# Synopsis of the first lecture in ECO 5315

By Jim Garven
October 4, 2009

**Context for ECO 5315**

During Thursday night's class meeting, I introduced the managerial economics course by providing an important context not only for ECO 5315, but also for the entire EMBA curriculum. The EMBA curriculum is organized around a diverse set of courses which are based in large part upon social science disciplines such as economics, psychology and sociology. Much of your coursework will involve applications of important concepts and principles from these social sciences to business management problems. You'll find that courses like managerial economics, finance and accounting draw fairly heavily upon economics (especially microeconomics), whereas management and marketing tend to lean more heavily toward psychology and sociology. Furthermore, both ECO 5315 and QBA 5330 differ somewhat from the "core business foundations" courses (e.g., accounting, finance, and marketing) by being more focused upon developing an understanding of the *analytic foundations* for decision-making. This is why these courses occur so early in the program; the idea is to provide you with a conceptually and quantitatively rigorous toolkit that you can subsequently apply throughout the rest of the program.

**Calculus and Optimization**

A particularly important part of the analytic toolkit for managerial economics is basic calculus. Well over a century ago, Alfred Marshall developed many of the important principles of modern economics by applying "marginal" analysis to problems. It turns out that concepts such as supply and demand, maximizing profit, minimizing cost, etc. readily lend themselves to the application of basic algebra and calculus concepts.

I showed that algebra and calculus share in common the problem of calculating slope values. The primary difference is that the algebra indicates slope values for *discrete* changes, whereas the calculus indicates slope values for *continuous* changes. By a discrete change, I mean a change that is "countable"; e.g., in the equation $y = 10 + 5x$, a discrete change ($\Delta y$) occurs in $y$ whenever a discrete change ($\Delta x$) occurs in $x$. For example, suppose the initial value for $x$ is 2 and then we change $x$'s value to 4. When $\Delta x = 2$, $y$ changes from 20 to 30, so $\Delta y = 10$ and $\Delta y/\Delta x = 10/2 = 5$. By a continuous change, I mean a change that is infinitesimally small; specifically, we study how an infinitesimally small $\Delta x$ (called $dx$) causes an infinitesimally small $\Delta y$ (called $dy$) to occur. It turns out that in the case of our line example, $dy/dx = \Delta y/\Delta x = 5$. In cases involving nonlinear functions such as a parabola (where $y = x^2$), $\Delta y/\Delta x$ is at best a crude approximation for $dy/dx$. However, as $\Delta x \to 0$, $\Delta y/\Delta x \to dy/dx$; in other words, the algebra result converges upon the calculus result.

In calculus, slope values are determined via a procedure called "differentiation", and the slope of a function such as a line or a curve is referred to as its "first derivative". The first derivative indicates the rate at which one variable (let's call it $y$) changes with respect to small changes in another variable (let's call the other variable $x$). The second derivative corresponds to the rate of change in the slope itself. The second derivative comes in handy whenever we try to maximize or minimize a function. For example, suppose you are interested in determining how many units of a product to produce. If you produce and sell $Q$ units of this product at a price of $P$ dollars per unit, then total revenue of $TR = PQ$. If your total costs ($TC$) are fixed, then you would want to maximize total revenue, since this would maximize profit. However, one also typically incurs variable costs which increase as more units are produced, so in order to maximize profit, you'll want to produce up to the point at which the revenue generated from selling the last unit of product (also known as marginal revenue, or $MR$) is equal to the cost incurred from producing that unit (also known as marginal cost, or $MC$). Since marginal profit ($MP$) = $MR - MC = 0$, this implies that total profit is either maximized or minimized when $MR = MC$.

Suppose total profit is $\pi = TR - TC$, where $TR = 30Q$ and $TC = 40 + 3Q^2$; then marginal profit $MP = d\pi/dQ = dTR/dQ - dTC/dQ = 30 - 6Q$, which equals 0 if $Q = 5$. We know that this is maximum profit because the 2nd derivative (which corresponds to the slope of the slope of the total profit equation) is negative; i.e., $d^2\pi/dQ^2 = dMP/dQ = -6 < 0$. Conceptually, a negative second derivative implies that as one moves away from $Q = 5$; e.g., by selecting either $Q = 4$ or $Q = 6$, then profit must be lower than at $Q = 5$. Note that at $Q = 5$, $\pi = 30(5) - 40 - 3(5^2) = 150 - 115 = \$35$. Profit at $Q = 4$ is only $\pi = 30(4) - 40 - 3(4^2) = 120 - 88 = \$32$, so producing 5 instead of 4 units results in \$3 more profit. Similarly, profit is also \$3 lower at $Q = 6$ compared with $Q = 5$; note that if $Q = 6$, then $\pi = 30(6) - 40 - 3(6^2) = 180 - 148 = \$32$. Finally, also note that at $Q = 5$, $MR = 30$ and $MC = 6(5) = 30$!

**The Objective of the Firm: Maximize Shareholder Value**

Since our models must account for behavior across firms generally, we take the view that managers in profit-oriented organizations try to increase the net present value of expected future cash flows. The market value of the firm is equal to the present value of all of its future expected profits out into the indefinite future. Since we cannot know *a priori* how long the firm will exist, we compute the value of the firm as a perpetuity (recall from the lecture the famous saying that "…it is better to be vaguely correct rather than precisely wrong"!).

If we don't expect the firm to grow either more or less profitable over time, then its value $V = \pi/i$, and the *expected* annual rate of return from investing in this firm is $i = \pi/V$. The expected rate of return $i$ is also commonly referred to as the discount rate, or the firm's cost of capital. For example, if $\pi = \$10$ and $V = \$100$, then $i = 10/100 = 10\%$. However, if we expect the firm's profits to either grow or contract at the rate $g$ every period, then $V = \pi_1/(i - g)$. From this equation, we can see that the value of the firm is positively related to its expected profit ($\pi_1$) and the rate of growth in expected profits ($g$), and inversely related to its discount rate ($i$). For the sake of comparison to the no-growth case, let's calculate the value of the firm assuming a) 5% growth, and b) 5% decline:

a) (5% growth): $V = V = \pi_1/(i - g) = \$10/(.10–.05) = \$200$; and
b) (5% decline): $V = V = \pi_1/(i - g) = \$10/(.10+.05) = \$66.67$.

Other things equal, managerial actions which increase expected profit, increase growth, or reduce the discount rate will make the firm more valuable. In light of these insights, note the following:

- Expected profits ($\pi$) are influenced by managerial decisions which affect the firm's revenues and costs; marketing managers and sales representatives work hard to increase the firm's total revenues, while its production managers and manufacturing engineers strive to reduce its total costs.

- The firm's expected rate of growth ($g$) also depends upon how the firm strategically positions itself; e.g., whether it has substantial market share or not, how financially robust it is, etc.

- The discount rate ($i$) depends in part upon how much business and financial risk is taken on by the firm. If investors are averse to risk, this implies that the more risk the firm takes on, the higher the discount rate will have to be in order to attract investors. Business risks are affected by managerial choices concerning the lines of business that are selected and production technologies that are implemented. Capital is costly because resources are limited and the commitment of capital to one business activity precludes the possibility of committing it elsewhere; hence there is an *opportunity cost* which needs to be taken into consideration. Furthermore, the firm's financial managers play a major role in attracting and acquiring capital, and the decisions that they make concerning capital structure (e.g., relative proportions of different types of capital, debt maturity, liquidity, risk management, etc.) all affect the discount rate which the market uses to determine firm value.

**The Principal-Agent Problem – a Challenge to Value Maximization**

The interests of a firm's owners and those of its managers may diverge, unless the manager is the owner. However, since the capital raising and risk bearing capabilities of most entrepreneurs are limited, the separation of ownership and control often cannot be avoided. Unfortunately, the separation of ownership and control may give rise to conflicts, or so-called principal-agent problems because incentives are not properly aligned.

Moral hazard is what lies at the heart of the principal-agent problem. Moral hazard occurs when one party is responsible for the interests of another, but has an incentive to put his or her own interests first. In the owner-manager relationship, owners want managers to maximize firm value, whereas managers prefer more compensation and less accountability. Managers who choose not to maximize firm value may act this way if compensation is not adequately sensitive to the fortunes of the firm's owners. An important tactic for solving this this principal-agent problem involves devising methods that lead to convergence of the interests of the firm's owners and its managers; e.g., implementing executive compensation contract designs that directly tie managerial compensation to shareholder welfare; e.g., via share/option ownership, bonuses linked to profits, etc. We'll delve into this topic in some detail toward the end of the course when we cover chapter 14 in the textbook.

**Supply, Demand, and the Concept of an Equilibrium Price**

We ended our evening together by discussing the concepts of supply and demand and applying these concepts to evaluating the effects of public policies such as price controls. The demand function models the relationship between the quantity demanded and price within a given period of time, holding other influences such as income, product quality, prices and product quality of substitutes and complements, advertising expenditures, etc. constant. The demand curve is negatively sloped, which implies that the quantity demanded increases (decreases) as price falls (rises). The supply function models the relationship between the quantity supplised and price within a given period of time, holding other influences such as technology and costs of factor inputs (e.g., labor and capital) constant. The supply function has a positive slope, which implies that the quantity supplied increases (decreases) as price rises (falls).

We can determine the equilibrium price by equating supply and demand. If actual price is above (below) equilibrium price, there will be a supply surplus (deficit) that puts downward (upward) pressure on the actual price. If actual price is equal to equilibrium price, then there will be neither a shortage nor a surplus and price will be stable. Of course, this analysis presumes that everything else is held constant. Whenever the determinants of supply and demand change, then market prices will naturally converge toward new equilibrium prices and quantities.

This leads us to a consideration of the economics of price controls. If the government sets floors below which prices are not allowed to fall, this will likely create an excess supply in the market. An obvious example is the minimum wage law. By creating an excess supply of low-skilled workers, this policy produces the unintended consequence of unemployment for such workers. The problem with the policy is that an artificially high wage rate effectively prices low-skilled workers out of the market. The most recent example of this pertains to the 70-cent-an-hour increase in the minimum wage that took effect in July 2009; almost on cue, the August 2009 and September 2009 jobless numbers confirm the rapid disappearance of jobs for teenagers in particular (for a more detailed theoretical and empirical analysis, see "Delay the Minimum-Wage Hike" and "The Young and the Jobless".

On the other hand, if the government were to set price ceilings in some market, then this would likely result in excess demand. From time to time, the United States government has experimented with price ceilings which have usually resulted in socially adverse consequences. A classic example of this occurred at the end of World War II, when the government imposed wage-price controls in a futile attempt to tame inflation. Since firms could not legally pay market clearing wages to workers, they turned to other forms of compensation (e.g., pension benefits and health insurance) which were not legally counted at the time as wages. Here, the unintended consequence was to unnecessarily tie health insurance to employment, and this problem lies at the heart of the current health care reform debate, some 60 years later. Also, during the 1970's gasoline prices were regulated as part of a futile effort to mitigate the effects of price shocks due to oil embargoes by OPEC. The result of this policy was long queues for obtaining gasoline, and in many cases, people had great difficulty finding stations that had adequate supplies.