

## BIT 4464

### Case #3: Sharing Risk & Reward in the Supply Chain

Tasks 1 & 2 Due: Wednesday, December 9<sup>th</sup> at 11:59 PM

Tasks 3 & 4 Due: Saturday, December 12<sup>th</sup> at 11:59 PM

For this case, you will analyze the impact on the supply chain of sharing risk and rewards through buybacks and revenue sharing. The complete problem description can be found at the end of this assignment. You will analyze different options in Excel and recommend an overall strategy. This assignment has a series of tasks, some of which are completed individually and others as a group. As a result, scores may vary among group members.

#### Important Submission Notes

- You will be submitting **both** an **Excel spreadsheet** and a **written report (in pdf format)** as part of your assignment.
  - Name your files starting with your group number.** For example, Group 2 should upload two files: 2-analysis.xlsx and 2-report.pdf.
  - One member of the group needs to submit **both files** (in the same submission) in order for your peers to be able to perform their reviews. You will need to use the button to *Add Another File* during the submission. You can find details here: <https://community.canvaslms.com/docs/DOC-9539-421241972> *If you need to resubmit a revision, make sure that the most recent submission includes both files.*
- Task 1 (Group Task: 35 points):** Read the problem description at the end of this assignment. Your group will create a spreadsheet to analyze three scenarios.
    - Scenario 1:** The publisher does not share risk and reward, so Barnes & Noble orders independently (only considers what is best for itself).
    - Scenario 2:** The publisher offers Barnes & Noble a buyback (additional funds) for each book that is placed on clearance.
    - Scenario 3:** The publisher offers the books to Barnes & Noble at a wholesale price, but then receives a fraction of Barnes & Noble's revenue.

Specifically, your Excel file should include the following five worksheets (tabs).

- Independent Analysis:** No buybacks or revenue sharing. **You can find the template for this in the Excel file for Topic #17.**

	A	B	C	D	E	F	G	H	I	J	K
1	Example 15-1: Impact of Local Optimization (Retailer does what is in its own best interest, without considering overall supply chain)										
2											
3	<b>Inputs</b>		<b>Independent Retailer</b>				<b>Enter Information in the Yellow Cells</b>				
4	Mean Demand, $\mu$ =						Average demand to the retailer				
5	SD of demand, $\sigma$ =						Standard deviation of the retailer's demand				
6	Cost to Retailer, $c$ =						Unit amount paid by the retailer to the manufacturer				
7	Sale price at Retailer, $p$ =						Price charged by the retailer				
8	Salvage value, $s$ =						Salvage value of retailer				
9	Mfg's Cost, $v$						Cost for manufacturer to produce item				
10											
11	<b>Intermediate Calculations</b>										
12	Cost of Understocking, $C_u$ =										
13	Cost of Overstocking, $C_o$ =										
14	Optimal CSL, $CSL^*$ =										
15	Safety Stock, $SS$ =						Note: $SS$ is rounded to an integer				
16											
17	<b>Outputs</b>										
18	Order size, $O^*$										
19	Expected understock										
20	Expected overstock										
21	Retailer's Expected Profit						= Result of Equation 13.3				
22	Manufacturer's Expected Profit						=(c-v)*(order size, $O^*$ )				
23	Total Supply Chain Expected Profit =										
24											
25											



4. **Buyback Optimization:** Use Solver to find the buyback value that maximizes profit. Hopefully, Sheet 2 gave you some insights into what buyback values work well. Starting from a point that looked good on Sheet 2, run Solver to find the “best” option. (You’ll need to think about what the objective function and constraints should be.)

	A	B	C	D	E	
1	<b>Example 15-2: Impact of Risk Sharing Through Buybacks</b>					
2						
3	Mean Demand, $\mu$ =					
4	SD of demand, $\sigma$ =					
5	Retailer's Cost, $c$ =					
6	Retailer's Sale price, $p$ =					
7	Retailer's Salvage value, $s$ =					
8	Mfg's Cost, $v$ =					
9	Mfg's Buyback Price, $b$ =					
10	Mfg's Salvage Value, $s_m$ =					
11						
12	<b>Intermediate Calculations for Retailer</b>					
13	Cost of Understocking, $C_u$ =					
14	Cost of Overstocking, $C_o$ =					
15	Optimal CSL, $CSL^*$ =					
16	Safety Stock, $SS$ =					
17						
18	<b>Outputs</b>					
19	Order size, $O^*$					
20	Expected understock					
21	Expected overstock					
22	Retailer's Expected Profit					
23	Manufacturer's Expected Profit					
24	Total Supply Chain Expected Profit =					
25						
		Independent Retailer	Buybacks	Revenue Sharing	<b>Buybacks-OPT</b>	Rev Sharing-OPT

5. **Revenue Sharing Optimization:** Use Solver for the revenue sharing policy that maximizes profit. Same idea as Sheet 4.

	A	B	C	D	E	F	G
1	<b>Example 15-3: Impact of Risk Sharing Through Revenue Sharing</b>						
2							
3	Mean demand, $\mu$ =						
4	SD of demand, $\sigma$ =						
5	Whole sale price, $c$ =						
6	Retail price, $p$ =						
7	Production cost, $v$ =						
8	Revenue share fraction, $f$ =						
9	Retailer salvage value, $s_R$ =						
10							
11	<b>Intermediate Calculations for Retailer</b>						
12	Cost of Understocking, $C_u$ =						
13	Cost of Overstocking, $C_o$ =						
14	Optimal CSL, $CSL^*$ =						
15	Safety Stock, $SS$ =						
16							
17	<b>Outputs</b>						
18	Optimal order size, $O^*$ =						
19	Expected understock =						
20	Expected overstock =						
21	Expected sales =						
22	Expected retailer profit =						
23	Expected manufacturer profit =						
24	Expected Supply Chain profit =						
25							
26							
27							
		Independent Retailer	Buybacks	Revenue Sharing	Buybacks-OPT	<b>Rev Sharing-OPT</b>	+

## **IMPORTANT NOTES ON USING SOLVER**

- **Nonlinear optimization is difficult!** You cannot use Simplex LP Solver, so you will either need to select GRG Nonlinear or Evolutionary. Generally, GRG is faster, but sometimes it refuses to move away from the starting solution. If that happens, you might need to try the (slower) Evolutionary Solver.
  - **Where you start the search matters.** Solver might only converge to a local optimum. Use Worksheets 2 & 3 to determine good starting solutions for Worksheets 4 & 5.
  - **Give thought to your objective function and constraints.** Should you maximize profit for the publisher, Barnes & Noble, or the supply chain? Are there any limits you should place on Solver with respect to the performance of the supply chain partners, or should maximizing profit be your only consideration?
  - **Your overall recommendation is not required to come from Solver.** You can consider trade-offs that Solver cannot. If you prefer a different solution, explain why.
- **Task 2 (Group Task: 50 points):** Write a report to Bonsai Books that summarizes your findings and recommendations.
    - You are a consultant to the Bonsai Books, so make sure your report is focused on their needs and your findings.
    - Discuss the options you considered, along with the solutions that were obtained through Solver. Be sure to explain the assumptions you made in your optimization models (what was maximized, what constraints were included, etc.).
    - Use effective tables and graphs to support your recommendation.
    - Limit the body of your report (not including title page or appendices) to 5 pages.
    - You may include additional materials in an appendix not counted in the page limit, *but important summaries should be in the report body (and discussed there too).*
    - Your paper should include a title page with the names of all group members.
  - **Task 3 (Individual Task: 5 points):** Submit a questionnaire on how you and your teammates worked together. Just like you did for previous cases, you will receive an email from the Teammates website. Click on the link and fill out the very brief survey about how well you and your teammates worked. (Students working individually can skip this.)
  - **Task 4 (Individual Task: 10 points):** After the group papers and spreadsheets are turned in, review the submissions (Tasks 1 & 2) submitted by two other groups. As always, Canvas will assign you TWO people for reviews. *If it accidentally assigns you two people in the same group, please let me know right away so that I can correct it.* You will not be entering scores in a rubric. You will write a paragraph to each group in the Comments area. Be sure to mention 3 things: What they did well, what they could improve upon, and your overall impression of their work.

### **Rubric for Case 3: Sharing Risk & Reward**

<b>Criteria</b>	<b>Points</b>
Task 1: Analysis of the Scenarios	35
Task 2: Intro/Conclusion	10
Task 2: Presentation of Results & Recommended Solution	20
Task 2: Overall Quality (grammar, style, professionalism)	20
Task 3: Teammate Evaluations	5
Task 4: Peer Reviews	10

***As before, you can consult Tips on Writing Consulting Reports, which is attached to the Case 3 Assignment on Canvas.***

### Case 3: Problem Description

Bonsai Books is a start-up publishing company that specializes in manga books. Manga is a type of Japanese graphic novel that is popular with teenagers and young adults. Last year, they were excited to reach an agreement with Barnes & Noble to stock their books. However, they were disappointed with the number of books that Barnes & Noble ordered. Barnes & Noble expressed concern that the market for this type of books was volatile, and they were not sure how many books would be sold at full price. While placing books on clearance always leads to the sale of all books, the lower clearance price substantially decreases revenue. As a result, Barnes & Noble ordered conservatively last year, and Bonsai Books would like that to change this season. The management team at Bonsai Books has heard that some supply chains have been successful in increasing order size (and, therefore, the number of products sold) through strategies such as buybacks and revenue sharing, but they are uncertain which approach will be most effective. They have hired your consulting group to help them decide what to do this year.

Bonsai Books sells books to Barnes & Noble at a cost of \$14 each, and its cost of production is \$3 per book. Barnes & Noble prices the book to its customers at \$26. It expects the demand over the next two months to be normally distributed, with a mean of 40,000 and a standard deviation of 10,000. Barnes & Noble places a single order with the publisher for delivery at the beginning of the two-month period. Currently, Barnes & Noble places any unsold books at the end of two months on clearance, at which point the sales price is reduced to \$3. Any books that did not sell at full price always sell at the clearance price. As a base case, Bonsai Books would like you to consider how Barnes & Noble is likely to order for this season if Bonsai continues with its current pricing policy. Since they would like to understand the entire supply chain, they would like you to provide insights on how this ordering policy will impact Barnes & Noble (expected profit, number books placed on clearance, number of missed sales due to low availability, etc.), as well as what profit Bonsai should expect for itself.

Two Bonsai executives (Cecilia and Josie) advocate for a new strategy: sharing risk and reward to increase the Barnes & Noble's order size. However, they disagree about which approach to take. Cecilia advocates using a buyback strategy in which Bonsai Books agrees to refund Barnes & Noble \$ $b$  per book that does not sell during the two-month period. As before, Barnes & Noble will place these books on clearance at a price of \$3 in order to sell any books that remain. Bonsai Books would be sacrificing the additional \$ $b$  in an effort increase the number of books that Barnes & Noble orders. Cecilia is unsure what the value of  $b$  should be, but she is open to any values between \$1 and \$10. She would like to know how different values of  $b$  impact profit and the same performance measures that you evaluated for the base case.

Josie prefers to go with a revenue sharing approach. As before, Barnes & Noble will place these books on clearance at a price of \$3 in order to sell any books that remain. Josie would like to offer the books to Barnes & Nobles at a wholesale price of \$ $c$ , but then ask Barnes & Noble to share a fraction ( $f$ ) of its revenue with Bonsai Books. She is unsure what values  $c$  and  $f$  should take; however, she thinks that  $c$  should probably be between \$1 and \$6, while  $f$  should be somewhere between 0.20 and 0.50. Like Cecilia, she would like to know how the different values of  $c$  and  $f$  would impact profit and the same performance measures that you evaluated for the base case.

Please consider all this information and recommend what you think is best for Bonsai Books. Be sure to advise them of the advantages of your policy, as well as any risks that they might encounter if they implement either buybacks or revenue sharing.