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# Stochastic Partial Budgeting: A New Look at an Old Tool

Sunil P. Dhoubhadel

*University of Nebraska-Lincoln*, [Sdhoubhadel2@unl.edu](mailto:Sdhoubhadel2@unl.edu)

Matthew Stockton

[mstockton2@unl.edu](mailto:mstockton2@unl.edu)

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# CORNHUSKER ECONOMICS

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Institute of Agriculture & Natural Resources  
Department of Agricultural Economics  
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## Stochastic Partial Budgeting: A New Look at an Old Tool

Market Report	Yr Ago	4 Wks Ago	4/23/10
<b><u>Livestock and Products,</u></b>			
<b><u>Weekly Average</u></b>			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight. . . . .	\$89.45	\$94.00	\$100.39
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb. . . . .	116.51	129.10	130.35
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb. . . . .	99.48	108.43	116.10
Choice Boxed Beef, 600-750 lb. Carcass. . . . .	152.83	161.73	167.81
Western Corn Belt Base Hog Price Carcass, Negotiated. . . . .	60.63	65.95	80.32
Feeder Pigs, National Direct 50 lbs, FOB. . . . .	66.95	*	*
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean. . . . .	59.51	72.39	88.51
Slaughter Lambs, Ch. & Pr., Heavy, Woolled, South Dakota, Direct. . . . .	93.50	*	*
National Carcass Lamb Cutout, FOB. . . . .	248.09	273.75	292.34
<b><u>Crops,</u></b>			
<b><u>Daily Spot Prices</u></b>			
Wheat, No. 1, H.W. Imperial, bu. . . . .	4.89	3.60	3.93
Corn, No. 2, Yellow Omaha, bu. . . . .	3.66	3.45	3.44
Soybeans, No. 1, Yellow Omaha, bu. . . . .	9.86	9.34	9.94
Grain Sorghum, No. 2, Yellow Dorchester, cwt. . . . .	5.43	5.46	5.41
Oats, No. 2, Heavy Minneapolis, MN, bu. . . . .	2.01	2.12	2.05
<b><u>Feed</u></b>			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton. . . . .	190.00	135.00	135.00
Alfalfa, Large Rounds, Good Platte Valley, ton. . . . .	77.50	87.50	92.50
Grass Hay, Large Rounds, Premium Nebraska, ton. . . . .	85.00	*	*
Dried Distillers Grains, 10% Moisture, Nebraska Average. . . . .	132.00	100.00	101.00
Wet Distillers Grains, 65-70% Moisture, Nebraska Average. . . . .	48.50	31.00	34.50
<b>*No Market</b>			

Farm business managers are constantly making adjustments in their businesses for smoother operations and profitability. Many times, these choices involve actions to enhance the financial return of the farm business; while other times these decisions are made out of necessity to minimize the effects of unfavorable conditions or events such as drought or changes in the market conditions. Some of these decisions are relatively simple, requiring making choices among alternatives within an enterprise; while others are complex involving a total overhaul of the business and its enterprises. Alternative choices within an individual enterprise can have a differential impact on farm profitability. Therefore, making the best decision may make the difference between profit or loss for that enterprise. Partial budgeting is very useful in making such changes within an enterprise of a farm.

Partial budgeting is a financial tool used to assess the costs and benefits associated with a specific change in an individual enterprise within the business operation. This tool specifically focuses on the implications of the intended change in a business operation by comparing the benefits and costs resulting from implementing the alternative, with respect to the current practice. For example, a farm operation could use the partial budgeting technique to decide between using a new improved variety of seeds, or to continue using the current variety of seed. This may not be as trivial a matter as it would first seem, since seed technology might mean a change in cultural practices which could include differences in machinery, labor and capital requirements. Another example could be a change in harvesting regime, to either continue using a custom harvest service or to invest in a combine harvester. A livestock operation example could be whether to buy heifers for replacement or to raise them; or the decision to buy hay or rent a pasture. The list of choices producers may make within an enterprise is infinite. However, the key in making the best choice is to use a tool that will help you



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identify and quantify the costs and benefits of the choice, and make a comparison. Partial budgeting is such a tool, and while not new, can be a powerful tool in making those best choices.

### Steps Involved in Partial Budgeting

- **Identifying the proposed change/s:**  
Before starting partial budgeting, farm managers need to be clear in their minds about why they are considering making a change, and to recognize the possible alternatives to the current practice that might help them meet their desired outcome. Since partial budgeting requires some effort, it is wise to choose among the best alternatives based on your initial assessment.
- **Listing the key information necessary for analysis:**  
This step is crucial and involves carefully gathering information pertinent to the costs and benefits associated with the proposed alternative(s). This process includes listing information about anything that would be different among the choices, things such as costs, interest, yields, time, revenue, etc.
- **Identifying the positive and negative effects:**  
The proposed change will result in changes, where some are hopefully positive effects, while others will most likely be negative. The main objective of partial budgeting is to weigh the positive effects of the proposed change against the negative effects of the proposed change, all relative to the current method of operation.

Positive effects of the proposed change may result because of the elimination or reduction in cost of ceasing current activities, and/or the generation of additional revenues by adoption of the new activities. The negative effects of such a change could be generated by an increase in the cost by implementing the new activity, and/or a reduction in the revenue from ceasing the current activity. For example, in the case of a livestock enterprise where buying replacement heifers is compared to raising replacement heifers from the ranch, the positive effect could be the reduction in the cost of feeding heifers limited range resources. Other cost savings may include labor, building, equipment and management costs. The negative effects of this proposed change could be the cost of buying cows, the inclusion of inferior genetics which results in reduced returns from the calves, or any other added cost or loss in revenue that can be attributed to buying verses raising cow replacements.

### Estimating the Net Effect:

Once the positive and negative effects are identified and quantified, their difference will determine the outcome. If the proposed change has a positive net effect,

the change would be considered superior to the current method and would be considered for adoption. If the proposed change has a negative net effect, the change would be considered inferior to the current method and would not be considered for adoption. In the final analysis, it is the difference between the positive and negative effects that determine how the proposed alternative(s) compares with the current method of production. It is important to note that a partial budget decision is no better than the information that goes into it. The old adage “garbage in - garbage out” is very relevant.

The table below presents a simple format of partial budgeting.

Positive Effects	Negative Effects
1. Reduced Costs \$ _____	1. Additional Costs \$ _____
2. Additional Returns \$ _____	2. Reduced Returns \$ _____
Total Positive Effects \$ _____	Total Negative Effects \$ _____
<b>Net Effects \$ _____</b>	

### Making Partial Budgeting Stochastic

The term stochastic comes from probability theory. A stochastic process can also be referred to as a random process, for instance the roll of a dice. The application of this approach provides the ability to capture the possibility of many outcomes. These many outcomes are modeled based on some assumed statistical properties. The implication is that even if the initial condition, or starting point is known, there are many possible outcomes, with some paths more likely than others. This process results in a probability distribution of possible outcomes rather than a single result.

This concept can be directly applied to the partial budgeting process in the form of production, price, cost and any other information that may have uncertainty in the realization of a particular outcome. When we provide a single point value for any input value in a partial budget, the analysis is deterministic and will suffer in accuracy due to variation in values. Stochastic analysis addresses this problem. In stochastic partial budgeting, instead of specifying a single point for a specific value, such as price or cost, the analyst (based on experience) specifies a range of values that lie between the highest and the lowest possible values. The range of values is then used to create a probability density function. This is used in combination with other variables and their probability density functions to determine the range and probabilities of the final outcomes. These resultant outcomes with their associated probabilities are then graphed by their occurrence from randomly drawn values. This graph is known in statistics as a Cumulative Distribution Function (CDF), but is simply a mapping of the possible outcomes. This picture, or graph of the possible outcomes, is quite useful in determining not

only the average or expected outcome of a particular proposed change in operations, but also provides a range and a probability measure of any chosen outcome. By being able to attach a probability to a specific outcome value, the breadth of the forecast becomes more relevant and includes a measure of risk.

The Microsoft Excel Workbook located at [www.agmanagerstools.com](http://www.agmanagerstools.com) known as “A Stochastic Partial Budgeting for Beef Cow Replacements” provides an example of stochastic partial budgeting for making the decision to either buy replacement heifers or to raise them. Similar to the usual partial budgeting process, we list the positive and negative effects of buying replacement heifers instead of raising them. However, in the case of stochastic partial budgeting, when a dollar value is specified such as in the case of a cost or benefit, it is specified as a range rather than as a single measure. This range goes from the highest to the lowest outcome that is believed to be possible (see the “Example” tab/worksheet in the Excel Workbook). Entering information in this way naturally leads to the estimation of the probability distribution of net benefits, CDF, which is shown in Figure 1 and located on the “Example Graph” worksheet or tab of the Excel Workbook. The CDF has probabilities on the vertical or “y” axis and associated outcomes, and net benefits on the horizontal or “x” axis. In this figure, the black colored CDF indicates that there is a 100 percent probability of negative net effects when buying replacement heifers instead of raising them. The terminal top end of the CDF line indicates that there is 100 percent probability of incurring loss of \$75 or more when buying replacement heifers versus raising them. Similarly, the blue colored CDF line, which represents a 30 percent increase in the cost of feed, intersects the y-axis at approximately the 85 percent level, indicating that the chance of negative net effects occur 85 percent of the time, with the remaining net effects being neutral or positive occurring 15 percent of the time. This result indicates that buying replacement heifers versus raising them provides more benefits, at best, only 15 percent of the time. The comparison of these two

CDFs shows how sensitive to change the partial budget is and the importance of having valid information to use in those budgets.

The example provided in the Excel Workbook is hypothetical. It may or may not reflect actual conditions. In order to create your own partial budget, go to the workbook worksheet tab titled ‘Data Input,’ enable the macros of the worksheet, enter data in the green colored background data entry fields and activate the simulation by clicking on the “Run Simulation” button located at the bottom of the data entry fields on that worksheet. This will trigger the simulation process which will appear as a blinking screen. Once the blinking has stopped, the final output of the simulation process will be accessible as a CDF graph on the “Output Graph” worksheet tab.

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Sunil P. Dhoubhadel, (308) 696-6738  
Research Analyst  
West Central Research & Extension Center  
University of Nebraska-Lincoln  
[Sdhoubhadel2@unl.edu](mailto:Sdhoubhadel2@unl.edu)

Matthew C. Stockton, (308) 696-6713  
Assistant Professor and Agricultural Economist  
West Central Research & Extension Center  
University of Nebraska-Lincoln  
[Mstockton2@unl.edu](mailto:Mstockton2@unl.edu)

