Microeconomic theory focuses on a small number of concepts. The most fundamental concept is the notion of **opportunity cost**.

Opportunity Cost (or "Wow, I coulda had a V8!")

The underlying idea is derived from the concept that when an economic decision is made, there is a **goal** that the decision-maker (or agent) wants to achieve. All The choices are is made within some limitations or **constraints**. To acquire one thing, something else must be given up. The contribution toward the goal foregone from the best such alternative is the **opportunity cost** of the choice undertaken. For example, when I spend some money on one purchase, I forgo the satisfaction I would have received from spending that same money on something else. All decisions that are made within this context of scarcity result in some opportunity cost.

Opportunity cost differs from the accounting cost. Say I own a business where I work 40 hours a week and I earn $12,000 after I pay all my expenses. From an accounting point of view I made a profit. However, from an economist's point of view, I have overlooked the opportunity cost of my labor. What was that opportunity cost? The amount of income I could have earned by using those 40 hours in the next best alternative ... perhaps, working for another firm doing the same type of work?

Rationality-Goals, Constraints, Behavior

For these problems to make sense we have to assume that our agents are rational. By **rational** we mean something very specific. Namely that our decision-makers, or **agents**, have goals or objectives. Since they will typically be asked to choose subject to certain limitations, we will model their behavior by asking how they can best achieves these goals within the limitations imposed by the constraints. From that model we will infer something about choice or **behavior**.

For example say I am an individual with a specified amount of money to spend. I may purchase different goods at known and fixed per unit prices for each. How will I spend my income? Perhaps I have some way of comparing different baskets of goods. Then I might select that market basket which was preferred to all others which I could afford. (I could maximize my satisfaction subject to a budget constraint).

It is important to note that when we are talking about **'rationality'** we are not making any value judgment about the goal. In our example, I am not saying that the preferences are sensible. (Perhaps they are self-destructive and unhealthy!) When we talk about theory of consumer choice we talk about people having **preferences**. We are not making any judgment about the reasonableness of the preferences. In this case of the consumer, the question is: given an individual's budget, how does that individual best achieve his/her preferences? **As long as his/her actions are geared so as to best achieve those preferences, then he/she is rational.** So the notion of rationality means that you are following some sort of optimizing or maximizing behavior. This is what allows us to infer something about the agent's behavior. This allows us to do the exercise of asking how behavior changes when the constraints change. This is called **comparative statics**. It allows us to ask for example, what would be the affect of a sales tax? How would it alter the environment that people operate under and how would that in turn alter their behavior? Thus Given this information, we can make certain predictions.

Not Modeling the Real World

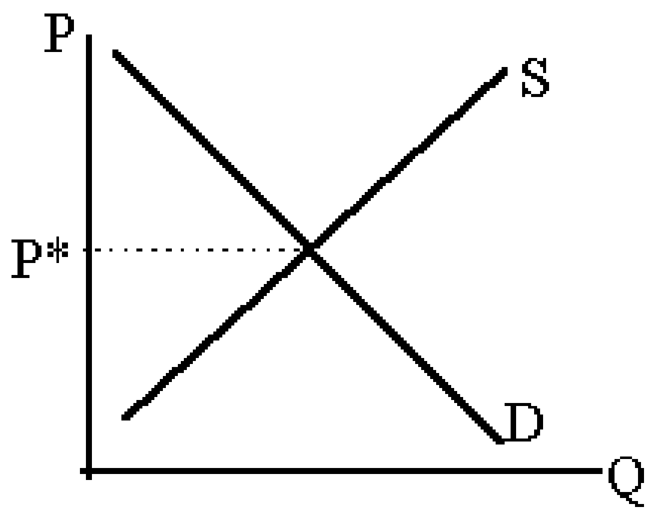
Let's take a step back. This is not a course about modeling the real world. There are incredible refinements that one has to make in order to describe the way in which people make decisions. We are grossly simplifying the nature of the consumer or firm's problem in order to produce a simple, tractable model. A map that is as detailed as the terrain it is attempting to describe is too large to be of any use. Similarly when we speak about constructing models, we will not be attempting to construct them with all of the richness and complexity of the world. Rather we will be focusing on those aspects we think are most important. We will focus on features that we think have the essence of what drives a particular problem. In this course, we will be examining how those concepts work and interact. For example, we will see how this notion of opportunity cost plays against changes in prices and how they alter behavior.

In order to simplify, we will make numerous assumptions. We will assume that people's preferences do not change from one moment to the next and that they depend only on the physical amounts that are consumed and not upon the prices at which those things are sold. ("I would like diamonds just as much even if they were cheap.") Thus we will make assumptions that under certain circumstances may not be the right ones. So when we look at a **real** problem, we may have to adjust our usual assumptions to insure that our model is appropriate.

Comparative statics can often tell us is in what direction certain changes might push decisions, but we will need quantitative data in order to assess the magnitudes of these changes. For example, one party may argue that the Aid to Dependent Children program creates an incentive for people to have more children; or that an income tax would discourage people from working as hard as they otherwise might by lowering the incentive to trade labor for leisure. However, neither argument tells me by how much. They don't convey whether these effects are negligible or whether they would have a profound effect in encouraging people to behave differently. All the theory can tell us is that that may be something to examine. Theory can help us organize our thoughts and hopefully figure out which questions about the world we need to be able to answer in order to figure out the magnitude of those predictions. Once we can answer those questions predictive about the world, then we can agree on what **will** happen and get down to arguing about what we'd like to have occur.

Equilibrium and Comparative Statics

Say we have a market for some commodity (see figure 2). In ECON 1 you learned that price would be equal to P*.



Figure

P* is an **equilibrium** price for the market. That is, under plausible assumptions regarding the behavior of individuals and firms, when all firms are offering to sell at P* and all individuals offering to purchase at P*, no agent has an incentive to behave differently. Since supply and demand are equal, all plans can be fulfilled. At any different common price, the market wouldn't clear and some agent's intentions would be thwarted leading to a change in behavior.

The problem of equilibrium is closely related to the question of **stability**. If a system at P* is at rest, then would a price not at P* lead to a change toward P*? For example, if price were higher, would the supply in excess of demand lead to price-cutting and would this cause price to fall toward P*? For comparative statics we are concerned with both the existence and stability of equilibrium.

Positive and Normative Economics

When we speak of simply describing the outcome resulting from a change in constraints, we are engaging in what is commonly termed **positive economics**. We are not attempting to characterize the change as "good" or "improving" but are merely noting the changes in measurable quantities that have resulted from our experiment. Frequently however, economists compare alternative changes to the constraints (say from some governmental policy choices) and here **value judgements** begin to enter. At the level of the individual decision maker, the agent's goals provide a measure for evaluating whether the change is improving. When many agents are involved, there are both universal improvements and trade-offs between agents. While the former are unambiguously "better", the latter present the more interesting problems. In our later discussion of welfare economics, we shall seek to establish some minimal criteria for judging

1. when a situation can be improved and/or
2. when a policy constitutes an "improvement" or "potential improvement."

Mathematical Notation

Make sure you know how to read things like:

$X=\{ x| f(x) \geq x^o\}$

Which reads: Capital **x** is a set of elements **x** such that **f** of **x** is at least as large as $\mathbf{x^o}$

∀ means "for all"

∃ means "there exists"

s.t. means "such that." In the case of constrained maximization, s.t. means “subject to.”

rhs means "right hand side"

lhs means "left hand side"

The sign "=" is different from "≡ ". The second one means "identity". To illustrate the difference, consider Figure 2. We define equilibrium as the p and q such that D(p)=S(p). However, as functions, D(p) and S(p) are not identical equal (it is clear that the two lines are not identical equal) and therefore this is they are not an identity.

One way to check this is by differentiating both sides of the equation. In fact, in this case, $D'(p) \neq S'(p)$. If we differentiate an identity, then both sides remain equal. Let's use the example of the tax where $S(p^*)=D(p^* + t)$. If we define p^* as a function of t we can write it as an identity: $S(p^*(t)) \equiv D(p^*(t) + t)$. For any value of t, p^* is going to be that value that makes this identity true. If we differentiate this identity we get:

$$S'\left[\frac{dp^*(t)}{dt}\right] \equiv D'\left[\frac{dp^*(t)}{dt} + 1\right],$$

where S' is evaluated at $P^*(t)$ and D' is evaluated at $P^*(t)+t$. Solving for $dp^*(t)/dt$ we get :

$$\frac{dp^*(t)}{dt} = \frac{D'}{S'-D'}$$

This algebraic expression tells me how a price is going to change as I put on a tax.

I. Constant function rule.

Consider a constant function y=f(x)=k, this function has no slope and therefore the derivative will alway be zero.

$(dy/dx)=0$ or $(dk/dx)=0$ or $f'(x)=0$

II. Power function rule

$(dx^n/dx)= nx^{n-1}$ or $f'(x^n)= nx^{n-1}$

III. Sum-difference rule

$$\frac{d}{dx}\left[f(x) \pm g(x) \pm h(x)\right] = f'(x) \pm g'(x) \pm h'(x)$$

IV. Product Rule

$$\frac{d}{dx}\left[f(x)\cdot g(x)\right] = f'(x)g(x) + g'(x)f(x)$$

V. Quotient Rule

$$\frac{d}{dx}\frac{f(x)}{g(x)} = \frac{f'(x)g(x) - g'(x)f(x)}{g(x)^2}$$

VI. Chain Rule

Assume

z=f(y)

y=g(x)

$$\frac{dz}{dx} = \frac{dz}{dy}\frac{dy}{dx} = f'(y)g'(x)$$

PARTIAL DIFFERENTIATION

Consider a function with multiple independent variables (multivariate function).

$y=f(x_1, x_2 \ldots\ldots x_n)$

Assuming that all the independent variables are not correlated with one another. If x1 undergoes a change while all others right hand side (independent) variables remain fixed, there will be a corresponding change in y (Δy). The difference quotient in this case can be written as follows:

$$\frac{\Delta y}{\Delta x_1} = \frac{f(x_1 + \Delta x_1, x_2, \ldots., x_n) - f(x_1, x_2, \ldots., x_n)}{\Delta x_1}$$

The derivative will be found when we take the limit of ($\Delta y/\Delta x_1$) as $\Delta x_1 \Rightarrow 0$. This derivative is known as the "partial derivative" since it is only concern with one independent variable and is usually denoted as follows

$$\frac{\partial y}{\partial x_1} \equiv f_1' = \lim_{\Delta x_1 \to 0} \frac{\Delta y}{\Delta x_1}$$

Notice that the d in the derivative have been replaced by ∂.

With Partial derivatives we can take the derivative of a multivariable function with respect to only one independent variable in the function. This assumes that the independent variable in question is not correlated with other independent variables. In order to deal with a function in which some or all of the independent variables are correlated, we must resort to a total derivative. This allows us to take the derivative with respect to a certain independent variable taking into account the effect that changes in other independent variables will have on the variable in question. This is based on the notion of a total differential which will be discussed below.

Statistics:

Mean (Average)
Average refers to the sum of numbers divided by n. Also called the mean average.

Weighted Average.
Instead of dividing by the numbers of observation (n) each observation is weighted by a number between zero and one. The sum of the weights needs to equal one.

$$\text{(Weighted Average)} = \sum_{i=1}^{n} w_i R_i$$

where w_i = the weight given to observation i;
R_i = the value for observation i;
n = number of observations.

Median: The middle value of the given numbers or distribution in their ascending order.

Mode: The value that appears most often in a set of data.

Variance (Standard Deviation)

1. Variance: Measure of the variation of possible values for each observation around the mean.

$$\sigma^2 = \sum_{i=1}^{n} \left[R_i - E(R_i) \right]^2 * w_i$$

where w_i is the weight assigned to observation R_i. Is they are equally weighted each w_i is simply 1/n.

2. Standard deviation: The square root of the variance:

$$\sigma = \sqrt{\sum_{i=1}^{n} \left[R_i - E(R_i) \right]^2 * w_i}$$

Covariance is a measure of the degree to which two random variables move together.

a. A positive covariance indicates that the samples tend to move in the same direction, while a negative covariance indicates that they tend to move in opposite directions.

b. The size of the covariance indicates the size of the comovement.

c. Covariance is defined as:

$$\mathrm{Cov}_{ij} = \sum_{i=1}^{n} \sum_{j=1}^{m} \left[R_i - E(R_i) \right] \left[R_j - E(R_j) \right]$$

Covariance and Correlation

a. Covariance has a drawback in that it depends upon the variability of the individual series. It also has as its unit of measurement the product of whatever the two variables are measured in.

b. The correlation coefficient is defined as:

$$r_{ij} = \sum_{i=1}^{n} \frac{Cov_{ij}}{\sigma_i \sigma_j}$$

where:

r_{ij} = correlation coefficient of variables;

σ_i = standard deviation of i;

σ_j = standard deviation of j.

1. The correlation coefficient ranges from -1 to -1. A coefficient of +1 indicates perfect positive correlation, while a coefficient of-1 indicates perfect negative correlation.
2. The correlation coefficient is unitless.
3. Standard Deviation of a Portfolio