t-1} \geq 0 \quad (3)$$

$$TI_t = CI_t - CE_t + T_t - D_t - I_t + TI_{t-1} \quad if \quad TI_{t-1} < 0 \quad (4)$$

where:

CI_t cash income in year t

CE_t cash expenses in year t
T_t terminal value of the investment in year t
D_t tax deduction in year t due to depreciation
I_t interest portion of payment in year t
TI_t taxable income in year t
tax marginal tax rate (35%)

Cognisance should be taken of the fact that the interest deduction (I_t) only enters the equation if borrowed money is used. Therefore the value of I_t will be equal to zero when the profitability of the investment is evaluated. The financial feasibility of the investment was evaluated by subtracting the instalment on borrowed capital from $RATNI_t$, while including the interest portion (I_t) as a tax deduction in the calculation of taxable income. Since the after-tax net income is calculated on a real-term basis, the payment also needs to be on a real-term basis (Boehlje & Eidman, 1984). Procedures developed by Meiring (1984) were used to calculate the real payment schedule.

3.3 Risk simulation

The main purpose of risk simulation is to quantify the impact of specific risk sources on the variability of key performance indicators. Developing risk-simulation models is a complex process. Typically only the variables assumed to be most important for decision-making purpose are included as stochastic variables so as to keep risk models practical and reasonably transparent (Lien, 2003). Price risk was identified by the principal decision-maker of the case study farm as the most important source of risk. Following is a description of the procedures used to incorporate price risk into the profitability and feasibility analyses. Due to a lack of data from the principal decision-maker of the case study farm, data from the Unit for Wildlife Economics[3] at the University of the Free State, as well as Agrimark Trends[4] (AMT), were used to approximate game price and weaner price variability respectively. Average auction prices for game sales are available from 1990 to 2005. The real price data showed significant trends in the data, which may be the result of structural changes that took place in the respective industries. When quantifying risk, it is important to account for any trends in the data to ensure that the risk is not overestimated (Goodwin &

[3] The Unit for Wildlife Economics in the Department of Agricultural Economics at the University of the Free State has taken over the responsibility of the Centre for Wildlife Economics at the University of the North West to update and maintain a database on auction prices.
[4] AMT is a private company collecting agricultural statistics, based in Pretoria (http://www.agrimark.co.za/).

Mahul, 2004; Richardson, 2004). Polynomial time trend OLS regression analyses were used to de-trend the price data. In the case of beef prices, a seven-year cyclical component was highly significant and was therefore used to de-trend weaner prices. The de-trended cumulative probability distributions of prices that were used as inputs to the simulation process are shown in Table 1.

Table 1: De-trended cumulative probability price (Rand/animal) distributions of alternative game species and weaners (2005)

	Roan antelope	Blesbuck	Blue wildebeest	Buffalo	Duiker	Eland	Gemsbuck	Kudu	Impala
Minimum	45878	723	1460	46077	1000	3875	2744	2112	603
0.1	54948	749	1659	48477	1072	4510	3135	2311	629
0.2	61744	773	1982	79117	1188	5033	3390	2424	648
0.3	68631	811	2249	94553	1218	5180	3575	2474	672
0.4	79609	826	2516	114761	1266	5359	3636	2567	717
0.5	117696	856	2796	128344	1405	5536	3754	2613	776
0.6	148836	970	2990	132403	1573	6491	4415	2966	882
0.7	153782	1057	3654	136728	1659	6976	4571	3199	993
0.8	160385	1140	3806	145621	1987	7345	5415	3294	1020
0.9	167589	1159	3888	173799	2209	7744	5559	3486	1052
Maximum	172686	1231	4020	194487	2702	8033	5625	3759	1089
Average	112030	935	2815	117245	1559	6020	4175	2836	825
STDEV[2]	50730	177	904	46335	501	1337	984	510	181
CV[3]	0.45	0.19	0.32	0.40	0.32	0.22	0.24	0.18	0.22
Kurtosis	-2.11	-1.48	-1.49	-0.60	0.32	-1.30	-1.31	-1.08	-1.74
Skewness	-0.07	0.42	-0.03	-0.15	1.02	0.11	0.35	0.41	0.24

Table 1 (continued):

	Red hartebeest	Zebra	Springbuck	Steenbuck	Sable antelope	Mountain reedbuck	Waterbuck	Cattle weaners[1]
Minimum	1972	2748	355	481	25839	3234	3689	1775
0.1	2745	2948	483	911	30667	3276	4273	1817
0.2	3060	3125	535	1087	40821	3533	4627	1861
0.3	3266	3300	555	1400	48504	3934	4866	1904
0.4	3465	3832	594	1661	54096	4231	5261	2057
0.5	3524	4253	639	1910	59484	4354	5835	2073
0.6	4096	4420	668	1922	69544	4415	6322	2117
0.7	4301	4687	699	2133	84986	4493	6387	2133
0.8	4901	4789	736	2320	94048	4564	6762	2234
0.9	5041	5083	786	2456	106755	5367	7988	2334

Maximum	5161	5610	866	3889	115013	7147	8219	2461
Average	3796	4064	630	1807	66205	4423	5850	2069
STDEV[2]	971	909	136	831	29492	1221	1425	210
CV[3]	0.26	0.22	0.22	0.46	0.45	0.28	0.24	0.10
Kurtosis	-0.86	-1.23	-0.13	1.73	-1.18	4.15	-0.83	-0.75
Skewness	-0.10	0.01	-0.19	0.80	0.31	1.77	0.34	0.23

1 Average price of 240kg weaner from April to June
2 Standard deviation
3 Coefficient of variation

The coefficient of variation is a relative measure of variability. From Table 1 it is clear that the auction prices of game are much more variable, compared to the average weaner price from April to June. Furthermore, it is also clear that more high-value species like roan antelope, Cape buffalo and sable antelope are prone to higher price variability.

The risk simulations were conducted by means of the procedures described by Richardson *et al.* (2000), which use multivariate empirical distributions to characterise risk. The procedure to correlate the random variables hinges strongly on the ability to factor in the correlation matrix. Problems were encountered when trying to factor in the price correlation matrix when all the species were included. To reduce the number of entities to be correlated, a decision was made to correlate the income generated from game sales in a specific scenario with that of cattle sales. The procedure preserves the correlation structure between the prices of the different game species, since an income is calculated for each year of the de-trended historical data series. Three game income distributions were generated based on the years of available data. Fifteen years' worth of data was available for most of the game species. Only eight years' worth of data was available for mountain reedbuck and 12 years' worth of data for roan antelope. These two species, as well as the composite income distribution constructed for all game species with 15 years' worth of data, together with the income from weaners, were treated as separate distributions, which resulted in a correlation matrix[5] that was unproblematic to factor in. The factored-in correlation matrix is multiplied with independent standard normal deviates to correlate them. Integrating the area under the normal distribution yielded correlated, uniformly distributed numbers, which were used in an inverse transformed method to draw correlated values from the empirical distributions. These values were then

[5] The correlation matrix changes for each scenario evaluated, based on the specific composition of the game species included.

substituted into the profitability and feasibility models to generate distributions of profitability.

The risk simulation model was developed in Excel, while SIMETAR (Richardson *et al.* 2004) was used to run 100 iterations. One hundred iterations were deemed sufficient, since Latin Hypercube sampling was done, which reproduces the cumulative probability distributions with fewer iterations compared to other sampling techniques.

4. Results

As discussed in the procedures used, the results discussed in the next two sub-sections firstly analyse the relative profitability of converting from cattle farming to game ranching, after which the financial feasibility of such a shift is considered.

4.1 Profitability

The profitability of the three scenarios to convert to game ranching is presented in Figure 1. Also included for each scenario is the NPV, after taking borrowed capital into account.

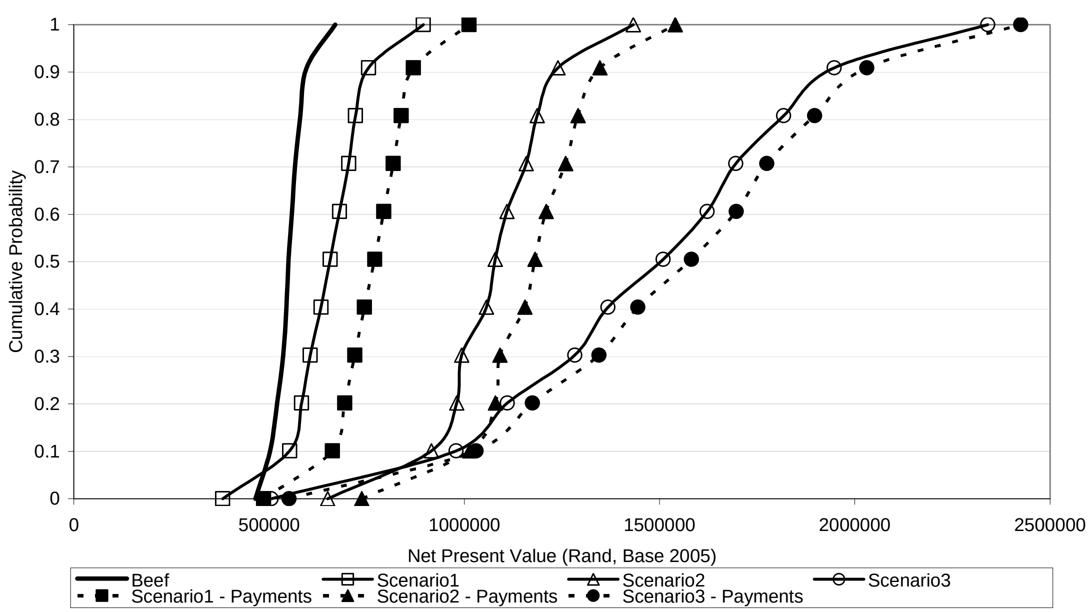

Figure 1: Cumulative probability distributions of the net present value of alternative scenarios to convert to game ranching, taking financing into account

From Figure 1 it is evident that the profitability of game ranching is higher than that of cattle farming when evaluated over a period of 15 years. Scenario 1, however, has a 5% probability of performing more poorly than beef. Scenario 2 dominates Scenario 1, which is an indication that the availability of starting capital plays an imperative role in profitability. The high-value game scenario (Scenario 3) is by far the most profitable; however, the variability is much greater compared to the other two scenarios.

What is interesting to note is that profitability increases when money is borrowed to finance the investment. The reason is that tax payments are lower due to the tax deductibility of interest paid. Care should be taken to interpret the higher profitability of the investments as being financially feasible. The financial feasibility of the scenarios should be evaluated to determine whether sufficient positive cash flows are generated to cover the instalment associated with borrowed capital during each year of the analysis.

4.2 Financial feasibility

In the previous section the alternative scenarios were evaluated to determine whether the investments would generate an after-tax net cash flow larger than the investment plus interest on borrowed capital. All the alternatives revealed that it is profitable to invest in game. The main objective of this section is to evaluate the annual cash flow implications of the alternative scenarios. The results of the analyses are shown in Figure 2 to Figure 4. More specifically, these figures show the probability of not generating a large enough cash income (i.e. positive cash flow) to cover the payments and also the chance to make more money than with beef cattle.

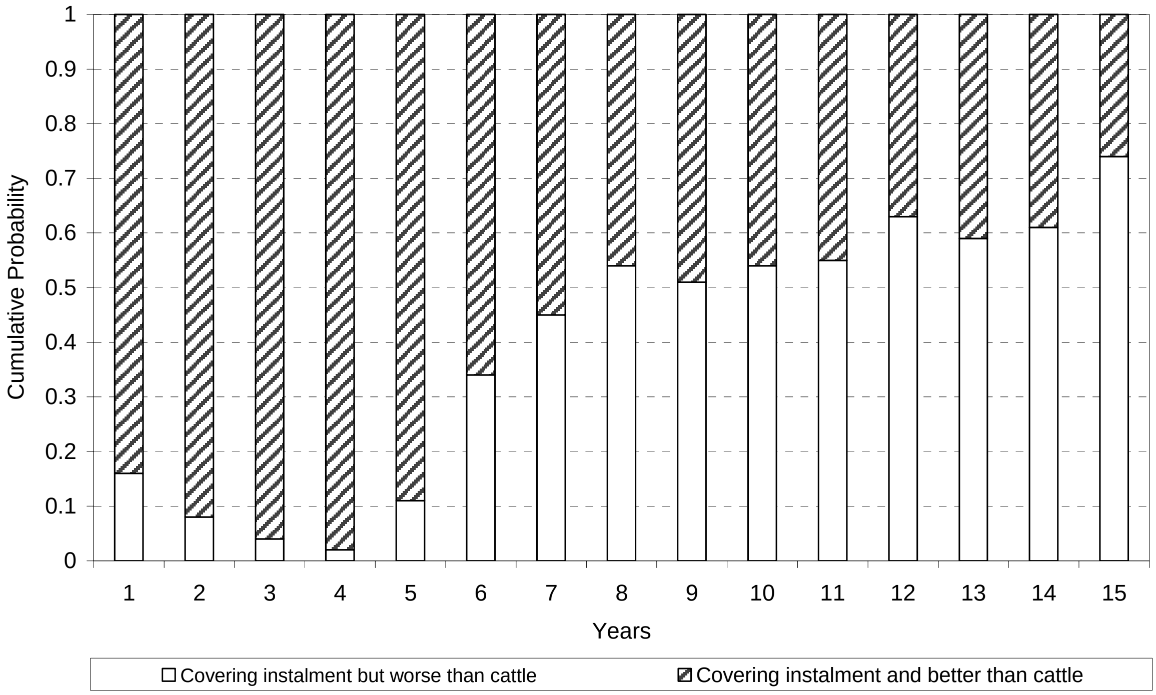

Figure 2: Probability of making more money with game ranching using Scenario 1

From Figure 2 it is clear that Scenario 1 will generate sufficient income to cover the annual instalments. The probability of making less money than with beef cattle is very low and decreases during the first four years. During the first four years no taxes are paid, because of the large taxable loss generated in year one, which is carried forward to the following years. The downward trend in the probability of making less money than with beef cattle can be ascribed to the fact that it becomes easier to repay one's instalments as time progresses. However, there is a steady increase in the probability of making less money with game ranching, ranging from 10% in year five to 53% in year eight. The reason why the profitability of game ranching decreases over time when compared to cattle farming is that the amount in taxes paid each year increases over time, because tax deductions decrease. From year 8 to 14 the probability ranges between 50% and 60%. In year 15 the chance of making more money with game farming decreases to 26%.

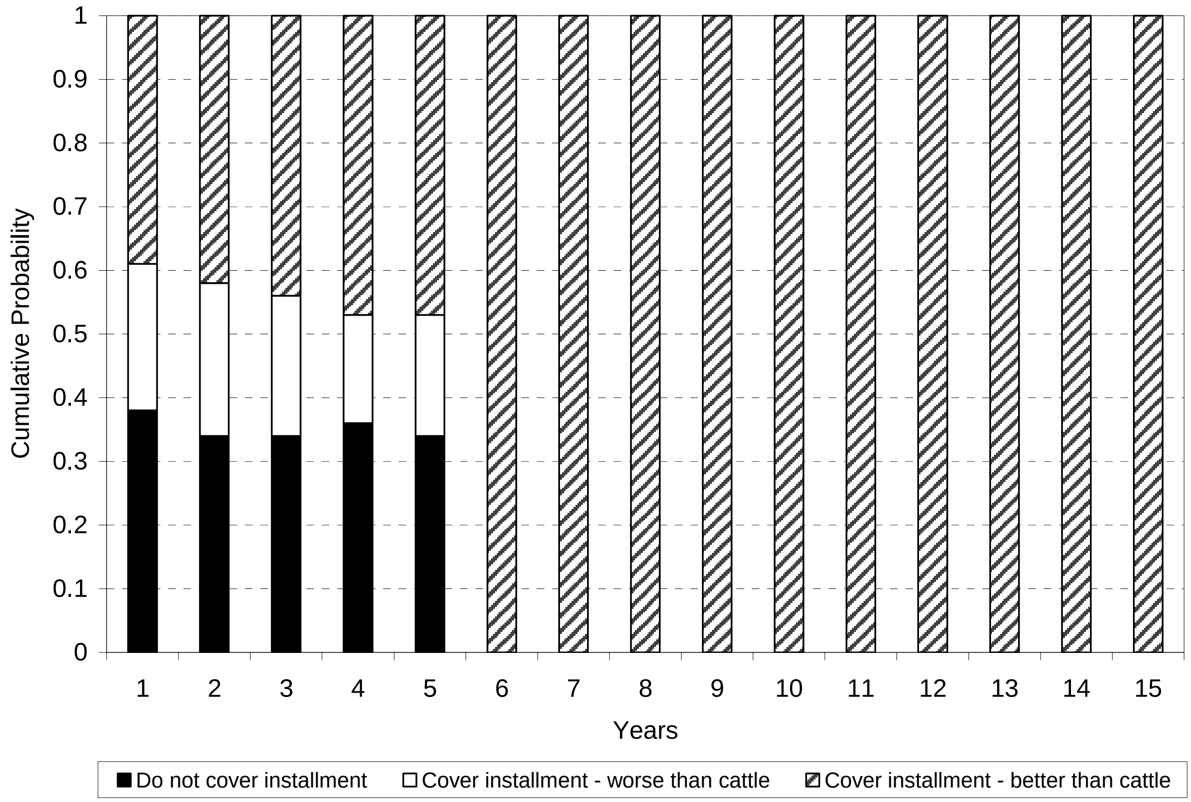

Figure 3: Probability of generating annual cash flows that will cover instalments or which are greater than with beef-cattle using Scenario 2

Although the profitability (NPV) of Scenario 2 is much higher than that of Scenario 1, Scenario 2 may not be financially feasible. Figure 3 shows that there is on average a 35% chance of not covering the instalments during the first five years. Meiring (1984) and Gill (1984) formulated a decision rule whereby at least 70% of the stochastic cash flows have to be sufficient to cover the instalments in each year, in order for an investment to be classified as financially feasible. Given this decision rule, it is clear that Scenario 2 is not feasible for the first five years. Again a slight increase (40% to 48%) in the probability of making more money with game is observed over the first five years, with the reasons being the same as explained under Scenario 1. Once the borrowed money that was used to finance game purchases is repaid, the chance of improved performance with game is 100%.

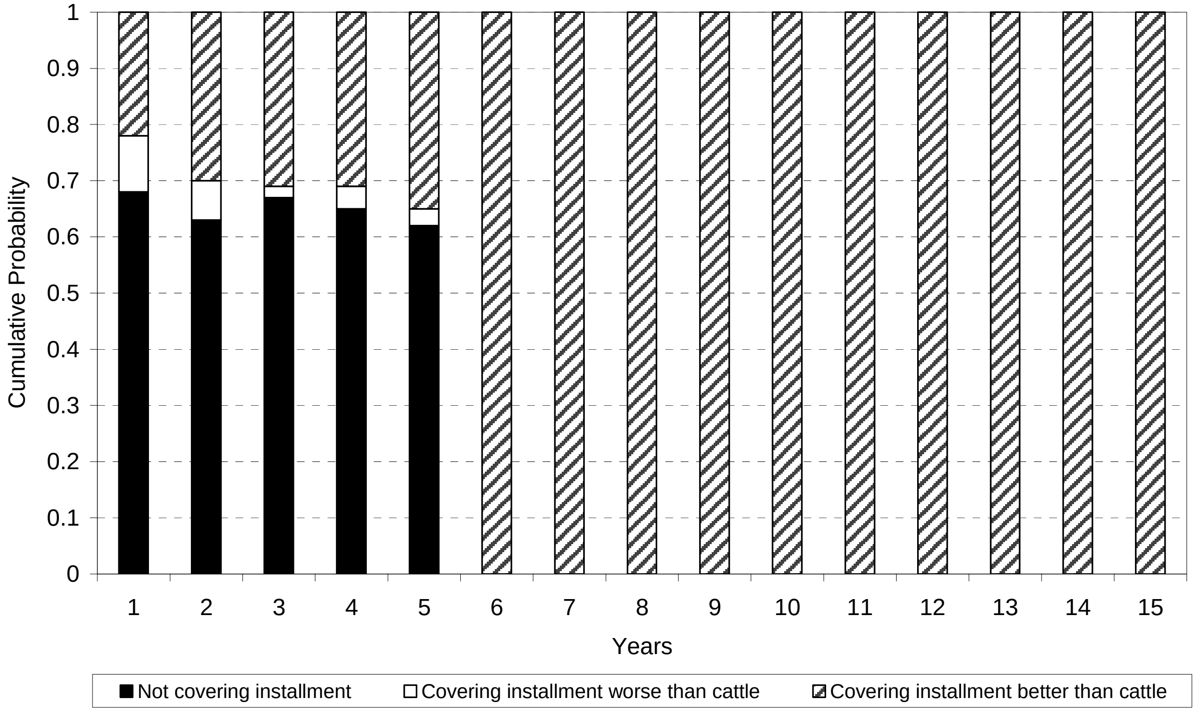

Figure 4: Probability of generating annual cash flows that will cover instalments, or which are greater than with beef-cattle using Scenario 3

In Scenario 3, an additional R2.15 million is borrowed over and above the R850 000 borrowed in Scenario 2 to allow for the purchase of high-value game species. Although a much larger annual income is generated with Scenario 3, the higher variability of the income resulted in the scenario not being financially feasible over the first five years, with the probability of not covering the instalments being greater than 60%. Again, if the financial (cash flow) problems of the first five years can be overcome, Scenario 3 becomes financially feasible from year 6 onwards.

From the discussion above it is clear that Scenario 2 and Scenario 3 may not be financially feasible due to the high probability of not covering the instalments over the first five years. However, no indication is given of the extent to which instalments are not covered. If the shortfalls are minor, the scenarios may still be feasible. In the following section the extent to which instalments are not covered is evaluated.

4.2.1 Cash flow shortfalls

The cumulative probability distributions of the amounts by which instalments in each year are not covered are given in Table 5 for Scenario 2 and Scenario 3.

Table 5 clearly shows the difference in the risk of not being able to cover the instalments in Scenario 2 and Scenario 3. The shortfall in Scenario 2 will never be more than R77 000 in any year. Furthermore, the probability that the shortfall will be less than R24 000 ranges between 10% in year 1 and 40% in year 5. The relatively minor shortfalls and fairly high occurrence probability of these shortfalls increase the overall probability that Scenario 2 is financially feasible if the shortfalls can be financed. The simulated shortfalls for Scenario 3 are much greater than those of Scenario 3. On average the shortfalls will be R270 000. Furthermore, there is a 90% chance that the shortfall in any year will be greater than R69 000, with the maximum shortfall being as high as an average of R500 000 in any given year. Securing financing for such large shortfalls may prove troublesome, and even more so if the shortfalls occur in consecutive years.

Table 5: Cumulative probability distributions of the amounts by which instalments are not covered during the first five years for Scenario 2 and Scenario 3

Cumulative Probability	Scenario 2				
	Year 1	Year 2	Year 3	Year 4	Year 5
Minimum	10477	1954	696	2896	646
0.1	18739	9753	9005	9640	2772
0.2	30284	17269	15511	14496	7573
0.3	38960	28463	21863	21066	16283
0.4	40490	33894	32891	29497	20942
0.5	45095	38919	34687	30566	29355
0.6	47358	40500	36273	38038	34306
0.7	52516	45846	38367	40784	38526
0.8	53916	50435	41480	43802	39964
0.9	61819	60888	56683	46023	55868
Maximum	76631	71907	75217	72428	72073
Average	42928	36327	32495	31490	28334
Stdev	16099	18705	18387	16622	19483
CV	0.38	0.51	0.57	0.53	0.69
Kurtosis	-0.15	-0.60	0.17	-0.14	-0.46
Skewness	-0.17	-0.07	0.42	0.25	0.41

Table 5: Continued

Cumulative Probability	Scenario 3				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Minimum	5604	16995	29508	7534	4750
0.1	75053	88355	74539	68924	71889
0.2	98371	144779	106809	105426	104041
0.3	163704	224171	157602	174306	165777
0.4	211487	288744	229286	211285	225540
0.5	268235	324472	265423	245770	295162
0.6	318928	351057	322442	289793	338597
0.7	379599	384386	377863	363885	385993
0.8	422107	418021	404430	413262	412650
0.9	459746	442503	416712	440453	442741
Maximum	520555	498154	490606	508096	503464
Average	262963	292118	262124	258077	270552
Stdev	147955	136088	134861	144132	145614
CV	0.56	0.47	0.51	0.56	0.54
Kurtosis	-1.34	-1.06	-1.38	-1.20	-1.32
Skewness	0.01	-0.44	-0.19	-0.02	-0.22

Table 6 shows the probability of simulating a shortfall in two consecutive years during the first five years for Scenario 2 and Scenario 3. From Table 6 it is clear that the probability of simulating consecutive shortfalls is fairly low for Scenario 2, i.e. less than 16%. On the contrary the probability of simulating consecutive shortfalls is on average about 30 percentage points higher for Scenario 3. Thus, when the level of shortfall and the probability of consecutive shortfalls are considered, Scenario 2 may still be financially feasible whereas Scenario 3 will definitely not be financially feasible. A major factor that may improve financial feasibility is the length of the loan repayment period for the financing of game purchases, as well as the interest rate.

Table 6: Probability of simulating a shortfall in any two consecutive years over the first five years for Scenario 2 and Scenario 3

	Year 1 & Year 2	Year 2 & Year 3	Year 3 & Year 4	Year 4 &Year 5
Scenario 2	15%	16%	9%	14%
Scenario 3	44%	46%	39%	35%

5. Conclusions

From the results it is apparent that care should be taken to judge the feasibility of investment decisions using the NPV alone, as there may be a high probability of not meeting instalment obligations in specific years. The results in Section 3.1 (profitability) clearly indicate that the NPV values increase due to tax deductions when instalments are taken into account, while the feasibility analysis (Section 3.2) indicates that there is a high probability of cash flow deficits. Profitability should thus be complemented by a feasibility (cash flow) analysis.

The main conclusion from this research case study is that it would not be financially feasible to convert from cattle farming to game ranching, even though game ranching is more profitable than beef-cattle farming. In cases where it is financially feasible to convert (Scenario 1), one may end up performing worse with game than with beef cattle if the annual cash flows are compared. Furthermore, it is important to note that the variability of annual cash flows will also increase when converting to game ranching. The results indicate that large sums of additional starting capital are required in order for the investment to be financially feasible. For this reason the principal decision-maker is advised to seek foreign investments to supply the necessary capital to make the investment financially feasible, or alternatively to explore a phased transition from cattle farming to game ranching. The feasibility may furthermore be improved if a longer loan repayment period can be negotiated from a financial institution. The results reveal a trade-off between increasing profitability and decreasing financial feasibility, which should be explored in more detail in future research. A possible path of investigation is to analyse the trade-off with a risk programming model.

When evaluating the results and conclusions drawn from the results it is important to take cognisance of the assumptions made and the data used to generate the results. The results in this study were generated for a case study farm in the NCP and are therefore specific to the case study farm. However, the modelling procedure is general in nature and can easily be used to evaluate profitability and feasibility in other regions. Furthermore, the modelling procedure proved to provide important information regarding the chance of success while considering price risk. Only price risk was taken into account in the analyses, and it is acknowledged that other sources of risk may also impact significantly on the results. Interest rate variability will influence the feasibility of the investment directly. Another important source of risk that should be investigated is the fact that, due to the price of high-value species, only a few animals are kept. The death of a single animal therefore constitutes a major financial loss. Of critical importance when conducting a risk analysis is the data used to quantify risk. Due to a lack of data, a fairly short time series of data was available for price risk analyses, which made it impossible to know for certain whether the quantified distributions reflected the true distribution of outcomes.

The point of departure was, however, to generate some indication of the impact of price variability rather than to assume it away because of a lack of data. A clear need exists in the game industry to gather and keep price information.

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