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REDUCING BUDGET RISK BY USING PROBABILITIES

P.J. van Blokland,

Abstract:
This paper emphasises the importance of budgeting for a family run firm. It concentrates on the inadequacy of the typical budget forecast that is shown to firm owners and lenders. This original budget is changed to a useful indicator of the firm's future by incorporating risk, using probabilities and a decision tree. Without this incorporation the firm can misallocate its anticipated net income between family salary, firm re-investment and debt reduction. The final budget, adjusted to the individual firm's risk calculations, produces a weighted net income. This number is a more realistic one for allocating salary, investment and principal.

BACKGROUND

We need budgets to run a business so that the firm owners, its lenders and other investors can see where the firm might be going. A budget is perhaps the best route map for the future that there is. So it is vital for a budget to be as realistic as possible. But there are two points that are equally important. One is that no-one can predict the future so all budgets will be wrong. All parties concerned with the firm's future need to understand this. Secondly, budgets have to be changed as things change and as the future inexorably becomes closer to the present. These alterations make the budgets more accurate and far more useful than they would otherwise be. Thus, there is not one set budget for a firm but a continually changing one.

The real problem is that small family run businesses, particularly farm type businesses, tend to produce budgets that are often not well thought through, are fixed and do not incorporate risk. This means that those associated with the firm, who mainly are the owners themselves and their lenders, make decisions ex post rather than ex ante. This practice is particularly serious when firm profits are allocated. Good budgets must include risk. This is what this paper is about.

PURPOSE AND PROCEDURE

This paper is essentially about incorporating risk into the budgeting procedure for a family run farm firm by using probabilities. A probability (Pr) is simply the chance of an event occurring. For example tossing a coin has a 50% or 0.5 chance of producing a head . The paper starts with a typical budget that makes no allowance for risk and uses a hypothetical firm to illustrate the main points. It then includes probabilities as a measure of risk by incorporating the likelihood of losses and varying cash costs. This is presented in a decision tree. The results of this tool are finally re-introduced back into the original budget.

The main purpose of this procedure is to compare the allocation of net income before and after risk is included. Net income is also known as profit or earnings and is the bottom line of all firms, farm and non farm. It can only be spent on three things These are owners' salaries, principal payments and re-investing. In the corporate world, the salaries are equivalent to dividends and the principal and re-investing are retained earnings. Budgeting them right is of prime importance.

THE BASIC BUDGET AND TERMINOLOGY

The following budget is for one unit of sales. The unit could be a kilo, bushel, acre, square metre, hectare, 100lbs or whatever the firm owner decides is a reasonable unit.. The numbers are equally facile and are entered in figure 1. The purpose here is solely to illustrate the methodology.

FIGURE 1: UNIT BUDGET $ per unit

Cash costs (incl taxes)	7.00
Depreciation	1.50
Overhead	0.50
Total costs	9.00
Net income or ROI (c.11%)	1.00
Therefore Asking Price	10.00

This budget shows that the firm hopes to net $1.00 per unit. This is what is available for owners' salaries, re-invest in the firm and to pay principal.. The $1.00 net income also translates to a potential return of around 11% for the firm's $9 per unit investment. These numbers are typically what a firm owner will take to the bank to support a loan request and schedule principal payments.

But what happens if the firm does not get its budgeted net income? The salaries, principal and re-investing are all postulated on the firm netting $1.00 per unit. It is a risk free budget that makes no allowances for error. This is where probabilities should be incorporated, along with the decision tree, so that the firm can calculate the likelihood of obtaining this $1.00. A budget that embraces risk has a stronger basis for ownership evaluation and encouraging new investors in the business.

It may be useful to define the other terms used in this budget:

1. Cash costs are the items the firm pays cash for and will typically be at least 75% of the total costs of practically any farm firm in the world. Cash costs include fertilisers, chemicals, feed, labour, materials, energy costs, rent, repairs and interest. (In this example they also include owners' income and social security taxes).

2. Depreciation costs are for items that depreciate and are usually prorated among sales. These costs generally apply to buildings, machinery and equipment, breeding stock and bearing trees.

3. Overhead costs are associated with office expenses. They include accountant and legal expenses, office depreciation, business entertainment and travel as well as the traditional paper, secretarial and phone costs.

4. ROI or return on investment is used here as the percentage difference between total costs and asking price. It shows how much return the firm expects from investing $9.00 in each unit of sales.

5. Asking price is what the firm wants for selling one unit. It covers total costs and a reasonable ROI.

ASSUMPTIONS

The main assumption is that most budgets in family run small firms are like the one in Figure 1. Thus the firm expects to make a $1.00 per unit and will spend this dollar on family living expenses (i.e. salary), principal and re-investing. If the firm merely uses net income to accumulate cash, this accumulation is treated by accountants as re-investing. Consequently, the $1 per unit is automatically completely consumed by one or more of its three potential uses. The second assumption is that the firm has negotiated with a customer to be paid its asking price, or $10. Thus the paper concentrates on the changes in total costs stemming from unit losses such as yield reductions, deaths etc, and on cash cost variations. This concentration helps focus on the methodology.

The third assumption is that the firm typically experiences unit losses of either 4% or 8%. The final assumption is that cash costs can vary in the short run, e.g energy prices, and the firm is not certain what they will finally be. The owners decide that these costs will be somewhere between $6.30 and $7.70 per unit, making a 10% variation from the mean of $7 per unit.

USING PROBABILITIES

The firm's records and experience show the unit losses are more likely to favour the smaller than the larger number. These records show that seven times out of 10 it will lose 4% and the remaining three times it will lose 8% of its units.. There is thus a probability of 70% or 0.7 for 4% losses and therefore 30% or 0.3 for 8% losses.

Similarly, records, experience and current events suggest that the budgeted cash costs of $7.00 will be about right 50% of the time. But it is possible that they may fall to $6.30 or rise to $7.70 with equal chances for either event in this 10% range. There is, therefore, a 25% chance of either cost happening.

Note that these probabilities are the firm's probabilities and are perhaps unique to the firm. They represent the most likely situations according to its experience and preferences. They may not represent the probabilities of others in the same business but they make that firm comfortable. This point cannot be emphasised enough. It is vital that these probabilities make sense to the firm using them. It will then be the owners' job to explain them to others interested in the firm's progress. These numbers are combined in figure 2.

FIGURE 2: TABLE OF EVENTS AND PROBABILITIES

Cash costs	Pr	Losses (%)	Pr
$6.30	0.25	4	0.70
$7.00	0.50	8	0.30
$7.70	0.25		

COMBINING THE DATA AND PROBABILITIES INTO A DECISION TREE

The decision tree illustrates the consequences of including probabilities in the budget calculations. This is what should be done to produce the budget and before the owners discuss the consequences of this budget with parties interested in the progress of their firm.

The decision tree uses the probabilities presented first separately and then jointly, to produce its final results. The joint probability is the chance of two things happening, one event followed by the other event. For example, instead of calculating the separate probability of tossing a coin to get a tail, the joint probability measures the chance of tossing a tail followed by a tail. It is calculated by multiplying the individual probabilities of the separate events together. Thus the probability of tossing a tail is 0.5 so the joint probability of tossing two tails in two tosses is 0.5 x 0.5, or 0.25. Applying the same argument to this situation:-

FIGURE 3: THE DECISION TREE WITH JOINT PROBABILITIES

Cash cost	Pr	% loss	Pr	net income($)	Joint Pr	
6.30	0.25	4		0.7	1.35	0.175
		8		0.3	0.98	0.075
7.00	0.5	4		0.7	0.63	0.35
		8		0.3	0.22	0.15
7.70	0.25	4		0.7	(0.10)	0.175
		8		0.3	(0.46)	0.075
						1.00

This table shows the results of combining expected losses with varying cash costs and their joint effect on net income per sales unit. The net income column illustrates that, under these postulated events, net income varies from negative 46 cents per unit to a positive $1.35 per unit. For example, in the first row, the joint probability of spending $6.30 per unit and 4% losses is calculated by multiplying. (1) 0.25 x 0.7 = 0.175 or 17.5%.

This is also the probability of netting $1.35 per unit. The cash cost of $6.30 and the depreciation plus overhead costs shown in Figure 1, (i.e $1.50 + $0.50 = $2.00) coupled with a 4% plant loss, changes the per plant costs viz:

2. (6.30/0.96) + (2/0.96) = total cost of $8.65

Thus the $10.00 asking price - $8.65 = $1.35 net income

In row 2, the same logic applies, but with the arithmetic adjustment of 8%. And so on for the rest of the table.

INTERPRETING THE RESULTS

The decision tree shows that the firm should not budget for $1.00 net income per unit. It might be useful to discuss why this is so. Suppose the firm normally produces 100,000 units a year. This means it expects $100,000 net income per year. Farming statistics in the USA suggest that the family expenses for a family of five, with the man and wife in their mid 40s working full time in the firm, are around $40,000, or 40% of the firm's net income. So this $40,000 is allocated in the budget as owners' salaries.

Likewise, re-investing in the firm for growth and a cash reserve, currently needs $33,000 or 33% of the anticipated net income. This leaves $27,000 or 27% of net income to pay off debt. Realise the order of allocation. Owners should pay themselves first, decide what they need for firm growth next and use the remainder to convince their banker that this sum ($27,000) is what they can afford to pay without living like paupers and neglecting the firm's future. These percentages are fairly typical in the USA if the firm's owners allocate the net income. However, too many agricultural firms allow lenders to do the allocation and lenders, understandably may earmark more than a quarter of the net for principal.

Looked at another way, about 40 cents in every unit sale is budgeted for the family, 33 cents (a third of the net income) for re-investing and 27 cents (a little over a quarter) to retire debt. These numbers can stay the same. But the decision tree indicates that the budget needs considerable alteration.

The last two columns show that the probability of getting $1.00 or more net income per unit (assuming that 98 cents is close enough) is only 25%. This is calculated by adding the top two joint probabilities in the final column of the table together. There is the same probability of making a loss, which is calculated by adding the last two entries in the final column, or 0.175 + 0.075. The remaining 50% of the time the firm now expects a profit of from 22 cents to 63 cents per unit. The owners can use these results to find a weighted net income per unit.

The weighted average for each entry is found by multiplying the numbers in each of the last two columns. For example, the probability of earning $1.35 net income per plant is 17.5% or 0.175. The weighted contribution of this combination is 1.35 x 0.0175 = 0.236. This procedure is done for all the decision tree rows, including the negative two rows. The sum of all these weights is 0.511, which means that the budgeted net income is now around 51 cents per unit. This is a more realistic number for the firm budget's net income. Interestingly, it is about half of what was originally budgeted.

The result is significant. If the net income percentage allocations stay the same, then the family salary is approximately halved to $20,000, re-investing gets around $16,500 and lenders receive $13,500. Knowing these numbers before the firm publicises its budget will have very different results than if they distribute these results ex post.

CONCLUSIONS

The conclusions are pretty obvious. The decision tree, with all its guesswork, produces a better budget at the start of the production cycle, than a budget that ignores risk. The family can allocate its net income with more certainty and make sure that they will have sufficient family funds before deciding on re-investing and promising specific debt reduction to their lenders. As things change, the budget will still be altered to reflect these changes. But, given the probability safeguards, it is more likely, at least in agricultural circles, that net income will be higher than 50 cents, because of the generally pessimistic nature of rural firms. Consequently it is much easier to allocate an "excess" than it is to justify a shortfall. Families will be pleased, the firm will grow faster and lenders will be pleasantly surprised and more prepared to help.

The tree is an extremely useful tool for modifying what the firm wants to do and commit to do in the future. Those associated with the firm should, and will, understand the results. The resultant budget represents the truth of the firm as seen through the eyes of its owners. Budgets should not be used, Enron like, to delude investors, debt holders and most importantly, the firm's owners.