

ECONOMIC ANALYSIS OF FARM CHANGE USING THE PARTIAL BUDGET

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Abstract

Many changes proposed by a manager on a farm affect only part of the business. Using the partial budget only those costs and incomes that change with a proposed business adjustment need to be considered. Partial budget can be used to analyze many practical farm management problems, such as substituting crop and livestock enterprises, changing input levels or types of inputs, changing the size of enterprises in the business and buying new or used machinery, equipment, buildings and facilities.

Keywords: partial budget, farm change, economic analysis

Resumo

Muitas das modificações propostas por um administrador em uma empresa rural afetam somente parte das atividades desenvolvidas. Usando-se o método do orçamento parcial somente os custos e benefícios que se alteram em função das modificações propostas precisam ser consideradas. O orçamento parcial pode ser usado para analisar diversos problemas práticos de administração rural, tais como substituição de culturas e criações, alteração dos tipos e níveis de emprego de insumos, ampliação ou redução de atividades dentro da empresa rural e aquisição de máquinas e implementos, construções rurais e outras facilidades novas ou usadas.

Palavras-chave: orçamento parcial, alteração de atividade agropecuária, análise econômica

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Introduction

Many changes proposed by a manager on a farm affect only part of the business. Therefore, a complete farm budget is not needed to determine the profitability of these specific changes in the operation of the farm. The farmer analyzes only those costs and incomes that change with a proposed business adjustment. He can accomplish this in an organized fashion by using the partial budget, which means that only the relevant costs and incomes are included in the analysis. He can use the partial budget to analyze many practical farm management problems, such as substituting crop and livestock enterprises, changing input levels or types of inputs, changing the size of enterprises in the business and buying new or used machinery, equipment, buildings and facilities.

This paper discusses the partial budget as a tool to determine the profitability of proposed changes in the operation of a farm business.

What is Partial Budget and of which components does it consist?

The partial budget (PB) analysis is best adapted to small changes that we consider in the business. If we analyze two alternatives, the analysis does not determine that these two are the most desirable enterprises for the farm. The budget only indicates that the change will increase, decrease or not change on net income. We then separate the positive and negative effects and list them in different sections of the PB (Lessley, et al., 1991).

The PB measures the positive and negative effects of a change in the business. The left side of PB shows the positive effects on net income including additional income and reduced costs. To counterbalance this positive effect, the right side includes reduced income and additional costs or the negative effects of the proposed change.

The PB has four categorical parts: additional income, reduced costs, reduced income and additional costs (Lessley, et al., 1991).

Reduced costs

If soybeans replace maize in the proposal, the expenses associated with not planting maize are reduced costs (Devillet, et al., 1981). Reduced costs are either variable or fixed. If we no longer use or if we use less of a variable input like fertilizer, we reduce fertilizer costs. We may be able to reduce the appropriate fixed costs of depreciation, interest on average value, some repairs, taxes and insurance, if there is a reduction or elimination of investments in land, buildings, equipment, machinery, fences or breeding animals. In some cases, we cannot reduce costs for buildings, fences and other fixed items, since the business will be stuck with them. This can also be true of labor when the change requires less labor, but the supply is fixed with operator and full-time salaried help.

If labor time is reduced and there is a productive use for this labor, we would record the labor value as an additional income.

Total additional income and reduced costs have the same positive effect on net income.

Reduced income

A proposed change in the farm operation may reduce our farm income because of changes in production practices – enterprises being eliminated, reduced in size or output. For example, if we decide to reduce or eliminate maize and increase the cultivated area of soybeans, we would record the reduced income from maize in this section of the PB.

Additional costs

This portion of our PB includes any new costs associated with a proposed change. These costs can be fixed or variable. If we add a new crop or livestock enterprise to our business, calculate and include under additional costs variable cost items, such as seed, fertilizer, lime, fuel and oil, rent, hired labor, feed, veterinary services and medicine. We may also need additional investments for land, machinery, equipment, buildings, fences or breeding animals. Annual fixed costs, such as depreciation, interest on average value, some repairs, taxes and insurance, fall into this category. If an asset has a useful life of more than 1 year, prorate this investment over its useful life. If we can make a change without additional investments of more labor, do not enter these as additional cost.

Total reduced income and total additional costs have the same negative effect on net income.

Net income

Calculate the effect of the proposed change on net income by comparing the sum of additional income and reduced costs with the sum of reduced income and additional costs. If the additional income and reduced costs are greater than the reduced income and reduced costs we will have an increase in net income. While the increase in net income is positive, we should also compare the size of the net income increase with additional labor, investment and risk associated with the proposed change.

How could the Partial Budget be Used?

This section discusses two sample problems that could be solved using the PB.

Substituting One Enterprise for Another

Assume that we have been planning our cropping program for next year and that we can grow maize or soybeans with existing equipment on the farm. After checking all available price information, we predict that soybean prices will be more favorable than maize prices for the coming year. Consequently, we want to consider reducing maize cultivated area by 10 hectares and planting this land in soybeans. We will need to analyze maize and soybean costs, yields, prices, labor requirements and the like. For example, we project maize yield to be 80 sacks² per hectare, harvest price to be RS11 per sack, and cash costs for seed, fertilizer, lime, herbicide, fuel and oil to be RS770 per hectare. Maize labor requirements are 20 hours per hectare and must be hired at RS2 per hour. For soybeans, our estimates include a yield of 40 sacks per hectare at an estimated price of RS16 per sack with cash costs for seed, fertilizer, lime, herbicide, fuel and oil at RS442 per hectare. The labor requirements for soybeans are 15 hours per hectare and must be hired at RS2 per hour.

Now, we are ready to put the above numbers into a PB form for the analysis (table 1). Additional income will be the 40 sacks of soybeans x RS16 per sack x 10 hectares, of RS6,400. Reduced costs will be those associated with decreasing our maize production by 10 hectares, or RS8,100, calculated as follows: [(10 hectares x RS770 per hectare) + (10 hectares x 20 hours of labor x RS2 per hour)]. The additional income and reduced costs represent the positive (left) side of the change and amount to RS14,500.

The negative side of the change will include the reduced income from 10 hectares of maize x 80 sacks per hectare x a price of RS11 per sack, or RS8,800, along with increased cash costs for the soybeans of (10 hectares x RS442 per hectare) + (15 hours of labor x RS2 per hour of labor x 10 hectares), or RS4,720. The negative aspects add up to RS13,520 for the change. When we subtract the negative side from the positive side in the PB, there is an increase in net income of RS980 to the operation. In short, the net gain of growing 10 additional hectares of soybeans and fewer hectares of maize is RS98 per hectare (RS980 / 10 hectares). With this substantial increase in income, we should make the change as long as risk and other non-monetary factors are negligible.

² A bag weighing 60 kg.

What happens if our estimates on yields and prices are off? By dividing the difference of RS98 per hectare by the soybean price of RS16 per sack ($RS98 / RS16 = 6.125$ sacks), we see a decrease of only 6.125 sacks per hectare in soybean yield, which would cause us to be indifferent to making the change in the operation. Similarly, by dividing the RS98 by 40 sacks of soybeans per hectare ($RS98 / 40 = RS2.45$), we see a decrease in the price of soybeans of only RS2.45 per sack (from RS16.00 to RS13.55 per sack), which would cause us to reconsider our decision to change the crop enterprise. We can do the same analysis for maize. The point is, we calculated an increase in net income but after further analysis, we see that small changes in yield or price would lead us to continue producing maize.

Table 1: Partial Budget for a farm business to analyze maize and soybean production

Proposed change: Should we replace 10 hectares of maize with 10 hectares of soybeans?			
Positive effects		Negative effects	
	Value		Value
Additional income:		Reduced income:	
10 hectares of soybeans x 40 sacks/hectare x RS16/sack	RS6,400	10 hectares of maize x 80 sacks/hectare x RS11/sack	RS8,800
Total additional income	RS6,400	Total reduced income	RS8,800
Reduced costs:		Additional costs:	
10 hectares of maize x RS770 cost/hectare	RS7,700	10 hectares of soybeans x RS442 cost/hectare	RS4,420
10 hectares of maize x 20 hours/hectare x RS2/hour	RS400	10 hectares of soybeans x 15 hours/hectare x RS2/hour	RS300
Total reduced costs	RS8,100	Total additional costs	4,720
Total additional income and reduced costs (TAIRC)	RS14,500	Total reduced income and additional costs (TRIAC)	13,520
Change in net income: (TAIRC - TRIAC)			
		+ RS980	

Source: Own calculation based on (Daniel, [n.a.]) and (Audsley, 1989).

If the above proposal should require additional piece of equipment, we would include the annual fixed costs as additional costs. For example, if the change is made, an additional investment would have to be made in equipment and would amount to RS5,000. Since the equipment would have a useful life of more than 1 year, the RS5,000 initial cost must be prorated over the useful life of the equipment to determine the amount charged each year. According to Lessley and Holik the DIRT1-5³ procedure can be used to prorate the cost of investment over its useful life and for calculating the other costs of ownership (Lessley and Holik, 1987):

³ Depreciation, interest on average value, repairs, taxes and insurance.

Depreciation:	(Original cost – salvage value) / useful life
Interest on average value:	Average value x interest rate [average value is (original cost + salvage value) / 2]
Repairs:	Buildings: Replacement cost x 1 to 2 percent; Machinery: Cost x 3 to 5 percent (only fixed cost portion should be included here.)
Taxes:	Buildings: Assessed value x tax rate; Equipment and livestock: Not taxed in Brazil
Insurance:	Buildings: Replacement cost or present value x 1 percent; Equipment: Average value x 1 percent

The annual fixed cost for the R\$5,000 investment is calculated as follows:

Depreciation:	$(R\$5,000 - R\$1,000) / 8 \text{ years} = R\500
Interest on average value:	$\left(\frac{R\$5,000 + R\$1,000}{2} \right) \times 0.12 = R\360
Repairs:	$R\$5,000 \times 0.03 = R\150
Taxes:	Personal property not taxed in Brazil = R\$0
Insurance:	$R\$3,000 \times 0.01 = R\30
Total annual cost	R\$1,040

The R\$1,040 would be included in additional costs and would turn the net difference from R\$980 down to negative value of – R\$60. This negative net income change tells us to look more closely at yields, prices and costs before we make a decision to replace 10 hectares of maize with 10 hectares of soybeans.

If the change will enable us to sell a piece of equipment not needed in the change, the above process would be reversed. That is, we would recover some capital from the sale (less any taxes paid), which we could invest in some other activity for an annual return (investment x interest rate) that we would list as an additional income. Also, we would no longer incur depreciation, fixed repairs, taxes and insurance on the sold item. We would list these as reduced costs.

Custom Hiring or Owning a Combine

Based on the model of Audsley (Audsley, 1989), we use an example of a middle large farm of the Central Region of the Brazilian State Rio Grande do Sul (Wander, in press). On this farm we grow 50 hectares of maize that we have custom harvested for R\$165 per hectare (R\$55 per hour x 3 hours per hectare). We want to know if it would be more economical to buy a combine and harvest the maize on our own. We shop around and find a used combine we can buy for R\$50,000. The dealer states that it will harvest 0.33 hectares per hour and that the combine consumes 15 liters of fuel per hour. The price of fuel is R\$0.63 per liter. We know that oil and lubricant expenses run about 15 percent of fuel costs, and the going rate for skilled operator labor is R\$2.50 per hour.

With the above information, we calculate fixed and variable costs for the combine and compare them with the custom cost of harvesting maize. Additional costs will be the DIRTI-5 for the combine, plus variable costs for fuel, oil and lubricants, repairs and hired

labor. Using the DIRTI-5 method, enter the fixed costs plus variable costs in the PB under additional costs (table 2).

There is no reduced income from the proposed change. Consequently, we put none under this section in the PB.

We decide that owning a combine would allow for a more timely and efficient harvest, and estimate that this would result in harvesting 5 more sacks of maize per hectare when compared with custom harvesting. We value the maize at R\$11 per sack. Therefore, we list R\$4,400 as additional income in the PB (80 hectares x 5 sacks per hectare x R\$11 per sack).

Reduced costs will include the custom change expense that we no longer need by owning the combine. The amount listed is R\$13,200 (R\$165 per hectare x 80 hectares).

Table 2: Partial Budget for a farm business to analyze a machinery problem

Proposed change: Should we purchase a combine and harvest the maize on our own or continue to have our maize harvested on a custom basis for R165 per hectare?			
Positive effects	Value	Negative effects	Value
Additional income:		Reduced income:	
80 hectares x 5 sacks/hectare x R\$11/sack	R\$4,400	None	-
Total additional income	R\$4,400	Total reduced income	-
Reduced costs:		Additional costs:	
80 hectares x R\$165/hectare custom charge	R\$13,200	Fixed costs:	
		Depreciation	R\$4,500
		Interest on average investment	R\$3,300
		Fixed repairs (1 percent of cost)	R\$500
		Taxes	-
		Insurance	R\$275
		Variable costs:	
		Fuel	R\$2,268
		Oil & lubricants (15 percent of fuel)	R\$340.2
		Variable repairs (2 percent of cost)	R\$1,000
		Labor	R\$600
Total reduced costs	R\$13,200	Total additional costs	R\$12,783.20
Total additional income and reduced costs (TAIRC)	R\$17,600	Total reduced income and additional costs (TRIAC)	R\$12,783.20
Change in net income: (TAIRC – TRIAC)			R\$4,816.80

Source: Own calculation based on (Daniel, [n.a.]) and (Audsley, 1989).

The positive side of the change (additional income of R\$4,400 plus reduced costs of R\$13,200) amounts to R\$17,600. The negative side of the change (additional costs of R\$12,783.20 plus reduced income of R\$0) amounts to R\$12,783.20. When the positive aspects (R\$17,600) are compared with the negative aspects (R\$12,783.20), we find that there is a positive difference of R\$4,816.80. In terms of the net income increase, we should purchase the combine. However, is this increase large enough to cover the

investment risk? Also, RS4,400 was included as an additional income from increased maize harvested as a result of a timely and more efficient harvest. If we have not been doing the harvest, can this increase be expected? If not, the value should be left out. But even in such a case, we would have an increase in net income of RS416.80 (RS13,200 – RS12,783.20). Therefore, we should purchase the combine and harvest our maize on our own. Of course, if we have less than 80 hectares of maize, often found in the Central Region, we should recalculate our PB.

Conclusions

The PB is a useful tool for analyzing many farm management problems. It is also a powerful tool for analyzing practical problems that face farmers and extension workers on a day-to-day basis.

However, the results obtained are only applicable for one specific situation i.e. it has to be reviewed when applying it to other farms and market situations.

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