Single Period Choice

Goals

- Quick introduction to the problem of the firm.
- Cost function descriptions
- The concept of a volume index
- Solutions to the three single period problems:
    - Break-Even
    - Make vs Buy
    - Optimal Pace

Types of Costs

Economists recognize several types of cost:

- Sunk: in the past and can not be recovered. Example, One time licencing fee.
- Fixed: Costs uncorrelated or do not change over large changes in output. Example, monthly rent
- Variable: Costs that are correlated with or do increase with increases in output. Example, food costs

Accountants recognize one more kind of cost – semi-variable

- Has a fixed and variable component. Example, fully loaded labor cost with insurance.
- Economists would break this up into a fixed and variable component.

Contrasts between Economists and Accountants

- Economists tend to include opportunity cost – what you could have done. Example, instead of using the building you own for your business, you could have rented it out.
- Economists tend to view costs as a random variable. We do stats after we get the numbers and report parameter estimates with uncertainty.

Costs

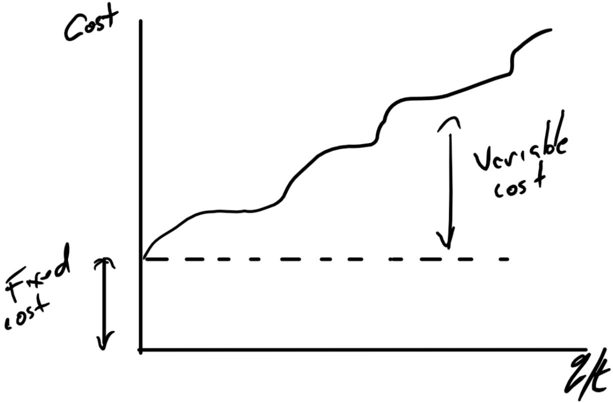
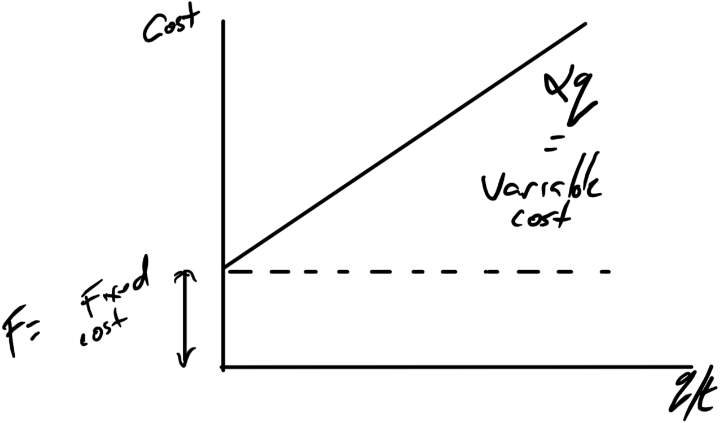


Figure 1

Simplified Assumptions for this Class

$$C = F + \alpha q$$



Derived Costs

It is often useful to transform these costs into a more useful form. The two primary transformations are:

- Average : $\frac{Some\_Cost}{q}$
- Incremental or Marginal:
  - Marginal $Cost`(q)$
  - Incremental$Cost(q+1) - Cost(q)$, the additional cost to produce one more.

These generalize to multiple dimensions. We will focus on incremental costs rather than marginal because no calculus.

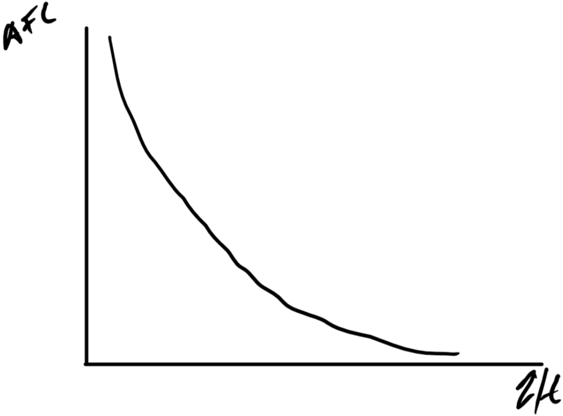
Average Costs

Divide cost by q to get *an* average cost function.

- Average Fixed Cost : $\frac{F}{q}$
- Average Variable Cost : $\frac{Variable\ Cost}{q} = \frac{\alpha q}{q} = \alpha$
- Average (Total) Cost: $\frac{Total\ Cost}{q} = \frac{F+\alpha q}{q} = \frac{F}{q} + \alpha$

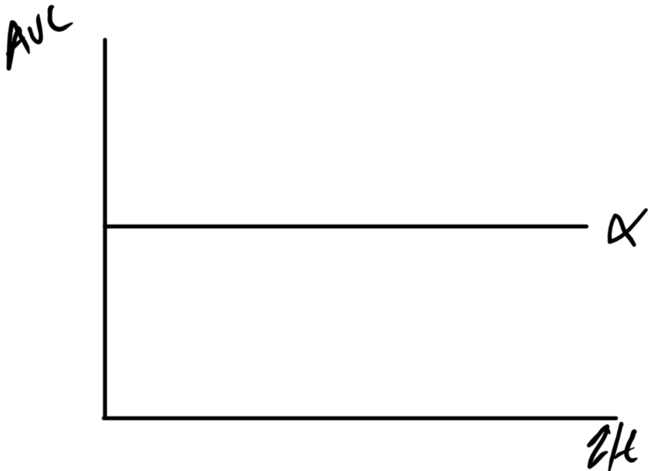
Average Fixed Cost

$$AFC = \frac{F}{q}$$



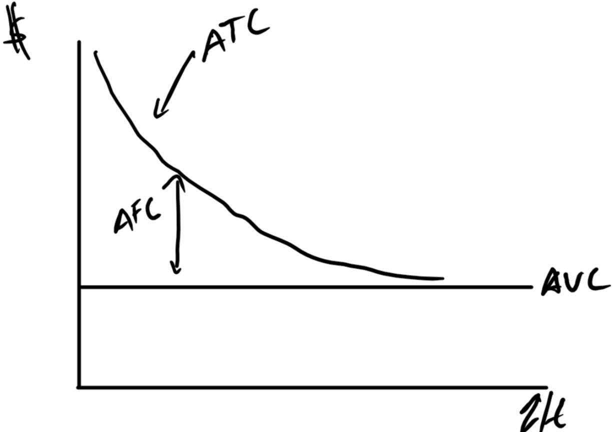
Average Variable Cost

$$AVC = \frac{\alpha q}{q} = \alpha$$



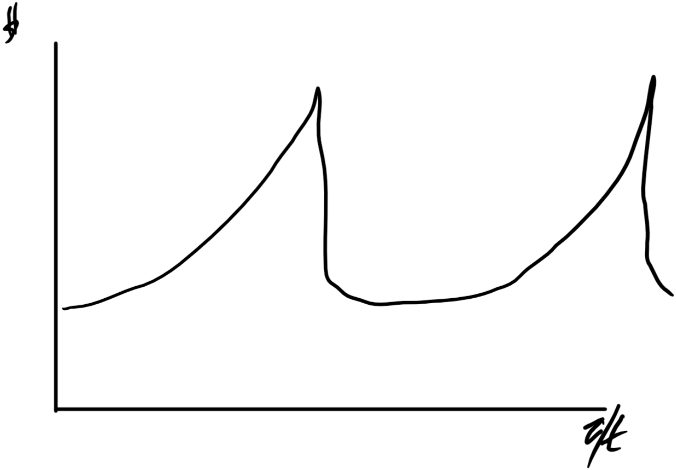
Average Cost

$$AC = AFC + AVC = \frac{F}{q} + \alpha$$



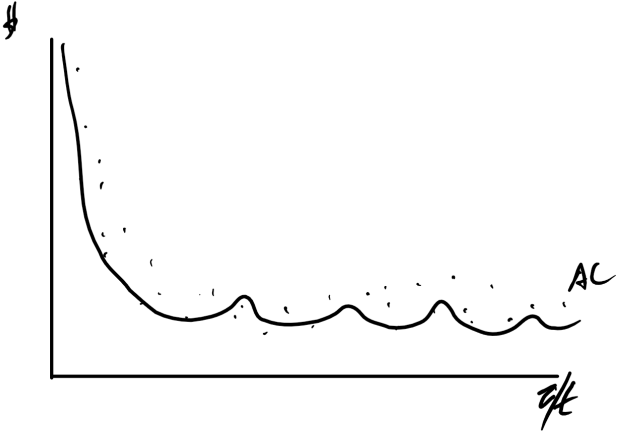
Real Life Average Cost: Theoretical

Spikes happen because of big capital investments.



Real Life Average Cost: Statistical

We observe lots of bad luck and must estimate potential costs (Frontier regression)



Incremental Costs

In intro micro (EC 201) you learned about marginal cost, $C(q)'$

- Incremental cost is the generalization to discrete changes in multiple dimensions.
- We will stick to the "Additional cost to produce one more" interpretation.
- You can talk about:
  - the incremental cost of adding a worker.
  - Incremental cost of adding a shift
  - Incremental cost of adding a new product line.

Note that with our assumptions: $IC(q) = \alpha$

$$IC(q) = C(q+1) - C(q) = (F + \alpha q + \alpha) - (F + \alpha q)$$

Volume Index

- Not all measures of output are simple
  - 1 MMbbl oil.
- Sometimes you have choices
  - 500 plates
  - 300 tickets
  - $2500 in food costs (Yes, quantity is sometimes measure like this.)
- Sometimes you have to combine more than one measure
  - Gross Domestic Product
  - kW, kWh

Choice of Volume Index

- Ideally, your volume index will be highly correlated with both costs and benefits (Costs and Revenue)
  - Not always the case
  - Often get one but not the other.
- Uncertainty about costs and/or benefits will be small for a known value of volume index.

Example

Needed a volume index for auto insurance cost by zip code for a study of alternative funding mechanisms.

I picked number of insured vehicles.

- Positively correlated with revenue – premium revenue.
- Positively correlated with costs – accident cost.

Example Volume Index

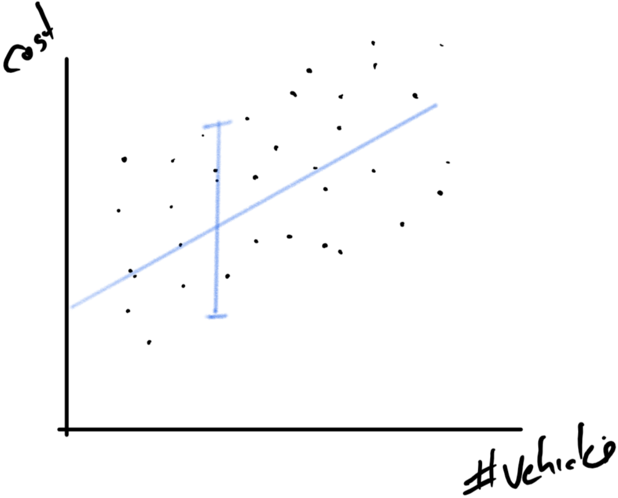


Figure 8

Refinements

- Large uncertainty for number of vehicles
- Missed a lot:
  - Urban vs Rural: Lots of small accidents vs few catastrophic.
  - Sources of the cost per claim
  - Different risks based on driving habits.

Refinements (Con't)

Starting with number of insured vehicles

- Vehicle Miles Traveled (VMT)
  - More correlated with risk, more driving more accidents.
  - Worked better.
- Passenger Miles Traveled (PMT)
  - Better correlation with source of costs, medical rather than the vehicle.
  - Worked way better.

Finding better Volume Indexes

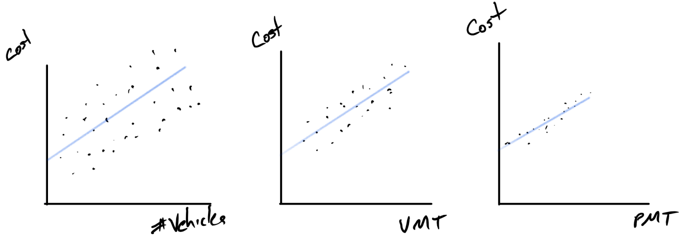


Figure 9

The “Right” volume index

- Finding the right volume index will really reduce the uncertainty of your cost estimates.
- Only when you are working with historical data of costs/benefits in a regression style model.
- This is an engineer/economist split on technical approach, i.e., The “estimate” vs “estimate” confusion.
  - Engineers estimate: Some calculated value based on assumed values.
  - Economist estimate: Statistical estimate.

The Single-Period Choice Problems

- Break-Even: Find output such that benefits are equal to costs

$$B(q) = c(q)$$

- Make vs Buy: Find the lowest cost technology given a known quantity.
- Optimal Pace: Find the quantity that maximizes net benefits.

$$\max_q B(q) - c(q)$$

Break-Even Problem

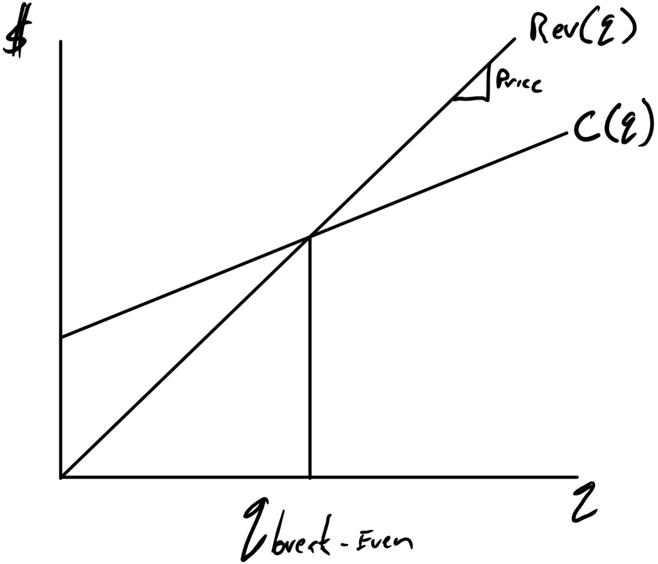


Figure 10

Break-Even

- This is the go back to bed problem.
  - If the break-even is huge, don't do it and go back to bed.
  - If the break-even is small, don't worry about it and go back to bed.

Example From a Student

San Antonio River Walk Sunglasses Shack

- 5K a month rent for the spot
- Figure $10 for sunglasses, counterfeit, wholesale.
- Sales price of $100 per (This is the River Walk)

Cost and Revenue Function

$$C = 5000 + 10q$$
$$R = 100q$$

Solve for q such that revenue equals cost

$$\begin{aligned} 5000 + 10q &= 100q \\ 5000 &= 90q \\ q = \frac{5000}{90} &= 55.56 \end{aligned}$$

About 2 a day. Go back to bed.

Make vs Buy Problem

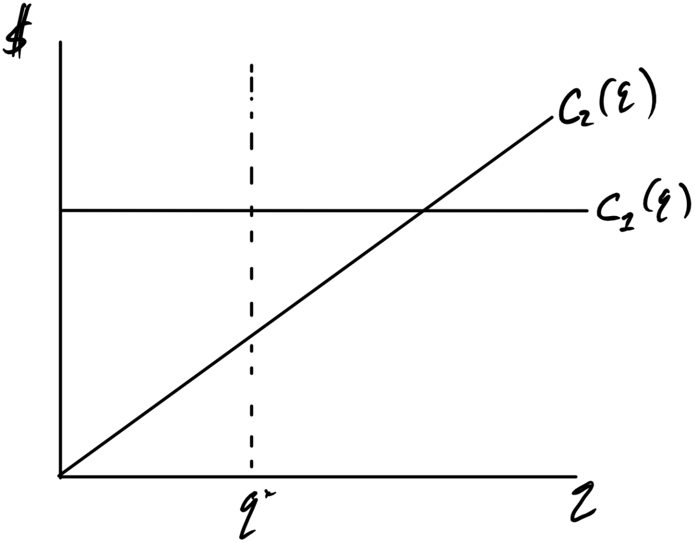


Figure 11

Fancy Way of Saying, "Do it the cheap way."

Example: Trimet Monthly Pass vs Daily Ticket

- Monthly Pass: $C_M = 100$
- Day Pass: $C_D = 5q$

How often do you go to class?

- 2 days a week: $C_M = 100$, $C_D = 5(8) = 40$
- 6 days a week: $C_M = 100$, $C_D = 5(24) = 120$

You have to really think about uncertainty if you go 5 days a week, $C_M = C_D$.

Optimal Pace Problem

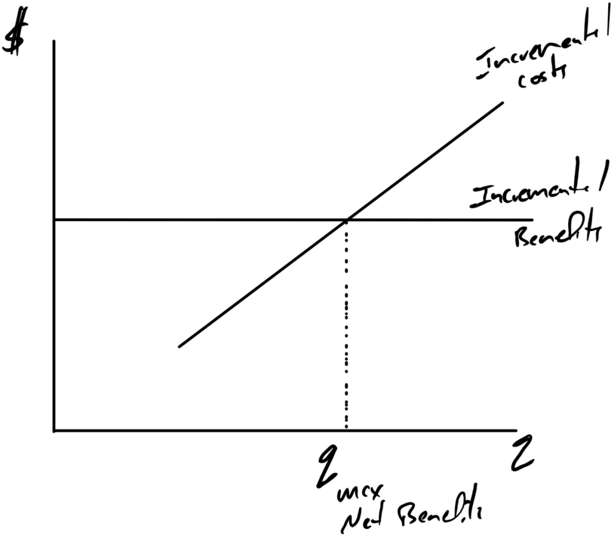


Figure 12

Looks Very Similar to Increasing Cost of Funds

- Same shape requirements
  - IC must be non-decreasing
  - IB must be non-increasing
  - At least one must be strict, i.e., IC increasing or IB decreasing.
- Pretty flexible idea

Stooges Example

- Jobs can only be done today (single period)
- All workers are equally productive
- One task per worker only

Workers	Wages	Tasks	Pay
Larry	\$9	Shine Shoes	\$8
Curly	\$5	Paint a Fence	\$12
Moe	\$7	Register Voters	\$4
Shemp	\$1	Wait Tables	\$5
Joe	\$2	Babysit	\$14

Get them in the right order

Workers	Wages	Tasks	Pay
Shemp	\$1	Babysit	\$14
Joe	\$2	Paint a Fence	\$12
Curly	\$5	Shine Shoes	\$8
Moe	\$7	Wait Tables	\$5
Larry	\$9	Register Voters	\$4

- Incremental Costs from low to high
- Incremental Benefits from high to low
- Do all the tasks where IC<IB.

Only Do these

Workers	Wages	Tasks	Pay	Do it
Shemp	\$1	Babysit	\$14	Yes
Joe	\$2	Paint a Fence	\$12	Yes
Curly	\$5	Shine Shoes	\$8	Yes
Moe	\$7	Wait Tables	\$5	
Larry	\$9	Register Voters	\$4	

Net Benefits are: $(14 + 12 + 8) - (1 + 2 + 5) = 26$

Note you could do it wrong

If you don't get the curvature right you can employ everyone and do all the tasks.

Workers	Wages	Tasks	Pay
Shemp	\$1	Register Voters	\$4
Joe	\$2	Wait Tables	\$5
Curly	\$5	Shine Shoes	\$8
Moe	\$7	Paint a Fence	\$12
Larry	\$9	Babysit	\$14

But the net benefits are less:

$$(14 + 12 + 8 + 5 + 4) - (9 + 7 + 5 + 2 + 1) = 19$$