<u>AAE 575 Lecture 1 Week 3</u>

For the next couple of weeks we are going to focus on developing an economic model for our specific commodities of interest, and then identifying an empirical model from the economic model, and looking at specific problems associated with estimation and forecasting of prices. Keep a couple of points in min relative to modeling and forecasting:

1) Modeling is an attempt to assign causality, and translate information into good decisions about market (price) performance. Forecasting translates those decisions into expected outcomes **<u>BUT</u>** good decisions do not equal good outcomes. As a result, few market analysts rely on a single or even small set of decision criteria. While model development should be as objective as possible, selecting among a set of properly identified models is subjective. Your challenge as a trader is to decide what to believe when.
2) One way to evaluate what to believe is to have a set of hypotheses against which to evaluate the outcome of any empirical measure. For our case, we are going to use economic theory. We will have expectations about how prices should respond to changes in other prices, changes in income, etc. If the empirical model does not validate the theory, we, at least initially, want to reject the empirical results until we can rectify them with the theoretical expectations.

Demand Theory

Understanding demand theory is important in explaining price performance, and provides a framework for empirical studies of demand and price analysis.

We generally think of demand at the individual or household level. Each individual has a large number of consumptive desires. These may arise from basic needs (food and shelter), unique personal characteristics, and physical and social environmental influences. However, consumptive opportunities are usually constrained by income and/or wealth constraints. The consumer’s challenge is to pick a consumptive bundle that achieves the greatest possible satisfaction given constraints on expenditures.

Economists refer to this challenge (balancing well being against expenditure constraints) as maximizing utility, where utility is a measure of individual well being. Conceptually, this utility maximization problem could be expressed mathematically if we knew the algebraic form and parameters of the utility function. Constrained optimization techniques could then be used to derive the optimal consumption bundle from the consumer's consumption possibility set given expenditure constraints. In addition, we could articulate specific demand functions for each good, establishing a cause and effect relationship between the arguments of the demand function and the demand for any consumable of interest.

For example, assume a consumer has two products to consume, and we know the utility function can be specified as a multiplicative relationship between the two goods:

(1) $U = q_1 q_2$

where U is utility and q_i is some consumption good.
In addition, we can impose the income constraint:

(2) $Y = p_1 q_1 + p_2 q_2$

where Y is periodic income and p_i is price.
If we know income and price, we can substitute those in:

(3) $100 = 2q_1 + 5q_2$

We can now solve for q_2 as a function of q_1:

(4) $5q_2 = 100 – 2q_1$, or

(5) $q_2 = 20 – 4/5\ q_1$

This suggests that if prices and income remain unchanged, an increase in q_1 will result in a decrease in the consumption of q_2. By substituting for q_2 in then utility function we can express utility purely as a function of q_1:

(6) $U = 20q_1 - 2/5q_1^2$

We can now measure the marginal benefit (i.e., effect on utility) of consuming one more unit of q_1. The marginal change in U given a change in $q_1$by the partial derivative of U relative to q_1:

(7) $\partial U/\partial q_1 = 20 - 4/5\, q_1$

We hypothesize that we will continue to consume a good until its marginal satisfaction from one more unit of consumption is zero, i.e. until we are satiated. For q_1, this can be measured by setting the above derivative equal to zero:

(8) $20 - 4/5\, q_1 = 0$

and solving for q_1:

(9) $20 = 4/5\, q_1$

or

(10) $q_1 = 25$

Substituting for q_1 in the budget constraint results in $q_2 = 10$.

Look back at equations 4 and 5. Notice that we expressed q_2 as a function of its own price, the price of q_1, and income. If we solve equation (2) for q_2 we get:

(11) $q_2 = Y/p_2 - p_1q_1/p_2$

If we solve equation (2) for q_1, substitute into (11), and then solve 11 for q_2, we would eventfully express q2 purely as a function of prices and income. This is the demand expression for q_2.

While we don't really know what anyone's utility function looks like, we have discovered what the relevant arguments are in the individual consumer's utility function:

DEMAND = f(own price, other prices, income)

Consumer versus Market Demand

Consumer demand reflects the quantity purchased by an individual consumer as the price of the relative good changes. Everything else (like other prices and income) are held constant. We can present it two ways: 1) as a matrix of price, quantity pairs (a demand schedule), or 2) as a graph or algebraic function of prices and quantities (a demand curve).

Market demand is an aggregation (or horizontal summation in a graphical sense) of all individual consumers demand functions. In addition to the arguments of the individual consumer demand function, it includes population, and is impacted by consumer entry and exit from the, market, and aggregate changes in tastes and preferences.

We need to differentiate between two types of demand changes. The first is a change in static demand. This is a movement along an specific demand curve, and is referred to as a change in the quantity demanded (as opposed to a change in demand). Thus, a specific demand curve only examines a quantity response to a change in a good's own price, holding all else constant (income, other prices, population, etc.). However, we usually estimate demand functions using time series data, which implies all else was not constant over the time demand was observed. Thus, while a demand curve shows a price/quantity relationship for a specific moment in time, we general estimate a demand function over an interval of time. The result is that we are usually incorporating other changes into the measure of static demand.

The observed response to a price change will depend on assumptions consumers make about future price changes. If a consumer expects prices to continue changing in the direction of the initial change, the response may be very different than if they think the initial change is temporary, and there will be a return to the original price. For example, if prices decline, and consumers expect a further decline, their demand they may not increase consumption based on the notion of further price decline. If a price decline is viewed as temporary, and consumers expect prices to increase ion the futures, they may increase purchases relative to the prediction of a demand curve, especially if the good is storable.

Dynamic demand refers to changes in demand resulting from changes in demand arguments other than own price. Also, in the dynamic environment we can account for time lags between a price change and the consumer response.

It is important to differentiate between a parallel shgift in demnand, and structural changes in demand. For example, assume the following demand function:

$$Q = \alpha + \beta P + \gamma Y$$

A change in P (price) or Y (income) results in a parallel shift. Only purchasing power has changes, not the consumers' tastes and preferences. While more will be purchased at any given price, the new purchases simply result from an increase in the budget constrain. Them basic relationship between price, income, and demand have not changed.

A change in βor γ is a structural change in demand. There is a change in the amount purchased given some change in price or income. For example, if β decreased, than every subsequent decrease in P will result in a smaller change in Q than previously. There has been change in the preference for Q relative for Q. In other words, its contribution to overall utility is different than before. Several factors can lead to a structural change: 1) a change in the health perception of a good, a change in the substitutes available, a change in population, a change in the distribution of income across the population, etc.

In reality, several things can change at once. Foe example, if we attempted to compare the demand fro bee if the mid-1980's with the demand over the last several years, we would find a very different price/quantity relationship between the two different periods. One recent phenomenon has been the introduction of the high protein diet. This has increased people's perception about the relative health benefits of red meat, and expanded the total population reflected in the demand market curve (people whom were vegetarians have adopted a lean protein diet, including red meat).

However, the excellent returns in the equity markets in the late 1990's also contributed to substantial increases in income. Thus, the perceived incr4ease in the demand for beef has been influenced by factors that suggest a parallel shift in demand, as well as factors that imply a structural change in demand.

For most agricultural commodities, the relationship between income and demand is positive, but there are examples where the relationship is negative. It can also be positive at some levels of income, and turn negative at higher levels of income. Even when it is positive, however, the rate of consumption growth usually declines as income increases.

The relationship between total income and the amount spent on a food item is called the Engle curve. An important component in recognizing the impact of income changes on demand is where along the Engle curve the consumer is.

A redistribution of income can also affect demand even if aggregate income does not change. For example, if income is re-distributed away from consumers on the nearly flat part of the Engle curve toward consumers on the steeper portion, the increase in consumption by those receiving income will more than offset the decrease from those losing income. This suggests that even things like tax cuts will have different impacts on a good's overall demand depending on where (in terms of targeted income groups) the tax is directed.