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## Financial Analysis of Proposed Farm Adjustments with a Partial Budget

### Partial Budget for **[Crop Name]**

<table>
<thead>
<tr>
<th>Income</th>
<th>Profits</th>
<th>Cash Flow</th>
<th>Added Costs</th>
<th>Profit</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>125,000</td>
<td>125,000</td>
<td>12,500</td>
<td>112,500</td>
<td>112,500</td>
</tr>
<tr>
<td>1. Interest on loan</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
</tr>
<tr>
<td>2. Total reduced cost</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
<td>12,500</td>
</tr>
<tr>
<td>Total reduced returns</td>
<td>112,500</td>
<td>112,500</td>
<td>112,500</td>
<td>112,500</td>
<td>112,500</td>
</tr>
</tbody>
</table>

### Financial Analysis

1. Change in annual profit: **$25,000** — total positive effect (profit column) — **$25,000**
2. Average annual rate of return on investment: **12.5%** — annual profit (line 1), \( \frac{12,500}{125,000} \times 100 \) — **12.5%**
3. After-tax cash available for annual installment of principal: **$15,000** — total positive effect (cash flow column) — **$15,000**
4. Years to recover debt: **6.92** — line 3

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A Western Regional Extension Publication
WREP 0104
Financial Analysis of Proposed Farm Adjustments with a Partial Budget

by Gayle S. Willett, Extension Economist, Washington State University, Pullman, Washington, and Bart Eleveld, Extension Farm Management Specialist, Oregon State University, Corvallis, Oregon

Introduction

The objective of this publication is to familiarize farmers, agricultural lenders, students, and others with the power, flexibility, and use of the partial budget. Basic partial budgeting concepts will be discussed, and the budgeting procedure will be illustrated with an analysis of a proposed machinery investment.

Perhaps the adjustment most commonly considered by farmers and their lenders is one that involves only a single or small phase of the farming operation. The financial impact of this type of adjustment can be quickly analyzed with a partial budget. A partial budget examines only those cost and return factors that change as a result of making an adjustment in the business. Areas not affected by a proposed change should not influence the decision; thus, a partial budget simplifies the analysis by eliminating the constant factors.

In contrast, a whole-farm budget analyzes the financial impact of a proposed adjustment by comparing performance of the entire business before and after the adjustment is implemented. Therefore, unlike the partial budget, the whole-farm budget considers all phases of the business, including those not affected by the change in operation. Obviously, the use of a whole-farm budget to analyze a minor business adjustment requires added (and unnecessary) work by the analyst relative to a partial budget. However, when the proposed adjustment is substantial enough to affect several (most) phases of the business, the whole-farm approach should be used. Little work is saved by using a partial budget and the possibility of overlooking an important variable is increased. Furthermore, a whole-farm approach can provide a more comprehensive view of the farm's profitability and cash flow position, which is an important consideration for a weak business undergoing even marginal adjustments.

With these considerations in mind, what kind of changes might be appropriately analyzed by a partial budget? Several examples come to mind:
Basic Concepts

A partial budget is a tool that can be used to project the financial performance of a proposed minor adjustment in the business: it focuses only on those variables expected to change as a result of the adjustment. Moreover, the partial budget simplifies the analysis by focusing on average annual performance (that is, what happens in a typical year). Other, more sophisticated budgeting tools (for example, internal rate of return and net present value analyses) may require an estimation of economic impacts on a year-by-year basis and more accurately account for the effect of time on the value of money.¹ While the partial budget may be less accurate than these more advanced approaches, its accuracy is sufficient to prevent major errors in decision making. Furthermore, the analysis outlined in this publication can be readily completed by those with access to the relevant data, paper, pencil, inexpensive calculator, and a few minutes of time.

Regardless of the budgeting method, the analysis should answer three questions:

1. Will the proposed adjustment be profitable?
2. Will the adjustment have a cash flow that is strong enough to retire any added debt without disrupting the business?
3. Are the risks of financial loss due to unforeseen and/or uncontrollable adverse events acceptable?

Profitability is determined by two measures in the analysis. The first measure is the change in average annual profit and the second is the average annual rate of return on the investment. Annual profit is the return over all costs and is therefore, a return to the risk(s) that may be associated

¹Those who may wish to use a more sophisticated computerized analysis are referred to “Analyzing Agricultural Investments,” WREP 73, Cooperative Extension, Washington State University, Pullman, WA 99164, and accompanying software.
with making the proposed change. The rate of return is the annual return to the capital investment (if applicable) divided by the investment. Return to capital is computed by subtracting all costs, except interest, from the receipts. If the rate of return exceeds the cost of capital (expressed as a percent), the investment is profitable.

The cost of capital is the interest rate that represents the cost of the funds used to finance the investment. If the investment is entirely debt financed, the interest rate on that debt is the relevant cost of capital. The cost for a 100% equity capital investment is the rate of return the investor gives up on the best, similar risk use of these funds. If both debt and equity capital are used, the cost of capital is a weighted average of the two. For example, if an investment is financed with 80% debt, 10% interest, and 20% equity, 12% interest, the weighted average cost of capital is [(0.8 x 0.10) + (0.2 x 0.12)] = 10.4%.

Cash flow performance can be measured in different ways. One approach is to project annual cash flows for each year of the investment’s life to determine if sufficient funds are available to cover added cash costs and to make principal and interest payments. This method is particularly appropriate if large variation in annual cash flows is anticipated.

Another approach, and the method adopted for this publication, is to compare the time required to recover the debt with the loan repayment period. Cash flow is favorable if the debt recovery period is equal to or less than the loan repayment period. The debt recovery period is computed by dividing total investment debt by the average annual amount of cash generated by the investment for principal retirement. Average annual cash flow is based on a projection for a typical year; thus, unlike the first approach, this method does not require the projection of cash flows for each year of the investment’s life. The assumption underlying this second approach is that annual cash flows are level over time, which may or may not be true. Thus, while estimating the debt recovery period on the basis of a cash flow projection for a typical (average) year may be less accurate than the first approach, it has the advantage of greater simplicity.

Risk is analyzed by using a break-even analysis on the more important yet highly uncertain assumptions. Once the value that equates investment costs and returns has been identified, the decision maker must only assume the value will be greater or less than the break-even point. Making that judgment introduces less uncertainty into the decision than relying upon a single, “best guess” value. Risk may also be evaluated by changing some of the more important and uncertain assumptions...
to determine the impact on profitability and cash flow.

Using a Partial Budget
To use a partial budget, it is first necessary to identify the factors that will be affected by the proposed adjustment. Next, each of these factors must be quantified on an annual basis and classified:

<table>
<thead>
<tr>
<th>Positive effects</th>
<th>Negative effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added returns</td>
<td>Added costs</td>
</tr>
<tr>
<td>Reduced costs</td>
<td>Reduced returns</td>
</tr>
</tbody>
</table>

A comparison between total positive effects and total negative effects indicates the expected performance of the adjustment in terms of profitability, cash flow, and risk.

Perhaps the best way to learn how to use a partial budget and to gain an appreciation for its use in analyzing capital investments is through an example analysis.

Example: Purchase of a No-Till Drill
Suppose that a farmer is contemplating the purchase of a no-till drill. The drill will be used to seed the farmer's ground as well as for custom seeding for other producers. Assumptions applying to this proposed investment are:

- The no-till drill costs $110,000.
- The drill has an estimated 8-year life and a salvage value at the end of 8 years of $27,500.
- If purchased, the drill will be pulled by a power unit already owned by the farmer.
- The farmer is currently custom-hiring a no-till drill/power unit at $32 per acre to seed 250 acres of his own winter wheat ground.
- If the drill is purchased, the farmer feels he could use the drill and his power unit to seed about 1,000 acres for other farmers. He expects to charge his custom-hire clients $32 per acre.
- The $110,000 investment in the drill will be financed with a $27,500 down payment of the farmer's own funds and an $82,500 loan. The loan has a 13% fixed interest rate and must be repaid in five equal annual payments of $23,456 each. Funds used for the down payment could earn 13% in a similar risk alternative (for example, retiring debt on another machinery loan with a 13% interest rate).
- The marginal income tax rate is 15%. This is the rate at which any change in income will be taxed.

In the partial budget analysis (Fig. 1), positive effects appear on the left-hand side and negative effects are listed on the right-hand side. Positive effects include profit-increasing factors categorized as added returns or reduced costs. Negative impacts include profit-reducing factors classified as added costs or reduced returns. Two columns labeled profit and cash flow appear on both the left-hand and
Partial budget for **No-Till Drill Purchase**

<table>
<thead>
<tr>
<th>Positive effects ($ per year)</th>
<th>Negative effects ($ per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added returns</td>
<td>Added costs</td>
</tr>
<tr>
<td><strong>Custom Work</strong></td>
<td><strong>Drill Depreciation</strong></td>
</tr>
<tr>
<td>1. 32,000</td>
<td>10,312</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td><strong>Drill Interest</strong></td>
</tr>
<tr>
<td></td>
<td>4,347</td>
</tr>
<tr>
<td><strong>Cash flow</strong></td>
<td><strong>Drill Taxes, Ins, Taxes</strong></td>
</tr>
<tr>
<td>32,000</td>
<td>3,300</td>
</tr>
<tr>
<td><strong>Total added returns</strong></td>
<td><strong>Total added costs</strong></td>
</tr>
<tr>
<td>$32,000</td>
<td>$32,000</td>
</tr>
<tr>
<td>Reduced costs</td>
<td>Reduced returns</td>
</tr>
<tr>
<td><strong>Custom Hire Fee</strong></td>
<td><strong>Interest Foregone</strong></td>
</tr>
<tr>
<td>1. 8,000</td>
<td>3,575</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td><strong>Tractor Repairs</strong></td>
</tr>
<tr>
<td></td>
<td>1,300</td>
</tr>
<tr>
<td><strong>Cash flow</strong></td>
<td><strong>Total added costs</strong></td>
</tr>
<tr>
<td>8,000</td>
<td>$29,859</td>
</tr>
<tr>
<td><strong>Total reduced costs</strong></td>
<td><strong>Total reduced returns</strong></td>
</tr>
<tr>
<td>$8,000</td>
<td>$3,575</td>
</tr>
<tr>
<td><strong>Total positive effects</strong></td>
<td><strong>Total negative effects</strong></td>
</tr>
<tr>
<td>$40,000</td>
<td>$33,434</td>
</tr>
</tbody>
</table>

Financial analysis

1. Change in annual profit: **$40,000** total positive effect (profit column) – **$33,434** total negative effect (profit column) = **$6,566**

2. Average annual rate of return on investment: **$6,566** annual profit (loss), line 1, + **$7,922** interest (profit column) + **$110,000** investment × 100 = 13.2%

3. After-tax cash available for annual retirement of principal: **$40,000** total positive effect (cash flow column) – **$25,731** total negative effect (cash flow column) – ($6,566) change in profit × .15 marginal tax rate) = **$13,284**

4. Years to recover debt: **$82,500** loan + **$13,284** line 3 = 6.2

Fig. 1—Partial Budget for Purchase of No-Till Drill.
right-hand sides. The profit column contains entries affecting the annual profitability of the investment. Only cash costs (except initial investment) and returns are entered in the cash flow column. The analysis in the cash flow column identifies the effect of the investment on the farm's annual cash flow and ability to service added debt.

At this point, it might be useful to discuss the entries in the partial budget. Changes that increase profit and cash flow may also be improved through reduced costs. The purchase of the drill will eliminate the need to hire custom services, an annual savings of $8,000 (= $32 per acre \times 250\text{ acres})

Since the added custom fees from seeding other farmers' ground and reduced custom costs on the farmer's own farm are both cash items, entries are made in both profit and cash flow columns. Thus, the total positive impact on profit and cash flow is $32,000 (added returns) + $8,000 (reduced costs) = $40,000 per year.

On the negative effect side of the budget, there are several entries under the added cost category. The first item is depreciation on the drill. Since the drill is to be used for 8 years, it is not proper to allocate its entire cost to a single year. Depreciation is a way of allocating the cost over the drill's productive life. Also, the farmer expects to be able to sell or trade the drill at the end of 8 years for $27,500. Thus, the $27,500 salvage value should be subtracted from the $110,000 cost and the difference divided by 8 years to get an annual depreciation expense of $10,312. While the calculation of depreciation in this manner is acceptable for an economic analysis, it does not necessarily correspond to the annual depreciation that may be claimed as an income tax deduction. Even though depreciation is a valid business expense and, therefore affects profitability, it is not a cash expense. Thus, depreciation is not entered in the cash flow column.

Interest on the drill loan is an outlay that affects both profit and cash flow. The average annual cost of $4,347 appearing in the profit column is computed by dividing the total interest paid on the 5-year loan by 8 years. Since the profit analysis is based on the average annual effect during the 8-year ownership period, it is necessary to spread the interest cost over 8 years. In contrast, the cash flow analysis is based...
on average annual performance during the 5-year loan period. The analysis focuses on this time period since cash flow effects will be most critical while the loan is being paid back. Thus, total interest on the drill is divided by 5 years instead of 8, resulting in an annual interest cost of $6,956, which is entered in the cash flow column.

The cost for property tax (if applicable), property insurance, and housing on the drill may be calculated as a percent of the average drill investment. Since the drill will have a value of $110,000 when it is new and $27,500 when it is traded or sold, its average value is an average of those two figures, ($110,000 + $27,500).

It is assumed that equipment formerly stored in the machine shed will be moved outside to make room for the more expensive drill. Thus, even though no added housing was constructed, a housing cost should be allocated to the drill. Also, a repair cost is estimated for the drill.

If the farmer buys the drill, added operating costs will be incurred on the tractor used to pull the drill. These costs include fuel, oil, repairs, labor, and supervisory/management efforts devoted to overseeing the drill enterprise. If the labor and management is hired or the farmer is fully employed, costs for these resources should be included in both the profit and cash flow analysis. If the farmer provides these services and is underemployed, no cost should be included in the analysis (profit and cash flow). The example assumes the farmer is fully employed and will be operating and managing the drill enterprise and will, therefore, have less time to devote to alternative activities valued at $8.00 per hour.

2 Assistance in estimating machinery costs is generally available from publications and computer programs published by Cooperative Extension at your state's land-grant university. For example, see the first reference listed at the end of this publication.

Why are depreciation, interest, property tax, insurance, and housing costs for the tractor not included? Recall that the farmer already owns this power unit. This means these expenses will be paid whether the farmer buys the drill or not. Since they do not change as a result of buying the drill, they are irrelevant and omitted from consideration. It might be correctly argued that added tractor use could shorten its useful life and thereby increase annual depreciation. An alternative approach, adopted for this analysis, is to increase repair costs enough to prevent shortening the tractor's useful life.

The final entry under reduced returns recognizes that if the drill was not purchased, the farmer would not have to spend the $27,500 down payment. He would have these funds available for another use where $3,575 ($27,500 x .13) could be earned. If the drill investment is to be financially attractive, it must generate enough income to cover the returns foregone from that alternative.
The three questions raised earlier can now be answered with the partial budget analysis.

Is the Drill Investment Profitable?

As noted in the financial analysis section appearing at the bottom of the partial budget, an annual before-tax profit of $6,566 is projected (line 1). That figure is obtained by subtracting the $33,434 total negative effects from the $40,000 total positive effects (profit columns). The $6,566 profit should be interpreted as the average annual compensation the farmer can expect to receive for the risk associated with making the drill investment. This profit is in addition to the compensation he will receive on other owned resources ($1,500 for labor and management, and $3,575 return on down payment) devoted to the drill enterprise.

Another way of expressing profitability is the average annual rate of return on the investment (line 2). This is computed by dividing the return to capital by the total investment. The return to capital is profit, as defined on line 1, plus interest on debt and equity capital. Interest costs are added to profit because in computing a return to capital a cost should be assigned to all resources except capital. Since profit is net of an interest cost, these costs are excluded by adding them to the profit. In the example, returns to capital are $6,566 profit + $7,922 interest (= $4,347 interest on debt + $3,575 interest on equity) = $14,488. Division of $14,488 returns to capital by the $110,000 capital investment yields a 13.2% average annual before-tax rate of return. Since the drill investment is projected to earn a $6,566 profit and has a rate of return (13.2%) that exceeds the cost of the money used to finance the investment (13%), purchasing the drill is profitable. However, the farmer’s decision will depend on whether the profit is sufficient to compensate for the added risk(s) and cash flow performance.

Can the Drill Loan Be Paid Back?

This question can be answered by examining the cash flow position of the investment. As indicated by the cash flow columns, annual cash inflows (positive effects) amount to $40,000 and annual cash outflows (negative effects) are $25,731. The subtraction of outflows from inflows gives a net cash inflow of $14,269. That amount is available to pay income taxes and to retire principal on the drill.

1When the proposed adjustment does not include a capital outlay, line 2 of the financial analysis may be omitted.
loan. Income taxes are estimated to be $985, a figure estimated by multiplying the marginal tax rate (15%) times the $6,566 profit. Thus, as noted on line 3, $13,284 ($14,269 - $985) is available for annual retirement of principal.

Since $13,284 is available annually for principal retirement and the drill loan is $82,500, it will take about 6.2 years ($82,500 ÷ $13,284) to pay off the loan (line 4, financial analysis). This means that if the drill loan has a 5-year repayment period, the drill will not generate cash fast enough to meet debt payments as they come due. Funds will have to be diverted from other areas of the business to service the drill debt. While this may not pose a problem for the farmer with a strong cash flow, it does result in a deterioration of the business’s cash flow position. Restructuring the loan so that it carries a 6- or 7-year repayment period would be preferable from a cash-flow standpoint, but it would have the disadvantage of increased interest costs. If the farmer wants to buy the drill because of acceptable profitability and has a precarious whole-farm cash flow, he would be well advised to negotiate with the lender for a 6- or 7-year loan.

What About the Risk?

Due to the narrowness of the profit margin and the weak cash flow, the risks associated with the drill investment are considerable. The risks are even more evident when it is realized that the outcome is highly sensitive to the assumptions used for such key factors as custom-hire acreage and fees—both of which are hard to accurately predict.

One way of getting a better feel for the risk is to change some of the assumptions and see how profitability and cash flow are affected. Analyses could be completed for the most likely, optimistic, and pessimistic situations. The use of a computer makes this kind of a risk analysis much easier. Another approach for handling risk is to do a break-even analysis on the more important, yet uncertain assumptions. In a break-even analysis, the value is computed for the uncertain variable that makes the investment a break-even proposition. It is then necessary to determine only whether the value of the uncertain variable is likely to be greater or less than the break-even value. Making that judgment introduces less risk into the decision than assuming a single value for the variable.

Two highly uncertain, yet important, factors in the drill investment analysis are the custom-hire fee and the acreage of custom work done off the farm. To find the break-even custom rate, an equation that sets the total positive effects (left-hand side of partial budget) equal to the total negative effects

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4 Line 4 may be omitted when no additional debt is associated with the proposed adjustment.
(right-hand side of the partial budget) should be specified. Assuming the farmer receives the same custom rate when he works for someone else as he would pay to have the work done on his own farm, the break-even custom rate can be computed in the following manner:

\[
\begin{align*}
\text{Total positive effects} & = \text{Total negative effects} \\
1,250 \text{ acres} \times \text{custom fee} & = $33,434 \\
\text{Break-even custom fee} & = $33,434 \div 1,250 \\
\text{Break-even custom fee} & = $26.75
\end{align*}
\]

Thus, a custom fee of $26.75 results in a break-even investment. Accordingly, the farmer knows that the custom fee must average more than $26.75 per acre over the next 8 years, if the investment is to be profitable.

Assuming a custom fee of $32, the break-even custom acreage (CA) can be calculated as follows:

\[
\begin{align*}
\text{Positive effects} & \quad \text{Negative effects} \\
$8,000 \text{ reduced custom costs} + ($32 \text{ custom fee} \times \text{custom acreage}) & = \$21,534 \text{ fixed costs}^5 + ($9.52 \text{ variable costs per acre}^6 \times 250 \text{ acres owned ground}) + ($9.52 \text{ variable costs per acre} \times \text{custom acreage}) \\
$8,000 + $32 \text{ CA} & = \$21,534 + $2,380 + $9.52 \text{ CA} \\
$32 \text{ CA} - $9.52 \text{ CA} & = \$21,534 + $2,380 - $8,000 \\
$22.48 \text{ CA} & = \$15,914 \\
\text{CA} & = \$15,914 + $22.48 \\
\text{CA} & = 708
\end{align*}
\]

Thus, providing the custom rate is $32 per acre and all the other assumptions hold true, the farmer will break even on the investment if he finds 708 acres of custom work annually. If more custom work is found, the investment is profitable. Less acreage, of course, makes the investment an unprofitable one.

Having used a partial budget to test the profitability, cash flow, and riskiness of the proposed investment, the farmer is now in a good position to make an informed decision.

\footnote{Fixed costs include depreciation, interest on loan, property taxes, insurance, housing, and interest foregone on down payment.}

\footnote{Variable cost per acre ($9.52) is the sum of fuel, oil, repairs, and operator time ($= \$11,900) divided by 1,250 acres.}
Summary

The partial budget is a tool that can be conveniently used to analyze the financial effect of a proposed farm business adjustment. Several points inherent with the use of a partial budget should be noted:

- Costs and returns not affected by the choice of alternatives are not included in the analysis.
- The accuracy of a partial budget analysis is no better than the information used in the analysis.
- A single partial budget compares only two alternatives. While that comparison will show which of the two alternatives is more profitable, it does not indicate the most profitable use of resources.
- In the format used in this publication, partial budgeting does not account for the time value of money. More specifically, it does not recognize that postponed expenditures are less costly than immediate outlays or that immediate receipts are more valuable than postponed receipts.

References


Partial budget for ______________________________

<table>
<thead>
<tr>
<th>Positive effects ($ per year)</th>
<th>Negative effects ($ per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added returns</td>
<td>Profit</td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>Total added returns</td>
<td>$</td>
</tr>
</tbody>
</table>

Reduced costs

| 1. | | | 6. | | |
| 2. | | | Reduced returns |
| 3. | | | 1. | | |
| 4. | | | 2. | | |
| Total reduced costs | $ | $ | 3. | | |
| Total positive effects | $ | $ | Total negative effects | $ | $ |

Financial analysis

1. Change in annual profit: $ total positive effect (profit column) – $ total negative effect (profit column) = $ $

2. Average annual rate of return on investment: $ annual profit (loss), line 1, + $ interest (profit column) + $ investment × 100 = %

3. After-tax cash available for annual retirement of principal: $ total positive effect (cash flow column) – $ total negative effect (cash flow column) – ($ change in profit × marginal tax rate) = $ $

4. Years to recover debt: $ loan ÷ $ line 3 = _____
