

# Review of ACCT3210 Parts I & II

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Questions:

## Questions:

- ▶ “I am good.”
- ▶ “/”
- ▶ “sample exam questions”
- ▶ “Can we cite Python or Excel when structuring our answers?”
- ▶ ” ”
- ▶ “.”
- ▶ “Every topics. Please tell more about what will be examined and how’s the format. Thank you.”
- ▶ “Can you provide a few more BUDGETING questions for us to practice?”
- ▶ “taxation returns and tax shield”
- ▶ “Would like to do more exercises on the question that related to tax like the assignment 8.”

## Question Summary:

### 1. Questions about what to practice:

- ▶ “Sample exam questions.”
- ▶ “Can you provide a few more BUDGETING questions for us to practice?”
- ▶ “Would like to do more exercises on the question that related to tax like the assignment 8.”

See slides from Session 6, and following slides.

## Question Summary:

### **2. Questions about exam format.**

- ▶ “Every topics. Please tell more about what will be examined and how’s the format. Thank you.”
- ▶ “Can we cite Python or Excel when structuring our answers?”

See slides from Session 6, and following slides.

## Question Summary:

### **3. Questions about taxes.**

- ▶ “taxation returns and tax shield”
- ▶ “Would like to do more exercises on the question that related to tax like the assignment 8.”

See slides from Session 10, and note that we will only ask definition related multiple choice questions about the tax topics.

## Review Outline:

## Key Topics by Lecture:

1. Location, Time, and Format.
2. Lecture 2:
  - ▶ Key terms: ATC, MC, IC.
  - ▶ Key concept: How do these terms relate to each other and to ideas from other courses.
3. Lecture 3:
  - ▶ Data Analysis Workflow.
  - ▶ Bad (esp. Missing) Data.
  - ▶ How to plot, estimate, and interpret. (basic steps)
4. Lecture 4:
  - ▶ Optimization Workflow.
  - ▶ What does it mean for a constraint to 'bind'?
5. Lecture 5:
  - ▶ Shadow prices.
  - ▶ Framing of the marginal cost.
6. Lectures on Rates of Return and Taxation (7,8,9):
  - ▶ Multiple Choice on Terms (see list below)
7. Lectures on Incentives:
  - ▶ **Not covered by the Mid-term.**



Location, Time, & Format:

## Location & Time:

- ▶ **Time:** The midterm exam is scheduled from **1800** to **1900** on **18 March 2024**.
- ▶ **Locations:** 1103 and LTB, room assignments will be posted on Canvas.

## Format:

- ▶ You have up to one hour for the exam.
- ▶ The exam has five numbered sections worth 30 points per section.
- ▶ The final section of the exam is multiple choice and covers the tax portion of the course.
- ▶ We will only consider your best four sections, and the maximum number of points possible will be 120.
- ▶ You may skip one section without penalty.
- ▶ Please limit yourself to the space provided for each answer, you may use the back of each page for any scratch work you need.
- ▶ Read each question carefully. These questions come from the homework and lectures, please review them carefully as the questions have been modified to the constraints of the exam.
- ▶ This exam is closed book and notes. No aids or assistance of any kind are allowed.
- ▶ Mere suspicion of cheating, sharing answers, or using any unfair means of aid is enough to get your test withdrawn.
- ▶ When you are done, turn in the examination. Failure to do so will result in an automatic failing grade.

## Lecture 2:

## Lecture 2 Topics:

1. Average total cost.
  2. Marginal cost.
  3. Incremental cost.
- ▶ How do these terms relate to each other and to ideas from other courses (esp. Introductory Economics)

## Marginal Cost and Incremental Cost:

- ▶ The **incremental cost** is the change in cost due to changing output by a specific increment, most often one unit. This is often calculated as the difference in costs before and after the change, and is the slope of the line through those two points on the cost curve.
- ▶ The **marginal cost** is the rate of change of cost at a particular point. This is the slope of the line tangent to the cost curve at the point you are making the calculation.

## Marginal Cost and Incremental Cost:

- ▶ *These terms are equivalent*
  1. When the cost curve is linear,
  2. When a linear approximation is appropriate (i.e. useful),
- ▶ *and the terms are often used interchangeably.*
- ▶ *You should clarify in cases where the difference matters (i.e. if the two are meaningfully different).*
- ▶ The exam question will be a version of P1.1 and will not treat the two as interchangeable. **i.e. on the exam  $MC \neq IC$ .**

## Why am I emphasizing this?

In introductory microeconomics marginal cost is often defined as the incremental cost. For example:

- ▶ *Microeconomics* (6e) Perloff, page 190: “A firm’s marginal cost (MC) is the amount by which a firm’s cost changes if the firm produces one more unit of output.”<sup>1</sup>
- ▶ *Microeconomics* (8e) Pindyck & Rubinfeld, page 237: “Marginal cost, sometimes called incremental cost, is the increase in cost that results from producing one extra unit of output.”
- ▶ *Principles of Economics* (4e) Mankiw, page 276: “Marginal cost tells us the increase in total cost that arises from producing an additional unit of output.”
- ▶ *Economics* (14e) Samuelson & Nordhaus, page 733: “The extra cost (or the increase in total cost) required to produce 1 extra unit of output (or the reduction in total cost from producing 1 unit less).”

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<sup>1</sup>In a footnote Perloff mentions the precise definition referencing infinitesimals, but does not discuss when these two definitions are interchangeable and when they are not.



## Why am I emphasizing this?

The role of marginal cost in microeconomic theory depends on the mathematical attributes of the **derivative of the cost function**, attributes which the incremental cost only shares when the two are interchangeable.

- ▶ Price theory.
- ▶ Aggregation to macroeconomic theory.
- ▶ Monopoly definition and pricing.

Particularly important when 'increments' are large (e.g. aircraft) or hard to define (e.g. social media).

## Average Cost (AC):

Total Cost of producing the output over the number of units of output.

- ▶ This is a simple average for single-product firms.
- ▶ Average cost is only defined in multi-product firms when the cost function is separable. That is when there is no interaction between the production of products within the firm. The production processes cannot:
  1. Interfere with each other,
  2. Share capital,
  3. Exhibit any synergy.

## Average Cost (AC):

- ▶ Synergy is the reason why products are grouped within firms, and grouping products within firms is costly so it is unlikely that AC is ever useful in practice.
- ▶ This is at odds with the common use of the concept of average total cost in microeconomic theory, where the decision to enter or exit a product market is made based on expected average total cost.

## Links to Relevant Slides and Examples:

- ▶ Lecture notes.
- ▶ MC, IC, AC defined
- ▶ Formula for AC
- ▶ Formula for MC
- ▶ Formula for IC
- ▶ Excel Example

## Lecture 3:

## Lecture 3 Topics:

- ▶ Data Analysis Workflow.
- ▶ Bad (esp. Missing) Data.
- ▶ How to plot, estimate, and interpret. (basic steps)

## Data Analysis Workflow.

1. Obtain data.
2. Plot data.
3. Model data and evaluate.
4. Interpret data.

## 1. Obtain data.

- ▶ The data you gather should be informed by the question you are asking, if you are modeling cost then you should consider the input of those who designed the products as processes as well as those who conduct them.
- ▶ The model you intend to fit is implicit in this step. If you think  $x$  causes  $y$  you will collect measures of  $x$  and  $y$ .



## 2. Plot data.

- ▶ This should be a test of your intuition, and the quality of the data.

### 3. Model data and evaluate.

- ▶ Start with simple functional forms (i.e. linear regression).
- ▶ Evaluate fit by plotting data and the model, as well as formal statistical tests.

## 4. Interpret data.

- ▶ What does the estimated relationship mean?
- ▶ Does it make sense? Is it physically possible?
- ▶ What is the level of uncertainty inherent in the data? This is both what you see in the graph and what you know about the data generating process.

## Bad (esp. Missing) Data.

- ▶ The handling of missing data is critical. Always ask whether a missing value is a 0 (e.g. R&D is not reported if none occurred) or should be thrown out.
- ▶ More generally, it is important to think through how the data are translated from the real world into rows in your dataset.

## How to plot, estimate, and interpret. (basic steps)

- ▶ Can you explain the steps to create a plot of a dataset using Excel or Python (or something else)?
- ▶ The names of the commands do not need to be precise, you can assume that the tool has been set up and that the person you are explaining it to has a general knowledge of the tools.

## Links to Relevant Slides and Examples:

- ▶ Data Workflow (Data Science)
- ▶ Data Workflow (Statistics)
- ▶ Data Workflow (Accountant)
- ▶ Python Example
- ▶ Excel Example

## Lecture 4:

## Lecture 4 Topics

- ▶ Optimization Workflow.
- ▶ What does it mean for a constraint to 'bind'?



# Optimization Workflow

1. Identify the choice variables.
  - ▶ Keep in mind that the constraints may limit the choice variables.
  - ▶ Be explicit about any natural constraints (e.g.  $q > 0$ ).
  - ▶ Include initial values (guesses) if required.
2. Write out the objective function.
  - ▶ Make any substitutions.
  - ▶ Note whether the objective is to maximize or minimize the function.
3. Write out the constraints.
  - ▶ These will be equations with more than one variable.
  - ▶ Single variable constraints will be reported with the choice variables.
4. Solve.
  - ▶ This will be done with a solver (gekko, excel) in practice.
  - ▶ You will not be asked to take this final step on the exam.

## Optimization workflow:

- ▶ Can you explain the steps solve an optimization problem using Excel or Python (or something else)?
- ▶ The names of the commands do not need to be precise, you can assume that the tool has been set up and that the person you are explaining it to has a general knowledge of the tools.

## What does it mean for a constraint to 'bind'?

- ▶ In the case of a profit function a binding constraint prevents the firm from earning more profit.
- ▶ When a constraint binds, the optimal production plan will include choices equal to the constraint.

## Links to slides and examples.

*Note that lectures 4 & 5 both have examples of the optimization workflow.*

- ▶ Step 1. Choice Variables (linear example)
- ▶ Step 1. Choice Variables (non-linear example)
- ▶ Step 2. Objective Function (linear example)
- ▶ Step 2. Objective Function (non-linear example)
- ▶ Step 3. Constraints (Linear example)
- ▶ Step 3. Constraints (non-linear example): Note that there are no remaining multivariate constraints!
- ▶ Step 4. Solve (Linear example)
  - ▶ Again, you do not have to do this by hand.
- ▶ Excel Examples

## Lecture 5:

## Lecture 5:

- ▶ Shadow prices.
- ▶ Framing of the marginal cost.

## Shadow prices.

For a given objective function and constraint, the shadow price on the constraint is the rate at which the value of the objective function changes as the constraint is relaxed. You may have heard this referred to as a Lagrange multiplier ( $\Lambda$ ) in math and econ where we are interested in its infinitesimal properties; however, in our case we are most interested in its value over specific intervals. I.e. what is the predicted benefit of purchasing 1500 more machines? Increasing a budget by \$100,000,000?

- ▶ Python Example
- ▶ Excel Examples

## Framing of the marginal cost.

In P5 we have:

- ▶ Revenue:  $R = 40x + 42y$
- ▶ Cost:  $C = 30x + 30y$
- ▶ Profit:  $\Pi = 10x + 12y$

What is the marginal cost of  $x$  based on this information?

$$\frac{\delta C}{\delta x} = 30$$

This the marginal cost in the direct sense that you will have to obtain \$30 of resources that you do not have in order to produce 1 unit of  $x$

Is \$30 all you give up to produce one more unit of  $x$ ?

No. Because the amount of  $y$  you produce depends on  $x$ , so we are also giving up \$2 per unit of  $y$  that is displaced.



## Tax Terms

## Tax Terms

- ▶ These will be covered with multiple choice questions.
- ▶ The focus here is on terminology, not calculations, and this portion of the exam will be easy.

## Full list of terms:

1. Assets, investments, and projects all have different pre-tax returns ( $r$ ).
2. Tax rates  $t$  vary across individuals, jurisdictions, organizations, and assets.
3. pre-tax returns  $r$  correspond to post tax returns  $r(1 - t)$
4. When preferential tax treatment increases demand for a tax favored asset it's price increases. This price change is an *implicit* tax.
5. When tax payers use organizational forms like pensions and insurance policies to avoid taxes it is called *organizational form arbitrage*.
6. When high-tax tax payers issue taxable debt to finance the purchase of tax free debt (e.g. municipal bonds in the US) issued by low-tax tax payers (e.g. US non-profit universities) it is called *clientele arbitrage*.
7. The depreciation tax shield is the present value of the reduction in tax payments afforded by the depreciation deduction.
8. The value of the tax shield  $TS$  is a function of the investment  $x$ , the risk-free rate of return  $r$ , the tax rate  $t$ , and the depreciation rate  $d$ .

$$TS = f(x, t, d, r)$$

9.  $TS$  is increasing in both  $d$  and  $t$ .

## Basics of Time Value and Taxes:

1. Assets, investments, and projects all have different pre-tax returns ( $r$ ).
2. Tax rates  $t$  vary across individuals, jurisdictions, organizations, and assets.
3. pre-tax returns  $r$  correspond to post tax returns  $r(1 - t)$

## Implicit Taxes:

4. When preferential tax treatment increases demand for a tax favored asset it's price increases. This price change is an *implicit* tax.

## Org. Form Arbitrage:

5. When tax payers use organizational forms like pensions and insurance policies to avoid taxes it is called *organizational form arbitrage*.

Most individuals will do this during their lifetimes, as this is what happens when you have debt and save for retirement. In HK retirement saving is mandatory, so anyone with **any debt** and income is doing this!

## Clientele Arbitrage:

6. When high-tax tax payers issue taxable debt to finance the purchase of tax free debt (e.g. municipal bonds in the US) issued by low-tax tax payers (e.g. US non-profit universities) it is called *clientele arbitrage*.

## Depreciation Tax Shield:

7. The depreciation tax shield is the present value of the reduction in tax payments afforded by the depreciation deduction.
8. The value of the tax shield  $TS$  is a function of the investment  $x$ , the risk-free rate of return  $r$ , the tax rate  $t$ , and the depreciation rate  $d$ .

$$TS = f(x, t, d, r)$$

9.  $TS$  is increasing in both  $d$  and  $t$ .