Absorption costing problems

Looking backward, looking forward.

- We are in the final push to the end of the semester now.
- There are just four lectures with content and one in-class review session left.

Looking backward, looking forward.

- We may look back on this semester as an inflection point in the history of education for two reasons:

1. Return to in-person teaching.
2. Beginning the A.I. Conversation.

- So I want to start the talk today by looking back at what I think is important.

First, Simplicity.

A topic that we have not covered explicitly in this course.

1. Simple systems, that you can clearly introspect and explain are critical for decision making.
2. Complexity is not a virtue, but it is a good way to hide from responsibility!
3. Our task is to find simple expression of complex systems.

Second, Transparency.

1. Being able to show your work is, at this stage, a form of communication. To your future self and to others who may consume your analyses after the fact.
2. If you understand the system you will have some understanding of what happens when you change the inputs.
3. Mistrust opaque systems (this is my most devastating critique of AI) understanding why a decision process came to the conclusion that it did is as important as understanding the conclusion.
4. If you want to find a bad decision, just look for the ones that are least well understood.

Third, Doubt.

This we have talked about at every turn.

Always ask: 1. how is the decision process tricking us? 2. How are the data tricking us? 3. What is the real goal, what are the data trying to tell us? 4. What is the goal of the people who made the data?

Third, Doubt.

- Are we inheriting the system that gives us this answer form another process that has different needs and thus might trick us?
- This is the point of the current discussion of decision making.

Fourth, The answers are easy, it's the questions that are hard.

- You've been trained to answer questions, but that is the easy part, the part that can be automated.
- Programming easy things is often about as hard as programming hard things. Remember systems of equations in Python!
- Deciding what information to use and how to structure your question has always been the most important issue. Even more so now, as we can often trivially solve any well structured problem.

Fourth, The answers are easy, it's the questions that are hard.

- We have inherited an education system from a world where computers were people (and not nearly as well paid as they should have been).
- We (educators) used ability to solve complex problems as a measure of ability.
- You will need to unlearn complexity, this is something that we all get trained for incorrectly.

The minds that did that work and that will do the work you need to do are not different, but the training, and habits of mind that that you need in order to succeed at it are very different.

10-8 Aspen View

Aspen View produces a full line of sunglasses. This year it began producing a new model of sunglasses, the Peak 32. It produced 5,300 pairs and sold 4,900 pairs. The following table summarizes the fixed and variable costs of producing Peak 32 sunglasses. Aspen View uses variable costing to value its ending inventory.

	Fixed Cost	Variable Cost	Total Cost
Direct labor		$ 3.50	$ 3.50
Direct material		7.50	7.50
Manufacturing overhead	$3.20	4.50	7.70
Advertising	1.20	1.70	2.90
Distribution	0.70	0.25	0.95
Selling	1.20	0.90	2.10
Total cost	$6.30	$18.35	$24.65

Variable costing overview:

- *Motivation:* Solve some of the problems with full absorption costing.
- Problem 1: Death Spiral (effective)
- Problem 2: Incentive to overproduce (helps, but doesn't solve)

Variable costing overview:

- All fixed costs hit income in the year that they are incurred.
- Fixed costs do not get absorbed into inventory.

Q1:

What is Aspen View's ending inventory value of Peak 32 sunglasses?

Q1: Solution

Ending inventory value using variable costing:

Direct labor	$3.50
Direct material	7.50
Variable manufacturing overhead	4.50
Total variable cost of product	$15.50
Units produced	5,300
Units sold	4,900
Ending inventory	400
$\times$ Unit manufacturing cost	$15.50
Ending inventory value	$6,200

Q2:

Aspen View is considering switching from variable costing to absorption costing. Would this year's net income from Peak 32 sunglasses be higher or lower using absorption costing? Explain.

Q2: Solution

- Income would have been **higher** had Aspen View used absorption costing.
- Under absorption costing, some of the fixed manufacturing costs would have been allocated to the ending inventory rather than all of them being written off to cost of goods sold.

Q3:

Suppose Aspen View uses absorption costing. If, instead of producing 5,300 pairs of Peak 32s it produced only 5,000, would net income from Peak 32 sunglasses be higher or lower from the smaller production compared to the larger production? Explain.

Q3: Solution

- Assuming constant variable cost per unit, income would have been lower.
- With fewer units produced, less fixed costs would have been allocated to the ending inventory under absorption costing.
- The preceding statement assumes variable cost per unit is constant.

Q4:

Aspen View has an opportunity cost of capital of 20 percent. What is the cost of producing 5,300 pairs of Peak 32s instead of 4,900 pairs?

Q4: Solution

- Assuming that they can sell the 400 pairs of sunglasses in inventory, the cost of overproducing is the sum of:
  1. the additional warehousing costs plus
  2. $400 \times \$15.50 \times 20\% \times \xi$ where ξ is the fraction of the year the glasses are held until being sold.
- This calculation assumes that all of the variable advertising, distribution, and selling expenses are incurred when the sunglasses are sold, not manufactured.
- This illustrates both the overproduction incentive from full absorption costing and the improvement from variable costing.

Kothari Inc.

The telecom division of Kothari Inc. produces and sells 100,000 line modulators. Half of the modulators are sold externally at $150 per unit, and the other half are sold internally at **variable manufacturing costs plus 10 percent**. Kothari uses variable costing to evaluate the telecom division. The following summarizes the cost structure of the telecom division.

	Var. Cost
Materials	27.00
Labor	12.00
Overhead	4.00
Total manufacturing cost	43.00
Fixed manufacturing overhead	$1,700,000
Variable period costs (per units)	$18.00
Fixed period costs	$1,900,000

Q1:

- Calculate the net income of the telecom division (before taxes) using variable costing.

Q1 Solution (Revenue):

Revenues:	
Internal sales ($50,000 \times 1.1 \times \$43$)	$2,365,000
External sales ($50,000 \times \$150$)	7,500,000
Total revenue	$9,865,000

Q1 Solution (Cost):

Total revenue	$9,865,000
Less:	
Variable manufacturing cost	$4,300,000
Fixed manufacturing overhead	1,700,000
Variable period cost	1,800,000
Fixed period cost	1,900,000
Net income	**$165,000**

Q2:

- Telcom can outsource the final assembly of all 100,000 modulators for $9.00 per modulator. If it does this, it can reduce variable manufacturing cost by $1.00 per unit and fixed manufacturing overhead by $700,000. If the managers of the telecom unit are compensated based on telecom's net income before taxes, do you expect them to outsource the final assembly of the modulators? Show calculations.

Q2: Solution

Revenues:	
Internal sales $(50,000 \times 1.1 \times \$51)$	\$ 2,805,000
$\$51 = \$43 + \$9 - \$1$	
External sales $(50,000 \times \$150)$	7,500,000
Total revenue	\$10,305,000
Less:	
Outsourcing $(100,000 \times \$9)$	\$ 900,000
Variable manufacturing cost $(100,00 \times (\$43 - \$1))$	4,200,000
Fixed manufacturing overhead	1,000,000
Variable period cost	1,800,000
Fixed period cost	1,900,000
Net income	\$ 505,000

The Telecom managers face a strong incentive to outsource because their net income increases from \$165,000 to \$505,000.

Q3:

- What happens to the net cash flows of Kothari Inc. if the final assembly of the modulators is outsourced?

Q4: Solution

Outsourcing costs $\$(9 \times 100,000)$	\$900,000
Savings:	
Variable cost $\$(1 \times 100,000)$	-100,000
Fixed manufacturing overhead	-700,000
Net loss from outsourcing	\$100,000

Are there alternatives?

- Simply centralize outsourcing decisions!
- Contract allocation of fixed costs internally (managers must forecast and pay no matter what happens in the future).
- Other alternatives?

Naviski

Navisky designs, manufactures, and sells specialized GPS (global positioning system) devices for commercial applications. For example, Navisky currently sells a system for environmental studies and is planning systems for private aviation and fleet management. The firm has a design team that identifies potential commercial GPS applications and then designs and develops prototypes. Once a prototype is deemed successful and senior management determines that a market

exists for the new application, the new design is put into production, and the firm markets the new product through independent salespeople, direct marketing, trade shows, or whatever channel is most appropriate for that market.

Currently, Navisky has one very successful system in production (for environmental studies) and several others in development. Navisky, located in Austria, is one of nine wholly owned subsidiaries of a large Swiss conglomerate. Andreas Hoffman, president of Navisky, expects to retire next year. He receives a fixed salary and a bonus based on reported accounting earnings. The bonus is 5 percent of earnings in excess of €850,000 for actual earnings between €850,000 and €1,400,000. If actual earnings exceed €1,400,000, the bonus is capped at $£27,500[5$. (Earnings, both actual and target, are before taxes.)

The following data summarize Navisky's current operations (in euros).

	Annual Fixed Costs	Variable Costs/Unit
Development Costs	900,000	
Selling and administration costs	1,100,000	300
Manufacturing overhead	2,700,000	190
Direct materials		140
Manufacturing labor		50
Total	4,700,000	680
Selling price unit	5,500	

Senior management at Navisky, including Mr. Hoffman, expects to sell about 1,200 units of the environmental GPS device this year. However, they have considerable discretion in setting production levels. Their plant has excess capacity and can produce up to 1,500 environmental devices without seeing any increase in the variable manufacturing costs per unit.

Navisky uses a traditional absorption costing system to absorb manufacturing overhead into product costs for inventory valuation and to calculate earnings for internal compensation purposes as well as external reporting. At the beginning of the current fiscal year, there was no beginning inventory of the environmental GPS devices.

Q1:

How many units of the environmental GPS device would Mr. Hoffman like to see Navisky produce if he expects to sell 1,200 devices this year?

Q1: Solution

Production	1200	1300	1350	1360

Revenue (assuming sales of 1200 units)	€6,600,000	€6,600,000	€6,600,000	€6,600,000
Cost of goods sold:				
Variable mfg cost	(456,000)	(456,000)	(456,000)	(456,000)
Fixed mfg overhead	(2,700,000)	(2,492,308)	(2,400,000)	(2,382,353)
Period costs:				
Development costs	(900,000)	(900,000)	(900,000)	(900,000)
Fixed Selling and administration costs	(1,100,000)	(1,100,000)	(1,100,000)	(1,100,000)
Variable selling and admin costs	(360,000)	(360,000)	(360,000)	(360,000)
Actual earnings before taxes	€1,084,000	€1,291,692	€1,384,000	€1,401,647
Bonus	€11,700	€22,084	€26,700	€27,500

Mr. Hoffman, because he expects to retire next year and hence will not have to deal with any excess inventory, has an incentive to over produce. The table below indicates that given sales of 1200 units Mr. Hoffman would like to produce about 1,360 units. At 1,360 units, expected earnings are about €1,401,647, or just above the bonus cap of €1,400,000. So to maximize his bonus, Mr. Hoffman will want to produce 1,360 units, or 160 more than he expects to sell.

Q2:

Suppose Mr. Hoffman's bonus calculation was based on net income after including a charge for inventory holding costs at 20 percent of the ending inventory value. In other words, his bonus is 5 percent of net income in excess of $850,000 up to $1,400,000 where net income includes a 20 percent inventory holding cost. How many units of the environmental GPS device would Mr. Hoffman like to see produced if he expects to sell 1,200 devices this year?

Q2: Solution

Production	1200	1350	1400	1420
Revenue (assuming sales of 1200 units)	€6,600,000	€6,600,000	€6,600,000	€6,600,000
Cost of goods sold:				
Variable mfg cost	(456,000)	(456,000)	(456,000)	(456,000)
Fixed mfg overhead	(2,700,000)	(2,400,000)	(2,314,286)	(2,281,690)
Period costs:				
Development costs	(900,000)	(900,000)	(900,000)	(900,000)
Fixed Selling and administration costs	(1,100,000)	(1,100,000)	(1,100,000)	(1,100,000)

Variable selling and admin costs	(360,000)	(360,000)	(360,000)	(360,000)
Actual earnings before inventory costs	€1,084,000	€1,384,000	€1,469,714	€1,502,310
Ending inventory	0	150	200	220
Cost per unit of inventory	€2630	€2380	€2309	€2281
Ending inventory cost	0	357,000	461,800	501,820
Weighted average cost of capital	0.2	0.2	0.2	0.2
Holding cost of inventory	0	(71,400)	(92,360)	(100,364)
Earnings after inventory cost	€1,084,000	€1,312,600	€1,377,354	€1,401,946
Bonus	€11,700	€23,130	€26,368	€27,500

With an inventory holding cost of 20 percent deducted from earnings, Mr. Hoffman will prefer to produce 1,420 units because at this production level (and given sales of 1,200 units) Mr. Hoffman will reach the bonus cap of €27,500.

Q3:

Explain why your answers in parts (a) and (b) differ, if they do.

Q3: Solution

Interestingly, charging Mr. Hoffman an inventory holding cost of 20 percent actually causes him to over produce even more. Without the 20 percent inventory charge Mr. Hoffman only has to produce about 1,360 units (or 160 more than he expects to sell) to reach the €1.4 million earnings cap. But with the 20 percent inventory charge, Mr. Hoffman needs to produce about 1,420 (or 220 more than he expects to sell) to reach the cap. Hence, including the inventory holding charge has the perverse incentive of actually causing Mr. Hoffman to over produce even more. The reason for this is the existence of the bonus cap, and the fact that the 20 percent charge on inventory is less than the reduction in average fixed costs charged to cost of goods sold.

Q4:

How many units of the environmental GPS device would Mr. Hoffman like to see produced, assuming he expects to sell 1,200 devices this year if Navisky's net income is calculated using variable costing and net income includes a 20 percent inventory holding cost?

Q4: Solution

Production	1200	1350	1390	1400
Revenue (assuming sales of 1200 units)	€6,600,000	€6,600,000	€6,600,000	€6,600,000
Cost of goods sold:				
Variable mfg cost	(456,000)	(456,000)	(456,000)	(456,000)
Fixed mfg overhead	(2,700,000)	(2,700,000)	(2,700,000)	(2,700,000)
Period costs:				
Development costs	(900,000)	(900,000)	(900,000)	(900,000)
Fixed Selling and administration costs	(1,100,000)	(1,100,000)	(1,100,000)	(1,100,000)
Variable selling and admin costs	(360,000)	(360,000)	(360,000)	(360,000)
Actual earnings before inventory cost	€1,084,000	€1,084,000	€1,084,000	€1,084,000
Ending inventory	0	150	190	200
Cost per unit of inventory	380	380	380	380
Ending inventory cost	0	57,000	72,200	76,000
Weighted average cost of capital	0.2	0.2	0.2	0.2
Holding cost of inventory	0	(11,400)	(14,440)	(15,200)
Earnings after inventory cost	€1,084,000	€1,072,600	€1,069,560	€1,068,800
Bonus	€11,700	€11,130	€10,978	€10,940

Under variable costing and a 20 percent inventory holding cost, Mr. Hoffman will not over produce. He will produce exactly what he intends to sell, 1,200 devices. If he over produces under variable costing, earnings falls, and hence his bonus is lower.