15.963 Management Accounting and Control
Spring 2007

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Decision Making – Insource or Outsource

- Another common decision is whether to make parts in-house or to outsource.

- Oxford Engineering manufactures small engines.
  - The engines are sold to manufacturers who install them in such products as lawn mowers.
  - The company currently manufactures all the parts used in these engines but is considering a proposal from an external supplier who wishes to supply the starter assemblies used in these engines.
  - The starter assemblies are currently manufactured in Division 3 of Oxford Engineering.

Decision Making – Insource or Outsource

- The costs relating to the starter assemblies for the past 12 months were as follows:

Direct materials	$200,000
Direct manufacturing labor	$150,000
Manufacturing overhead	$400,000
Total	$750,000

- Over the past year, Division 3 manufactured 150,000 starter assemblies.
  - The average cost for each starter assembly is $5 (= $750,000 / 150,000).

Decision Making – Insource or Outsource

- Further analysis of manufacturing overhead revealed the following information.
  - Of the total manufacturing overhead, only 25% is considered variable.
  - Of the fixed portion, $150,000 is an allocation of general overhead that will remain unchanged for the company as a whole if production of the starter assemblies is discontinued.
  - A further $100,000 of the fixed overhead is avoidable if production of the starter assemblies is discontinued.
  - The balance of the current fixed overhead, $50,000, is the division manager's salary.

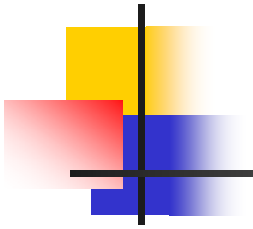
Decision Making – Insource or Outsource

- If production of the starter assemblies is discontinued, the manager of Division 3 will be transferred to Division 2 at the same salary.
  - This move will allow the company to save the $40,000 salary that would otherwise be paid to attract an outsider to this position.

Decision Making – Insource or Outsource

- The variable costs required to manufacture 150,000 starter assemblies are:
  - Direct Materials $200,000
  - Direct Manufacturing Labor $150,000
  - Variable Manufacturing Overhead $100,000
  - Total Variable Costs $450,000
- The variable cost per unit is $3.

Decision Making – Insource or Outsource



- Tidnish Electronics, a reliable supplier, has offered to supply starter-assembly units at $4 per unit.
- Because this price is less than the current average cost of $5 per unit, the vice president of manufacturing is eager to accept this offer.
- However, the general manager points out that this price is much higher than the variable cost per unit of $3 with insourcing, so she recommends against buying from Tidnish.
- Who is correct?

Decision Making – Insource or Outsource

- Note that production output in the coming year may be different from production output in the past year.
- Let X be the number of starter assemblies required in the next 12 months.

	Make	Buy
Variable Manufacturing Costs	$3X	-
Fixed Manufacturing Overhead	$150,000	$150,000
Avoidable Fixed Overhead	$100,000	-
Division 2 Manager's Salary	$40,000	$50,000
Division 3 Manager's Salary	$50,000	-
Purchase Costs (Tidnish)	-	$4X
Total	$340,000 + $3X	$200,000 + $4X

Decision Making – Insource or Outsource

- The relevant data is:

	Make	Buy
Variable Manufacturing Costs	$3X	-
Fixed Manufacturing Overhead	-	-
Avoidable Fixed Overhead	$100,000	-
Division 2 Manager's Salary	$40,000	$50,000
Division 3 Manager's Salary	$50,000	-
Purchase Costs (Tidnish)	-	$4X
Total	$190,000 + $3X	$50,000 + $4X

  - The number of units at which the costs of insourcing and outsourcing are equivalent is:
    - X = 140,000

Decision Making – Insource or Outsource

- On the basis of financial considerations alone,
  - If production is expected to be less than 140,000 units, it is preferable to buy units from Tidnish.
  - If production is expected to exceed 140,000 units, it is preferable to manufacture internally (make) the units.
  - If production is expected to be 140,000 units, Oxford should be indifferent between buying units from Tidnish and manufacturing (making) the units internally.

Decision Making – Insource or Outsource

- How, if at all, would the answer change if the company could use the vacated plant space for storage and, in so doing, avoid $50,000 of outside storage charges currently incurred?
  - The information on the avoidable storage cost is relevant. It is an opportunity cost if insourcing is chosen.
- The indifference point is now X=190k units
  - $240k + 3x = $50k + 4x

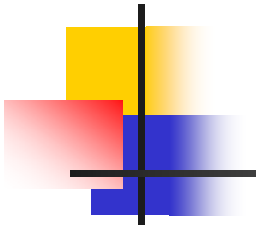
Decision Making – Insource or Outsource

- The justification provided by the V.P. of manufacturing is wrong because
  - she implicitly considered all fixed costs avoidable.
- The justification provided by the G.M. is wrong because
  - she implicitly considered all fixed costs unavoidable.

Decision Making – Insource or Outsource

- Takeaways from this example:
  - Since some fixed costs are avoidable with outsourcing, this is a long run decision.
  - For long run decisions, fixed costs are relevant.
  - The decision rule for long run decisions is to maximize total profits (as opposed to CM).
  - Fixed costs make more sense when production volume is expected to be high.

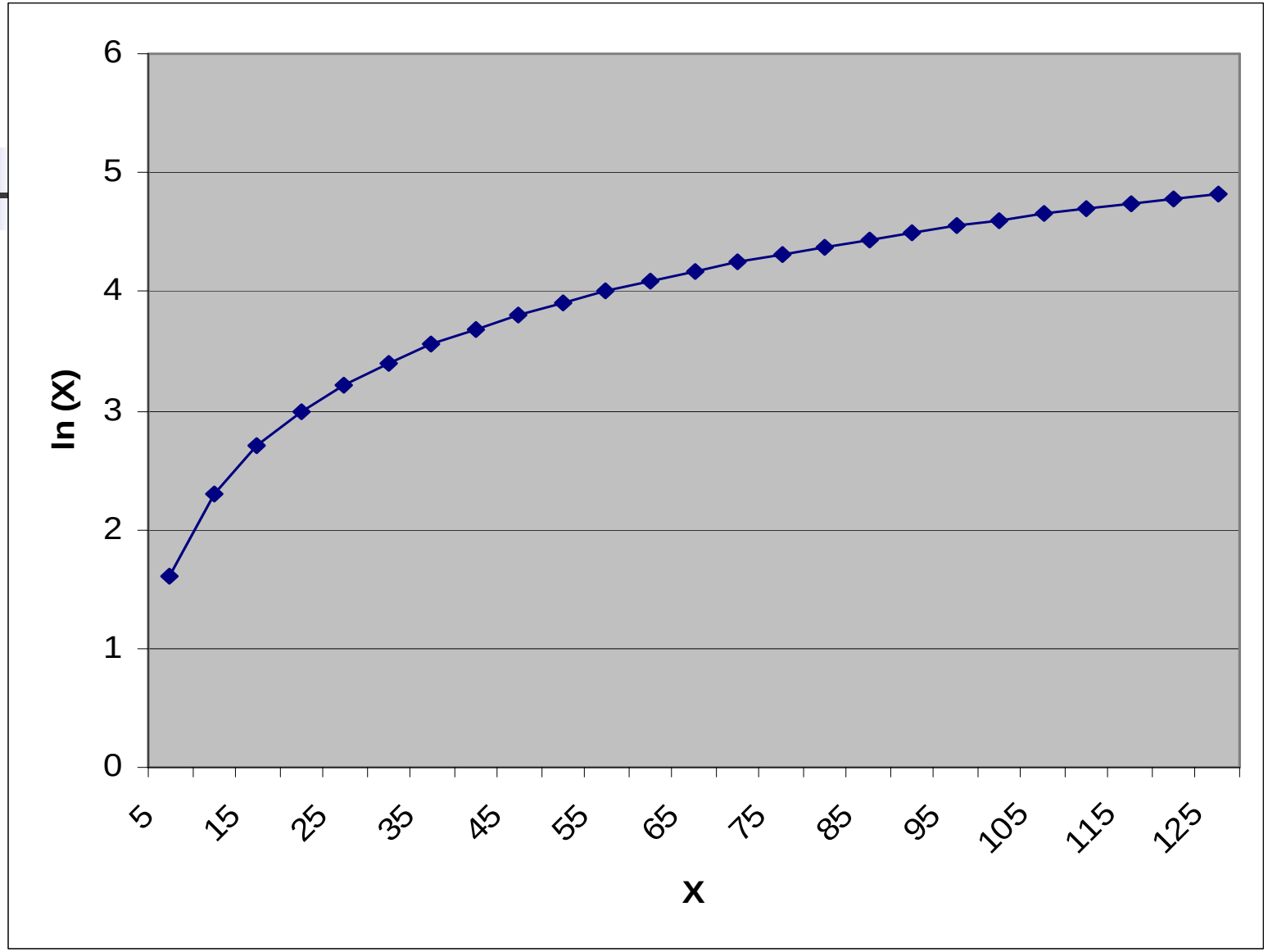
Strategic Considerations in Outsourcing



- Managing the cost structure, e.g., Porsche
- Where, in the value chain, are the rents?
  - E.g., Nike, Sulzer
- Transaction costs and holdup problems?
  - E.g., GM and Fisher Body
  - Transaction costs are high when the transaction involves durability, asset specificity, uncertainty and high frequency.
    - Under these circumstances, activity is internalized.
- Agency and governance costs, congestion costs.
  - These are costs of insourcing, and have to be balanced against the benefits.

Relevant Costs under Uncertainty

- When uncertainty is involved, cash flows that do not differ between alternatives may be relevant because of:
  - Risk effects
- Suppose you have a preference function for money of $U = \ln(X)$.

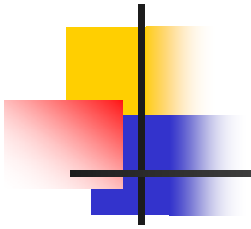

6
5
4
3
2
1
0
ln (X)
5
15
25
35
45
55
65
75
85
95
105
115
125
X

Relevant Costs under Uncertainty

- **Risk effect:**
  - You are offered two alternatives - a sure payoff of $5k, or a lottery of $10k (state 1) or -$1k (state 2) with equal probability.
  - Is your income from other sources, that does not differ between the alternatives, relevant?
  - Suppose your income from other sources will be $15k, regardless of whether you choose the sure payoff or the lottery.
  - In this case, you prefer the sure payoff of $5k
    - ln(20k) = 9.903
    - 0.5*ln(25k) + 0.5*ln(14k)= 9.837

Relevant Costs under Uncertainty

- Suppose your income from other sources will be $10k in state 1 and $20k in state 2, regardless of whether you choose the sure payoff or the lottery.
- The values you assign your alternatives now are:
  - 0.5*ln(15k) + 0.5*ln(25k) = 9.871
  - 0.5*ln(20k) + 0.5*ln(19k) = 9.879
- Now you prefer the lottery.
- This happens because it smoothes out your total income, and reduces the risk you are exposed to.
- Cash flows that did not vary between the two choices changed your decision, and so were relevant. This is the risk effect.



Relevant Costs under Uncertainty

- Takeaways from this example:
  - When choosing between alternatives where cash flows are uncertain, incremental analysis is not appropriate.
  - You have to consider the risk of the alternatives.

Decision Making – Product Mix under Constraints

- Multi-product firms are commonly faced with optimal product mix decisions.
- St. Lawrence Boat Yard produces a line of small recreational boats.
- Production is machine intensive, and each boat passes through a series of machines operated by skilled personnel.
- Variable costs are direct materials (DM), variable machining, variable manufacturing overhead (VOH) and sales commissions.
- Fixed costs are $9m, and annual capacity is 60k machine hours.

Decision Making – Product Mix under Constraints

- Variable machining costs are $200 per hour, and VOH is $50 per machine hour.
- Commission costs are 5% per boat and cruiser, and 10% per canoe.

Decision Making – Product Mix under Constraints

Boat	Demand	Price	DM	Var. Mach. Cost	Commission
Cruiser1	1800	3000	750	600	150
Cruiser2	2400	2400	650	500	120
Boat1	4500	2100	500	500	105
Boat2	4200	2000	500	400	100
Canoe	39000	800	100	200	80

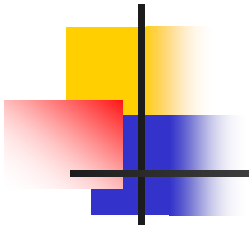
Decision Making – Product Mix under Constraints

- St. Lawrence wants to determine its product mix.
- What decision rule should they use?
- What is the VOH per unit, and the UCM?

Decision Making – Product Mix under Constraints

Boat	Demand	Price	DM	Var. Mach. Cost	Commission	Mach. Hrs.	VOH	UCM
Cruiser1	1800	3000	750	600	150	3	150	1350
Cruiser2	2400	2400	650	500	120	2.5	125	1005
Boat1	4500	2100	500	500	105	2.5	125	870
Boat2	4200	2000	500	400	100	2	100	900
canoe	39000	800	100	200	80	1	50	370

Decision Making – Product Mix under Constraints



- How many units of each should they sell?
- What prevents them from fully satisfying the demand for all products?
  - Machine hours – this is called the constrained resource.
  - How many machine hours would be needed to fully satisfy the demand for all products?

Decision Making – Product Mix under Constraints

Boat	Demand	Price	DM	Var. Mach. Cost	Commission	Mach. Hrs.	VOH	UCM	MH Used
Cruiser1	1800	3000	750	600	150	3	150	1350	5400
Cruiser2	2400	2400	650	500	120	2.5	125	1005	6000
Boat1	4500	2100	500	500	105	2.5	125	870	11250
Boat2	4200	2000	500	400	100	2	100	900	8400
Canoe	39000	800	100	200	80	1	50	370	39000
									70050

Decision Making – Product Mix under Constraints

- How many canoes should they sell?
- What is the UCM per machine hour?

Boat	UCM	MH Used	UCM/Mach Hr
Cruiser1	1350	5400	450
Cruiser2	1005	6000	402
Boat1	870	11250	348
Boat2	900	8400	450
Canoe	370	39000	370
		70050	

Decision Making – Product Mix under Constraints

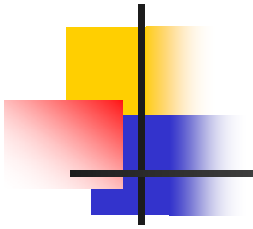
- St. Lawrence should satisfy the demand for Cruisers 1 and 2, Boat 2 and the Canoe.
- The remaining machine hours, 1200, should be used to produce 480 units of Boat 1.
- Suppose they can lease additional machining capacity as needed. What is the maximum they can pay per machine hour of leased capacity?
  - What is the UCM per machine hour of Boat 1 before variable machining costs (which become avoidable)?
    - ($870 + $500)/2.5 = $1370/2.5 = $548
    - This is the maximum St. Lawrence should pay per hour of leased capacity.

Decision Making – Product Mix under Constraints

- Takeaways from this example:
  - Decisions involving capacity constraints are usually short run decisions, because the constraint can be relaxed in the long run.
  - The decision rule therefore involves maximizing the contribution margin, modified to
    - Maximize CM per unit of the constrained resource.
    - This is a version of the short run decision rule we saw earlier.

Managing Constraints

- Bottleneck operations are a typical production constraint, possibly due to factor lumpiness and cost.
- Such constraints can also arise in other settings
  - e.g., the internet, where remote caching and mirroring help manage bottlenecks.
  - In retail, where linear feet of display space is a constraint.
- To manage bottlenecks,
  - improve the quality of parts passing through the bottleneck–
    - Cost of defective parts going through bottleneck is not just wasted material, but lost CM.
  - Reduce idle time and setup time at the bottleneck
  - Keep the bottleneck busy, and let it dictate the production schedule.



Summary

- Today, we have talked about:
  - long run decision rule;
  - strategic considerations in outsourcing;
  - relevant costs under uncertainty;
  - decision rule in the presence of constraints;
  - managing constraints.