ECON-UN 3211 - Condensed summary of topics

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Here's just a quick review of topics covered in the course that will hopefully be helpful for reviewing for the final. No math or pictures, just trying to organize how the topcis we've covered relate to one another in case it helps for building intuition because it can be a bit overwhelming that we're throwing a lot of seemingly different ideas at you—e.g., price-taking, oligopolies, and game theory—but taking a step back a bit here will hopefully reveal some sort of cohesion and interdependence between ideas.

- There are three basic economic activities covered in this course: consumption, production, and exchange
  - Pre-midterm
    - Topic 1: Consumption (problem sets 1-5)
    - Topic 2: Production (problem set 5)
  - Post-midterm
    - Topic 2: production (problem sets 6-7)
      - Externalities
      - Equilibrium
    - Topic 3: exchange economies, building on consumption to introduce the concept of equilibrium and explain where prices even come from (even without production!). It's just two consumers given endowments but because of their preferences still finding it mutually rational to reallocate resources with one another at a certain rate.
    - Topic 4: market structure, building on production by considering equilibria that arise through its interactions with a given demand function. You can also think of imperfect competition together with externalities as two different types of market failures: how firms behaving rationally generates equilibria that are inefficient in that they generate deadweight losses
  - So this will be the approach of this review
    1. Quick overview of consumption
    2. Relate this to exchange economies
    3. Quick overview of production
    4. Relate this to market failures: externalities and imperfect competition

1 Consumption without production or exchange

- There is a market that offers a choice between two goods
- A consumer likes both the goods (monotonic preferences) but has limited resources (a budget) to consume them
- There are two ways to evaluate the relative values of the two goods
  1. A utility function describes how a consumer values one good over the other
  2. Prices describe how "the market" values one good over the other
     - We take prices as given for the purposes when we covered consumer theory, but we saw later how they can arise:
     - In exchange economies without production, they come from preferences and endowments
     - In production economies without exchange, they are decided by firms maximizing profit who might not be accounting for externalities and/or in how production technology and market competition interact with consumer demand
- Marshallian demand combines these two valuations: given prices and budget, how much does the consumer want of each?
  - If a consumer values one good relative to the other ($\frac{MU_1}{MU_2}$) more than the market values that good relative to the other ($\frac{p_1}{p_2}$), maximizing utility would entail trading off the less preferred good for the more preferred one
  - This is effectively what the tangency condition under convex preferences captures
- However, even for well-behaved preferences, this ideal trade isn't always possible. In fact, you might want to trade away more of the less preferred good than you have implying the tangency condition is satisfied for negative values the less preferred good. You can't consume negative amounts of a good so you'll have to settle for a corner solution: use all your money on one good
  - Think of quasi-linear preferences between, say, vacation and food. These preferences give rise to piecewise demand where under a certain income level, you are spending all your income on food but above a certain income level, you spend all additional income on the other good.
  - Below that threshold income level, any amount of vacation you were offered, you'd exchange it for food at market prices because you need to survive: the tangency condition is satisfied at negative values of vacation so you have to settle for the corner solution
  - Above that income level, the tangency condition is satisfied at positive values of both goods

- A Marshallian demand function $x(p_1, p_2, m)$ is a neat object that takes all these preferences and constraints into account by solving the consumer maximization problem

- It's then worth asking, how does this function behave as I change its inputs, p and m (or I instead of m if that's how you choose to represent income)?

  - Well, first think about how the budget constraint changes
    - Changes in nominal income: shifts
    - Changes in relative prices: change in slope
  - Now think about how this interacts with the tangency condition
    - Changes in nominal income: when I get richer, maybe I start to prioritize some goods over the others
      - Normal good: I still want to spend more on this good as income increases
      - Zero income effect I: think of quasi-linear preferences again. After a certain income level, I stop spending any additional income on food: I have maxed out how much I like food, any additional food does not affect my survival so I'm spending 100% of any additional income on vacation instead
      - Zero income effect II: you can also think of perfect substitutes as a special case of quasi-linear preferences: linear-linear preferences where utility is linear in both goods. For a given price ratio, you always prefer one good over the other regardless of income
      - Inferior good: I'll spend less on public transit as my income rises because I can buy my own car

- OK, income is pretty intuitive, but price is more complicated! There are two ways price affects demand:

  - **Income effect**: Just like with a change in nominal income, prices change my *real* income: a price increase makes me poorer, a price decrease makes me richer. Even if nominal income stays the same, it's not enough to afford my original optimal bundle!
  - **Substitution effect**: Remember the tangency condition $\frac{MU_1}{p_1} = \frac{MU_2}{/}p_2$? Well, whenever this tangency condition holds, the price change will change the denominators regardless of what my income is. The change in prices makes me prefer a different way to allocate my budget even if my real income stays the same!
    - The price change makes the equality of the tangency condition an inequality and I will generally want to re-optimize (find a new point where this equality holds) unless
      1. both prices change by the same multiple, in which case it doesn't affect the relative value of the two goods, only how much I can afford of both which is an income effect
      2. I was already at a corner solution so the tangency condition already was not satisfied (e.g. perfect substitutes)
      3. The marginal utility is zero/undefined (kink point of perfect complements)
    - Unlike the income effect which can change consumption in either direction, the substitution effect will lead to (weakly) more demand in the good that became less expensive. It can never be negative under most reasonable preferences.

- OK, so price changes affect my demand through income and substitution effects. Why's this important? Because it means price changes have effects on consumer welfare!

  - Slutsky decomposition: compensate the consumer after the price change just enough that they can afford the same bundle
  - Hicksian decomposition: compensate the consumer after the price change just enough that they can access the same level of utility

- How do we measure these changes in welfare. This is easy when we just have a nominal income change because the welfare effect will be their change of income measured by the shift in budget lines. But price changes are different: we can't just use utility before and after price changes because "five utility", for example, has no specific meaning and utility is ordinal and not cardinal.

- For a change in prices p to p', which has income and substitution effects, we'd like to express the welfare effect the same way we do for a change in nominal income: through changes in "real" income.

  - Remember budget lines are defined by a nominal income level m (or I) and a price ratio p. So any budget line implies a "real income" defined by m and p. Comparing different budget lines allows us to compare real prices. The remaining question is which budget lines to compare so that we account for both price effects.

  1. Compensating variation: "the additional income necessary under the new prices to achieve the original level of utility"
     - Compare using the new prices p'
     - Nominal incomes to be compared:
       - Original nominal income m
       - Budget line under new prices p' that makes just affordable a bundle that gave the same utility (i.e. appears on the same indifference curve)

as the original bundle (which satisfied the tangency condition at the original prices and income).
    - This is the same as budget lines corresponding to the Hicksian income effect
    - Example: a worker negotiating a new contract after a price change has already happened
        * Inflation has increased the price of things I consume so I am effectively poorer
        * CV is the increase in nominal income needed to keep up with inflation in order to maintain the same standard of living
2. Equivalent variation: "the additional income necessary under the original prices to to achieve the original level of utility"
    - Compare using the old prices p
    - Nominal incomes to be compared
        * Original nominal income m
        * Budget line under original prices that makes just affordable a bundle that gives the same utility as the new optimal bundle
    - Example: politician is contemplating a tax on carbon. For an oil company, a tax is equivalent to an increase in price.
        * Oil company is willing to lobby/bribe the politician to avoid them passing the tax. Suppose they are the only ones hurt by the tax in this model.
        * EV is theoretically the most an oil company would be willing to pay to prevent the tax from passing, equivalent to their loss in welfare under the tax
        * The relevant prices are the old prices because welfare loss is calculated in the scenario where the price change never happens
3. Consumer surplus: "the monetary value of consuming at a price lower than the maximum one is willing to pay"
    - A price change induces a change in quantity demanded for a good
    - The change in consumer surplus is the area between the demand curve and the original price between this quantity interval

2 Exchange economies

- Models of consumption and exchange given a fixed endowment but no production (problem sets 7 and 8)
- Depicts how endowments and preferences give rise to opportunities for mutually beneficial exchange
- Consumer theory looked at how the consumer behaves when prices (market valuations of the relative value of two goods) differs from their preferences (i.e., their own valuations of the relative value of the two goods)
- Exchange economies show how prices can arise from the interaction of two consumers' preferences: one consumers' relative marginal utilities interact with another consumers' relative marginal utilities to distribute their fixed endowments
- Clearly if a given distribution of the initial endowment occurs at a point where one consumer prefers more of one good and the other prefers more of the other, there is mutual benefit to trading accordingly until they value the two goods equally. This is what (internal segments of) the contract curve captures: the marginal utilities of one good relative to the other are the same and so nobody would be better off. $MRS_A = MRS_B$.
- But the endowment might be such that at a given exchange rate (i.e. prices) there is excess demand for the same good
    - In other words, we both might have a desire to trade off some good 2 for good 1 at the given prices (we both are in excess demand for good 2)
    - Graphically, this means the tangency condition for both consumers are satisfied at different points of a given budget line through the endowment point
    - For markets to clear, the slope of that budget line (i.e. the prices) has to adjust
    - In this example, the relative price of good 2 will have to rise meaning it costs more of good 1 to get one unit of good 2
    - Eventually it rise to a point where the amount of good 1 that giving up one unit of good 2 gets you is enough to remove the excess demand for one of the consumers and make them desire more good 1
    - If the other consumer remains in net demand for good 2, this means mutually beneficial exchange becomes possible once again and the new prices equalize their MRS
- Another way of putting this: Remember how in consumer theory, we defined the tangency condition $MRS = \frac{p_1}{p_2}$ as describing where the market valuation of the goods matches the consumer's valuation of the goods?
    - Here, internal solutions are where this is true for both consumers simultaneously: $MRS_A = \frac{p_1}{p_2} = MRS_B$
    - Whenever prices are such that MRS_A is not equal to MRS_B, the prices must adjust until they are
    - In other words, when we say prices capture how "the market" values the two goods, the two consumers *are* the market! Prices don't come out of nowhere the way they are in our consumer theory model without exchange and production. They are an equilibrium object.
- But under some preferences, this may not be possible: no amount of good 1 will make me want to give up any good 2

  - An example that might be helpful to keep in mind is the quasi-linear preferences from before. Under a certain income/endowment level, I want food so much that no amount of vacation you can offer me will be worth giving up any food I currently have
  - This is how we get flat corner parts of the contract curve: I have no interest in any additional vacation until I have hit a threshold amount of food to consume
  - This is the intuition behind the corner/edge solutions to exchange economy problems

- Then also consider the Edgeworth box problems with perfect complements
  - I don't care about any single good on their own (e.g., left shoes or right shoes), I only care about the compound good (pairs of shoes)
  - If giving up some left shoes for right shoes increases the number of complete pairs I can own, then there's a possibility for mutually beneficial exchange and there are Pareto improving allocations
  - But if I already have equal numbers of left and right shoes, then giving up any amount of left or right shoes will strictly reduce how many pairs of shoes I can have. In this scenario there are no Pareto-improving allocations.
  - This is why the core is empty in one of the first Edgeworth box examples we looked at with perfect complements

3 Production

Very briefly:

- Recitation 5: Part 1: given technology, input prices and a desired level of production, what's the least costly way to produce at that level
- Recitation 6: Part 2: given this cost function and the market demand, what's the most profitable quantity to produce at?
  - At the firm level, supply decision q determined by
    - First-order condition: $MR = MC$
    - Second-order condition: concavity of the profit function
    - Shut-down condition: more profitable to produce $q^* > 0$ than $q = 0$
- Aggregate supply is then just summing all the firms' supply decisions
- Aggregate demand is given by a market demand function or by summing many types of consumers' demand functions

4 Market failures

- Problem set 6: we give you the demand facing the firm and their cost function and it's easy to solve.
  - Practice problem 2 is aggregate supply from many producers and aggregate demand from many consumers, which are equal at the competitive equilibrium and split consumer and producer surplus
  - Deviations from the surplus-maximizing equilibrium represent a market failure whose impact can be measured as a deadweight loss: the loss in the sum of consumer and producer surpluses
  - We look at two types of market failure:
    - Externalities (problem set 7): the market equilibrium differ is not a *social surplus-maximizing* equilibrium
    - Imperfect competition (problem set 9): the market equilibrium is not a *competitive* equilibrium
- Our treatment of externalities is relatively straightforward and this document is taking more time to write than I expected so I'll omit discussion here but might be useful to have the above classification of externalities and imperfect competition as forms of market failure
- Market failure because the market equilibrium falls short of the competitive equilibrium (problem set 9, recitation 9):
  - Back to the first-order condition for a profit-maximizing firm (MR=MC), MR has two components:
    - quantity effect: the increase in revenue from the last good sold
    - price effect: the decrease in revenue from lowering the price of all previously sold goods to the price of the last good; i.e., the slope of the demand curve
  - Competitive equilibrium (where aggregate demand equals aggregate supply) is where the *aggregate* demand intersects the *aggregate* supply as in Problem Set 6
  - This equilibrium determines the market price p^*. This market price in turn gives rise to a *flat* demand curve *facing the competitive firm* distinct from the aforementioned downward-sloping aggregate/market demand curve facing the market. Because this demand curve is flat, their marginal revenue has no price effect so only a quantity effect, which is constant at p^*
  - But for a monopolist, as the only producer in the market, the demand curve they're faced with is the aggregate/market demand curve. Thus their marginal revenue has the quantity effect *and* a (negative) price effect and is, in contrast, downward-sloping. This creates a wedge between their marginal revenue $MR(q)$ and market demand $p^D(q)$ which allows them to charge a markup:

    - MR is less than the market demand function $p^D(q)$ because of the price effect
    - This means the point where $MR(q) = MC(q)$ occurs at a quantity q^M lower than q^*, the efficient equilibrium where market demand $= MC$
    - At this quantity q^M, $MR(q^M) = MC(q^M)$ is less than $p^D(q^M)$. That is to say, at this quantity, the difference between what consumers pay $p^D(q^M)$ and what it costs to produce a unit at this quantity $MC(q^M)$ is the markup the monopolists can charge in excess of production costs. They have opportunities to profit that competitive firms do not.
    - In charging this excess price above the competitive price and above their production costs, the producer has extracted producer surplus at the cost of consumer surplus

- When this imperfect competition leads to an equilibrium with lower quantities and a higher price, it imposes a deadweight loss

- But the new equilibrium might not actually lead to lower quantities and a higher price! Remember, the price effect is what separates the MR curve from the market demand curve. There are two ways the MR curve can be made closer to the market demand curve:

    - If the producer is allowed to charge a two-part tariff: a price per unit and an entry fee (practice problem 1)
        - If the consumers are homogeneous then we saw that the producer becomes able to charge one price based on everyone's common willingness to pay
        - The producer ends up with an MR equal to the market demand curve but extracts all consumer surplus through the entry fee set at exactly at the point where there is zero consumer surplus while still being willing to pay
        - Since this willingness to pay is the same for everyone, you only need one price to do it
    - With heterogeneous consumers, demand curves and thus willingnesses to pay are different for the different types. Perfect extraction cannot be accomplished one price, so the producer has an incentive to offer different prices to different consumers, i.e., price discriminate:
        - 1st degree accomplishes perfect lossless extraction, there is no DWL because everyone is charged exactly the most they are willing to pay for the good. All consumer surplus is converted to producer surplus perfectly.
        - 3rd degree will generally transfer consumer surplus to producer surplus imperfectly leading to DWL. But the amount of DWL will also generally be an improvement over monopolistic pricing except in the special case where the ideal prices to charge all types of consumers all happen to be the same price.
    - So it's important here to differentiate between DWL and consumer surplus

- The rest of the topic is on the models of oligopoly. I omit discussion here because I already do so at the ends of my recitation slides