The Digital Economist

Lecture 1 – An Introduction

Economics is the study of social behavior guiding in the allocation of scarce resources to meet the unlimited needs and desires of the individual members of a given society.

This social science seeks to understand how those individuals interact within the social structure to address key questions about the production and exchange of goods and services. First, how are individual needs and desires communicated such that the correct mix of goods and services become available? Second, how does a society provide the incentives for these individuals to participate in the production these goods? Third, how is production organized such that maximum-possible quantities are made available given existing resources and production technology? Finally, given that these individuals are at one time involved in the production process and at other times seeking to acquire the goods that have been produced, how are trading rules and exchange agreements established?

The above questions stress the importance of understanding the process of production. The goal here is to understand the basic features of production without getting mired in great technical detail. This is accomplished by developing a simple model that maintains the important features of what are, otherwise complex, engineering relationships. Production is about the conversion of scarce resources into desired goods and services. These resources are often referred to as the **factors of production** -- a short list that includes:

- **Land** (acreage and raw materials)
- **Labor** (unskilled, semiskilled, professional)
- **Capital** (machines, factories, transportation equipment, and infrastructure) and
- **Entrepreneurship** (organizing the other factors of production and risk-taking)

This list is brief and yet complete intended to provide sufficient detail to model the input choices available to the producer. Accordingly, the combination of Land, Labor, Capital, and Entrepreneurship will be sufficient to describe the production of Apples, Wheat, Automobiles, Houses, a Freight Train, Education, or any other good or service.

However, we do live in a world of scarce resources. **Scarcity** refers to *a physical condition where the quantity desired of a particular resource exceeds the quantity available in the absence of a rationing system*. Potential candidates for **rationing systems** include:

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- **Tradition and Culture**, where the problem of allocation is addressed via social norms, customs and past history.
- **Planning and Central Government Command**, making use of complex mathematical tables to determine output goals and input requirements. Also includes allocation decisions by decree.
- **Voting and Political Procedures**, communication about resource allocation among individuals thorough the development of a consensus or perhaps majority rule.
- **Markets** -- using a system of prices to act as a means of communication about the availability of resources and the desire for those resources.

The emphasis of this course will be on the reliance on markets as a rationing system. Goods and services refer to:

- **Final Goods and Services** -- those products that are directly consumed by individuals to satisfy their needs and wants.
- **Intermediate or Capital Goods** -- are those goods used to produce other goods.

In the case of final goods, **Needs** represent those goods and services required for human survival. Needs are determined by nature, climate and region, and are often finite. Human **Wants or Desires** refer to everything else. Human wants are determined by society and the culture in which an individual lives. These wants are indeed unlimited and represent the source of the problem facing all economic systems.

We need to be careful in noting that Economics is not just about the production of goods and services. Equally important is developing an understanding about how wants and needs are communicated to the economic system, how to involve individuals in the production process and provide incentives for these individuals to specialize in areas of production where their talents are best used and then exchange goods with others.

MICROECONOMICS, OPTIMIZATION and RELATIVE PRICES

Microeconomics, as one branch of economic theory, is defined as the study of the behavior of individual economic agents. These agents are categorized as **producers** (*or business firms*), institutions that efficiently convert factor inputs into desired goods and services; and **consumers** (*or households*), that acquire these goods and services and are a source for the factor of production. Underlying the behavior of these agents is some type of **optimizing behavior** and how these agents react to changes in **relative prices**. In any market economy, these relative prices act as signals about surpluses or shortages that may exist in individual markets and will guide in the allocation of resources to their best use.

Optimizing Behavior
In microeconomic modeling, we begin by making assumptions about the underlying goals of economic agents based on **optimizing behavior** -- *the maximization of something subject to {s.t.} particular constraints.*

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For consumers (or households), the assumed goal is that these agents **maximize utility** subject to the constraint imposed by household income and market prices. In the case of producers (or business firms), the assumed goal is: **profit maximization** subject to the constraint of existing technology and know how.

The problem facing the Consumer:

$$max\ \mathbf{U} = f(\mathbf{x_1, x_2, x_3, \ldots x_n})$$ -- *the objective function,*

s.t.

$$\Sigma_{[i=1, \ldots n]} \mathbf{P_i x_i} \leq \mathbf{I}$$ -- *the constraint.*

Where:

- **U** = "Utility" -- *the satisfaction gained from choosing a particular bundle of goods,*
- x_i -- *quantity of the i^{th} good consumed,*
- P_i – *the market determined Price of the i^{th} good*,
- **I** -- *Consumer Income.*

In words: *Consumers allocate their income '**I**' in such a manner as to maximize their satisfaction from consuming those goods and services purchased at existing market prices.*

The problem facing the Producer:

$$max\ \boldsymbol{\pi} = \mathbf{P_x X - [wL + rK + nM + aR]}$$ -- *the objective function {Revenues – Cost},*

s.t.

$$\mathbf{X} = f(\mathbf{L, K, M, R})$$ -- *the constraint {the production function}.*

Where:

π – *Profits,*

P_x -- *the market determined price of good 'X'*,

X -- *the quantity of good 'X' produced*,

L,K,M, & R -- *the factors of production: L = Labor, K = Capital, M = Land and Raw Materials, R = Entrepreneurship*,

w,r,n, & a -- *factor prices: w = Wages, r = rental cost of capital, n = rents and material prices, a = the normal rate of profit (i.e., the opportunity cost [next best use] of the entrepreneur's time),*

$f(\ .\ )$ -- *technology and know how used to convert the inputs into the desired output.*

In words: *Producers exist to convert inputs into desired goods and services in an efficient manner.* Given that output prices and factor prices are determined in competitive markets, efficiency means exploiting existing production technology to the greatest extent

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possible. Profits earned by the entrepreneur represent the reward for taking risks (facing an uncertain demand for the output) and achieving efficiency in production (relative to competing producers) -- profits that are least equal to what the entrepreneur could earn by working for someone else.

Relative Prices

A **relative price** may be expressed in terms of a ratio between any two prices or the ratio between the price of one particular good and a weighted average of all other goods (aog) available in the market.

$$P^R = (P_x / P_y) \text{ or } (P_x / P_{aog}).$$

For example given the price of two goods -- *houses and apartments*, where we may observe that the price of houses are increasing relative to apartment rents.

$$(P_{houses} \uparrow / P_{apartments}) = P^R \uparrow,$$

This may be the result of increased desire (preferences) for detached housing. A developer would react to this signal by allocating resources (land, labor, materials) to the construction of houses. These scarce resources would be pulled-away from alternative uses -- apartment construction. The result is the construction of more houses and fewer apartments.

Suppose that in contrast we find that the rental rate of apartments is decreasing:

$$(P_{houses} / P_{apartments} \downarrow) = P^R \uparrow$$

This outcome may be the result of an over-supply of apartment units. Developers would react by building fewer apartments thus releasing scarce resources for alternative uses -- housing. The result is the same: more houses are built and fewer apartments constructed. More importantly, we find that more houses are built even though the price of houses has not changed.

In general, we would expect that if a relative price increases (the price in the numerator is larger or the price in the denominator is smaller), resources will be reallocated towards that good in the numerator. If, however, a relative price decreases (a smaller numerator or larger denominator), resources will be reallocated towards that good in the denominator.

Relative prices with respect to final goods and services (i.e., P_x/P_y) address the economic question of *what to produce*? These ratios can also aid in the understanding how factor inputs are used in the production of these final goods; that is, the question of *how to produce*?

In a country where capital is relatively scarce we might find that capital is expensive relative to other factors of production -- i.e., labor. This country might engage in **labor**

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intensive production relying on workers rather than machines to produce different goods. In other countries we might find that labor is relatively scarce and thus relatively expensive. Production in these countries might rely more on **capital intensive** production. In each case similar goods are produced. However, the methods used might differ -- not because one type of production is better than another but because these methods reflect the relative price of the factor inputs.

For example, we might find that:

In country-A:
Wage Rate (w) = $20.00/hour
Rental Cost of Capital (r) = $50.00/hr

and

In country-B:
Wage Rate (w) = $5.00/hour
Rental Cost of Capital (r) = $20.00/hr

To focus just on the price of capital, one might conclude that **country-B** might engage in capital intensive production given that capital is cheaper in dollar-terms. However, when expressed as a pair of relative prices:

$$(w/r)^{\text{country-A}} > (w/r)^{\text{country-B}}$$

We find that **Country-A** will rely on capital intensive production given that labor is relatively more expensive and thus scarce. **Country-B** will rely more on labor intensive production given that capital is relatively more expensive.

MANAGERIAL ECONOMICS

The primary role of the manager in a private sector firm is to create value within the firm and wealth for the owners of that firm via appropriate *decisions with regards to resource allocation.* The creation of value requires that managers have a solid understanding of the role of the market, forces of competition, strategic opportunities for collaboration, the behavior of their customers and market decisions by rival firms. Key concepts related to this role is outlined below:

- **Wealth** '**W**': The discounted stream of profits from entrepreneurial activity.

$$\mathbf{W} = \sum_{[t=1,\,T]} \frac{\sum_{[i=1,n]} P_{i,t}\, f(L_{i,t},K_{i,t},M_{i,t}) - \mathbf{C}_{i,t}}{(1+\rho)^t}$$

The numerator in the above expression represents the production 'f(.)' of **n** different goods by the firm multiplied by their market price less the costs of

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production '**C**' – the profits of the firm. These profits earned over **T** time periods are discounted at some rate 'ρ' -- a measure of how individuals and institutions discount future economic activity (*and use of resources*) relative to the present. Via use of this discount rate we then are able to convert the stream of present and future **profits** -- *a flow variable* into a measure of **wealth** -- *a stock variable.*

- **Profits** 'π' are earned when the **Value** of the goods produced exceed the costs of acquiring and combining the necessary resource inputs in production plus the transactions costs of offering these goods to the market.

- **Product Value**: Determined by individual Consumer wants and needs
  Determination by what the consumer is "willing" to pay.
  Threatened by competitive forces in the market place (i.e., *a competitor selling the same product for less*)
  Threatened by changing Consumer preferences.
  Threatened by changes in Consumer purchasing power.
  Threatened by Demographics.

- **Input Costs**: Determined by the next best use of those inputs.
  Subject to resource availability (*competitive uses of those resources*) and available technology

- **Transaction Costs**
  Subject to the Institutional and Regulatory Environment
  Subject to Market Efficiency and effectiveness

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Notation Used

Simple functional relationships:

$Y_t = f(Y_{t-1}, Y_{t-2}, \ldots Y_{t-k})$ – *a univariate (time-series) equation,*

$Q_d = f_{[-]}(P)$ – *a bivariate equation (inverse relationship [-] among variables)*

$X = f_{[+]}(L, K, M, R)$ – *a multivariate equation (positive relationship [+] among variables)*

$X = f(L, \mathbf{K}, \mathbf{M}, \mathbf{R}) \leftrightarrow X = f(L)$ -- variables K, M, and R held constant

Slopes, derivatives and rates of change:

Given $Y = f(X)$

$\frac{\Delta Y}{\Delta X} = \frac{y_1 - y_0}{x_1 - x_0} = \frac{rise}{run}$ -- *a slope* ('Δ' *a discrete change)*

$\frac{dY}{dX} = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$ -- *a derivative* – 'd' ↔ 'Δx → 0' (*rate of change*)

Given $Z = f(X,Y)$

$\frac{\partial Z}{\partial X} = \frac{dZ}{dX|_{\textbf{y-constant}}}$ -- *a partial derivative*

$\frac{\partial Z}{\partial Y} = \frac{dZ}{dY|_{\textbf{x-constant}}}$

$\eta_p = \frac{\%\Delta Q}{\%\Delta P}$ -- η_p = price elasticity of demand
η_I = income elasticity,
η_{xy} = cross-price elasticity

Other Notation

$\Rightarrow$ *implies that,*
$X\uparrow$ *an increase in the value of 'X',* $W\downarrow$ *a decrease in the value of 'W'*
'$\Delta x \to 0$' *changes in 'x' approach zero.*
max $U = f(x,y)$ -- *maximize the objective function,*
s.t. -- *subject to*
π -- profits, α,β – parameters (exponents/elasticities) of an equation

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Be sure that you understand the following concepts and terms:

- Economics
- Production
- Consumption
- Factor Inputs / Factors of Production
- Final Goods and Services
- Intermediate (Capital) Goods
- Human Needs and Wants
- Scarcity
- Markets as Rationing Systems
- Microeconomics
- Producers / Business Firms
- Consumers / Households
- Optimizing behavior
- Objective Function
- Constraint
- Profits / Profit Maximization
- Utility / Utility Maximization
- Relative Prices
- Resource Allocation
- Capital Intensive / Labor Intensive Production

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