Lesson 24 – Warranties and Service Contracts

Warranties

- A warranty guarantees, or warrants, a product will perform as specified for a given period of time
- If the product fails to perform as specified, it will be remedied by the supplier or manufacturer
- Some warranties required by law, particularly in consumer realm

Warranties

- Companies selling product define their warranty terms
  - Can be a marketing tool
- After selling products, some will fail during the warranty period and need to be repaired/replaced
- Need to account for the costs of these failed products

Warranties

- Warranty costs are driven by two variables
  - Number of products failed/returned within warranty period
  - Cost to address the failed products

- Warranties are typically 1-D or 2-D
  - 1-D: warranty is based on a single factor, typically calendar age
  - 2-D: warranty is based on two factors, typically age AND usage (e.g. number of operations/cycles, mileage, operating hours)

Warranties

- How many products will be returned during the warranty?

- Estimate a failure rate for the product.
  - Historical data
  - Durability/Reliability Testing
  - Accelerated Testing
  - Physics of Failure Models
  - Standards and databases

- Failure rate will generally change over time and be different for different failure modes
  - For our purposes, assume a single, constant failure rate
  - Can estimate failure rate from MTBF and vice versa: MTBF = $1/\lambda$
- Gets more complicated with multi-dimensional warranties
  - Need to assess/estimate customer usage – often great uncertainty here

Warranties

- Suppose we tested 20 fuel cell stacks for 2000 hours each, and there were six failures during the testing.
  - What is the MTTF of the stacks?
  - If we sell 2500 with a warranty period of 1000 hours, how many failures should we expect?
- MTTF = 20*2000/6 = 6667 hours.
- Assume constant failure rate, so R(t) = e^(-t/MTBF) = e^-tλ
  - Plug in 1000 for t, 6667 for MTBF and get R(t) = 86.1%
  - Failure rate F(t) = 1 – R(t) = 13.9%
- Expected failures = 2500*.139 = 348 stacks returned during warranty

Warranties

- Assume stacks returned during warranty can be repaired, but at a cost of $500 per stack.
  - What is the total amount of money we need to set aside to cover expected warranty costs?
  - How much should be added to the cost of each stack to account for warranty costs?

- 348 stacks x $500 per repair = $174,000 total
- $174,000/2500 = $69.60 per stack

Warranties

- The Time Factor

- Warranty accruals typically provide cash now to cover expenses later. Not common for short term warranties, but when timeframes get longer you can account for interest, taxes, and inflation for these costs.

- Generally the discounting effect makes warranty costs lower, but uncertainty in the costs is often greater than that effect.
- Inflation and obsolescence can become an issue for long term warranties.

Warranties

- Warranty accruals become part of accrued liabilities on organization's Balance Sheet
  - Represent likely or potential payouts due
- Accruals increase as units are sold and warranty liabilities are added
- Accruals decrease as units reach the end of their warranty term and are no longer liabilities
- Actual warranty expenses are taken from the accrual account

Warranties

- Example: at start of year, company has $1,000,000 in accrued warranty liabilities.
  - Sell additional units adding $200,000 in liabilities
  - Older unites expire, removing $100,000 in liabilities
  - Direct warranty costs of $175,000
- Ending accrual of $925,000

- May also make special one time adjustments to the accrual
  - Change in failure rate – field units fail at a different rate than was estimated from testing
  - Special charges – major problems that were not detected during testing/validation
  - Recalls

Extended Warranties

- If you have good data on expected failure rates, extended warranties offer potential additional revenue
- Principal is the same for a regular warranty analysis.
  - Estimate expected failure rate during the extended warranty period
  - Estimate cost of repair/replacement
- This gives an expected cost for the extended warranty period.
- Can then price the extended warranty based on expected costs and desired profit margin

Warranty Challenges

- Warranties typically provide data from the early life of a product, and don't provide insight into later failure modes or end of life issues
- Warranty claims are usually incomplete
  - Not all warrantable failures are claimed
  - Claims come with incomplete or erroneous information
- May lead to bias in conclusions
- Warranty Fraud
  - Warranty may be claimed when it is not appropriate
  - Not necessarily intentional
  - Most common cause is out of spec operation
- Goodwill warranty – may provide warranty coverage when it's not strictly due to maintain relations

Service Contracts

- Service contracts are an extension of the warranty and extended warranty philosophy

- More common for larger, more complex systems

- In addition to covering repairs of failed/broken items, also covers regular maintenance and servicing

- May also provide contractual performance guarantees

Service Contracts

- You sell large mining haul trucks to open pit mines. Your 170 tonne model costs you $1,000,000 to build, and you are willing to sell it for $950,000 if you can get an appropriate total return.

- You estimate the following annual costs to maintain the truck, including both warranty repairs (failures) and planned and preventive maintenance
  - Year 1: $200,000
  - Year 2: $350,000
  - Year 3: $200,000
  - Year 4: $350,000
  - Year 5: $600,000 (engine rebuild)

Service Contracts

- You want to sell a service contract that covers those five years. You will charge a fixed price each year. If you require and MARR of 22% on the total transaction (sale and service contract), what should you charge?

Service Contracts

MARR	22%				
Cost of truck:	$ 1,000,000				
List Price of Truck	$ 950,000				
Estimated Maintenance Costs			Net Sales Revenue	$	(50,000)
	Year	Cost	Revenue	Net Revenue	
	1	$ 200,000	$ 327,980	$	127,980
	2	$ 350,000	$ 327,980	$	(22,020)
	3	$ 200,000	$ 327,980	$	127,980
	4	$ 350,000	$ 327,980	$	(22,020)
	5	$ 600,000	$ 327,980	$	(272,020)
				NPV	$0.00

Service Contracts

- Benefits for the purchaser:
  - Regular, fixed payments
  - In theory a competent service provided
  - Minimum performance guarantees

- Benefits for the seller
  - Additional revenue stream
  - Ensures product is maintained properly
  - Often allows additional data gathering on their product