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**0. Preface** These notes are modified from those prepared by Ryan Oprea around 2010.

They are intended to help students follow in-class lectures, to organize readings, and to anticipate questions to ask in class. They mention but do not include crucial material. They are not a substitute for reading the text!

## 1. Competitive Markets

I. The Economic Environment

A. The first task in applying economic theory is to specify the essential elements of the economic environment. To clear underbrush, we must make a bunch of simplifying assumptions.

B. Traditional assumptions of competitive analysis:

1. Lots of small buyers and sellers
2. with a whole lot of information about one another
3. all selling the same product
4. with no barriers to their activity.

Actually we don't need the assumptions 2 or 3 or even much of 1. (I'll provide some evidence later).

Behavioral assumption: everyone takes price as given, and does not attempt to change it.

**Competitive markets** $\iff$ **price-taking**.

Q: But then who sets price?

A: impersonal forces of supply and demand.

Exercise: Which of the above assumptions seem reasonable for the Santa Cruz apartment rental market?

C. Market Demand Curve

1. A schedule showing the number of units buyers are willing and able to purchase as a function of the unit price.
   a. This in turn is just the sum of the individual demand curves from everyone in the market.
   b. Controls for "everything else" that might shift the curve...

   **Ex:** Demand in the Discrete [or indivisible] Goods Model

2. Usually we assume there are lots of units demanded and so we represent demand as a continuous function.

   **Ex:** Linear Demand: $q^d = a - bp$
   **Ex:** Log-linear demand: $ln(q^d) = ln(a) + \epsilon_d ln(p)$ or $q^d = e^a p^{\epsilon_d}$.

D. Market Supply Curve

1. A schedule showing the number of units offered by the market for sale as a function of the price charged.

   a. This in turns is just the sum of the individual supply curves from everyone in the market.

   b. Individual supply curves are actually the marginal cost curve of a firm (note however that no firm will supply at prices below their average variable cost).

   **Ex:** Supply in the Discrete [or indivisible] Goods Model

2. We usually end up assuming lots of firms and represent supply as a continuous function as well.

   **Ex:** Linear Supply: $q^s = x + yp$
   **Ex:** Log-linear supply: $ln(q^s) = ln(x) + \epsilon_s ln(p)$

II. Competitive Equilibrium

A. The second task of economic analysis is to apply it, and extract predictions and insights – we call this a **positive theory**.

B. Competitive equilibrium theory predicts: the quantity produced and the price of goods in a competitive market.

C. Intuition:

1. If prices were too high, more units offered than demanded ($q^s > q^d$). Unsatisfied suppliers lower their asking price, and other suppliers have to match.

2. If prices were too low, more units demanded than offered ($q^d > q^s$). Unsatisfied demanders bid the price up.

   **Ex:** Equilibrating forces in the Discrete Goods Model

D. The market won't settle down until there is neither excess supply nor excess demand, and equilibrium is achieved (or approximated).

E. A **competitive equilibrium** (CE) is a price $p^*$ and resulting quantity traded $q^*$ such that $q^s(p^*) = q^d(p^*) = q^*$.

   **Ex:** Equilibrium in the Discrete Goods Model
   **Ex:** Continuous version of discrete goods environment

III. Existence and Uniqueness

A. Is there a a CE? If so, is it unique?

B. If not, the prediction is less useful !

C. Theorem. If

1. $q^d$ is continuous and (strictly) decreasing in $p$,
2. $q^s$ is continuous and (strictly) increasing in $p$,
3. $q^d(0) \leq q^s(0)$ and $q^d(\infty) \leq q^s(\infty)$

D. Then there is a CE $(p^*, q^*)$ (and it is unique).

proof sketch: Apply the intermediate value theorem to excess demand function $Z(p) = q^d(p^*) - q^s(p^*)$.

IV. Welfare Economics

A. Another task in economic analysis is judging an outcome as (relatively) good or bad. This is called **normative** analysis, and is referred to as **welfare economics**.

B. Economists normatively judge outcomes by looking at the outcomes efficiency.

1. So what is efficiency, exactly?
2. Several versions (see Varian Ch 10 for a start) but we'll focus on a vanilla version, Kaldor-Hicks efficiency or cost benefit analysis.
   a. Producer surplus (PS): The amount a producer is paid that is in excess of [variable] cost.
   b. Consumer surplus (CS): The amount a consumer would have paid [WTP, on the demand curve] in excess of the amount she actually had to pay.
   c. Total surplus: TS = CS + PS
   d. Efficiency = [normalized] TS.

**Ex:** Surplus in the Discrete Goods Model

C. Efficiency is a really cold way of saying something really beautiful. An outcome is more efficient if we can make people more happy and/or use up fewer resources (broadly defined) in the process.

D. Economists sometimes call TS the gains from trade

1. It is a measure of the amount of happiness generated purely by the act of trading.

E. On typical supply and demand graphs, total surplus is the area to the left of the number of units produced which is under the demand curve but above the supply curve.

1. You can use integral calculus
2. If supply or demand are linear you can get it with geometry (and you can often approximate with geometry even if it isn't).
3. Our supply and demand charts actually show inverse demand and supply so it might be conceptually easier to use these when calculating surplus.

F. And one of the most celebrated results in economics: the "Invisible Hand Theorem:"

Absent externalities, CE maximizes efficiency.

1. That's right: if producers and consumers compete on price and achieve CE, then the market will:
    a. produce just the right number of goods.
    b. give them to the people who value them most.

    What's the qualification? Externalities refer to costs and benefits not captured or paid by the buyer and seller; we'll discuss examples later, like broadcast TV or water pollution.

    Any other qualifications? Well, the market might not reach CE due to monopoly power, or info problems, or agency problems. Again, we'll discuss examples later.

    Editorial remark: Some markets work quite well if left alone to self organize (e.g., rice). Others work well if engineered properly (e.g., electricity). A few seem problematic (e.g., police protection).

**Ex:** Using integration to find surpluses in continuous environments

V. Deadweight Loss

A. The theory of competitive markets reveals the strength of markets but also (maybe more importantly) the unintended and often unseen downsides of common policy choices.

1. Bad policy leads to **deadweight loss**: it prevents the market from generating all of the surplus possible.

B. Price Controls

1. Price can't rise or fall to adjust to competitive equilibrium
2. Underproduction

**Ex:** Minimum wage

C. Taxes

1. A more complex (and harder to see) cause of deadweight loss is **taxes** on goods
2. Taxes disconnect the price consumers pay from the price suppliers receive.

a. No tax: $p_d = p_s$
b. Quantity tax (tax per unit): $p_d = p_s + t$
c. Value tax (tax on percentage spent): $p_d = (1+t)p_s$
d. The equilibrium price $p^*(t)$ is different from the efficient price $p^*(0)$.

**Ex:** A quantity tax. Set $D = q^d, S = q^s$. Derive tax incidence formula

$$p_s(t) = p^* - \frac{t|D'|}{S' + |D'|}, \qquad p_d(t) = p^* + \frac{tS'}{S' + |D'|}. \tag{1}$$

Also graph PS, CS, $T = tq^*(t)$, and DWL.

D. Tariffs

1. A tariff is just a tax on a limited portion of sellers.
2. Although tariffs can be effective in aiding the untaxed portion of sellers, they cause an overall deadweight loss.

E. Subsidies

1. Even more counterintuitive, **subsidies** cause the same problem in reverse.
2. A subsidy to consumers for buying some product causes $p_d = p_s - t$

VI. Elasticity

A. Demand and supply curves are often best described in terms of **elasticity**,

1. the proportional sensitivity to price.
2. Elasticity of Demand: $\epsilon_d = \frac{\partial \ln D}{\partial \ln p} = \frac{\partial D}{\partial p}\frac{p}{D}$
3. Elasticity of Supply: $\epsilon_s = \frac{\partial \ln S}{\partial \ln p} = \frac{\partial S}{\partial p}\frac{p}{S}$.

B. Is it Elastic?

1. If $|\epsilon| > 1$ we say the supply or demand curve is elastic.
2. If $|\epsilon| < 1$ we say the supply or demand curve is inelastic.
3. If $|\epsilon| = 0$ we say that supply or demand is perfectly inelastic
4. If $|\epsilon| = infinity$ we say that supply or demand is perfectly elastic

**Ex:** Perfectly elastic and inelastic curves.

C. Elasticity and Curves

1. Note that elasticity changes up and down the curve for linear supply and demand curves.
2. However logarithmic supply and demand curves (described earlier) have constant elasticity (they are usually called constant elasticity curves)

D. Taxes and Elasticity

1. When a tax gets levied on a producer, how much of that tax ends up being "paid" by the consumer?
2. Turns out it depends on the elasticity of supply.
   a. Extreme cases:
      - Perfectly inelastic: None of it gets passed on to consumers
      - Perfectly elastic: All of it gets passed on to consumers
   b. In non-extreme cases it depends on the relative elasticity of the supply and demand curves.
   c. In constant elasticity of demand markets you can find the effect of a tax on the price faced by consumers by applying a simple formula:

   $\frac{\partial p_d}{\partial t} = \frac{\epsilon_s}{|\epsilon_d| + \epsilon_s}$

      - The greater the elasticity of supply relative to the elasticity of demand, the greater the portion of taxes passed onto consumers.

VII. The Communicative Role of Prices (Hayek, ...)