Introduction to economic analysis

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*Notes written in 2012. This explains the many references to the 2008-2012 great recession.
1 What Is Economics

[...] the difference between economics and sociology is very simple. Economics is all about how people make choices. Sociology is all about why they do not have any choices to make. (James S. Duesenberry).

Economics is a broad-ranging discipline in scope. Consequently, various definitions of economics have been attempted, with mixed success. Perhaps the most influential definition is due to Lionel Robbins (in his 1932 essay on The Nature and Significance of Economic Science):

economics is "the science which studies human behavior as a relationship between ends and scarce means which have alternative uses."

The point of this definition is to stress the issue of scarcity, essentially to point out that economists would be useless in Nirvana, where everybody is happy with an unlimited supply of anything they might desire. Without scarcity there are no choice problems; and no choice - no economics!

More pragmatically, it is nowadays commonplace to implicitly define economics functionally, as follows:

economics is the study of a specific set of phenomena we call 'economic;' demand and supply of commodities, market equilibrium and prices, effects of monetary and fiscal policies, [.....].

But this (as well as any) functional definition is very narrow. Economists actively study phenomena which are traditionally attributed to sociology, anthropology, political science, law, and even biology. Examples include: crime, family, fertility, primitive societies (like hunter-gatherers), voting, comparative analysis of political and legal institutions, social norms, social networks, genetic and cultural evolution of preferences, and so many others we do not have space to list.¹

¹Applications to economics outside of typically economic phenomena has a long tradition in the discipline. The economist which is mostly responsible for this, who has studied strange subjects when it was not cool to do so but who ultimately has received a Nobel prize for his efforts along these lines, is Gary Becker, from the University of Chicago. His view has been popularized recently by Steven Leavitt, also from the University of Chicago, in a recent series of books/blog entries/NYTimes columns/movies/... under the title of Freakonomics.
If a functional definition of economics is narrow, as the boundaries of the subjects studied in the discipline keep expanding, then we better rely on a methodological definition. An appropriate one could go something like this:

Economics is the study of aggregate phenomena as equilibrium outcomes of individual choices.

*Individual choice* and *equilibrium analysis* are in fact at the core of any economic analysis of whatever issue. These terms are somewhat jargony and hence it’s better to be clear about how we interpret them at the outset.

*Individual choice.* Individuals - not groups - make choices. When choosing individuals evaluate *rationally* costs and benefits: they will choose the best bundle of goods for their money; they will sell assets they know are over-valued and will buy assets they know are under-valued; they will engage less in criminal activities if the probability of detection is higher, if punishment is more severe, if more alternatives to crime are offered ex-ante, if crime is not "cool" in their social group; they will migrate when expecting improvements in their economic and social lifestyle.\(^2\) Rationality can be substantially relaxed - and it is nowadays in economics. But it still represents the standard assumption in most of the discipline. *Rational choice* is referred to (and criticized) as the method of economics in sociology and political science.

*Equilibrium.* Individuals in an economy or society interact through markets and through different institutions (families, firms, schools, peers). Choices of different individuals are connected in the economy, and an economic analysis of a specific phenomenon considers all the relevant connections, the direct and indirect effects of a change in the determinants of such phenomenon, for example. For instance, a preference shift of young people in favor of beef over chicken will have an effect in their demand, which will in turn have an effect on the relative price of beef and chicken, which will have an effect on the demand of all people, and of the producers of beef and chicken. An equilibrium is the level of demand of young and old people, the price, the supply of beef and chicken after all these effects have been taken into account. Similarly, a technological innovation which changes the demand for skilled workers will

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\(^2\)One of the first and forceful arguments for rationality is due to Jeremy Bentham, English jurist, philosopher, and legal and social reformer, between the 18th and 19th century. To posthumously show people would do anything for money, he bequeathed his considerable wealth to the University College of London, under the condition that his dissected body be carried to faculty meetings. To this day it is. Or so we like to believe.
have an effect on their wage, and on the wage of un-skilled workers too; in turn this will have an effect on their supply (e.g., because more people will acquire the demanded skills following an increase in the wage rate for skilled workers).

Often the notion of economic equilibrium is criticized by other social scientists (and even by some economists who should know better) on the grounds that modern economies should be better represented as in a sort of ”permanent disequilibrium.” This critique is based on a fundamental misconception of what an economic equilibrium is, a misconception induced by the meaning that the word ”equilibrium” has in common parlance (but not in economics!). An economic equilibrium is not in any sense a state in which economic variables are constant or slowly moving or anything like that. It is in fact possible to show that the notion of economic equilibrium, even when combined with individual rationality, is perfectly consistent with any sort of complex dynamics of e.g., aggregate capital or GNP. Even chaotic dynamics, that is dynamics which do not converge to a constant not a cyclical state and which depend greatly from initial conditions, are possible.\(^3\)

Let’s try to see the economic method (individual choice+equilibrium) at work on an issue which many would characterize as sociological, just to beat the dead parrot some more. Consider the issue of the effects of a minimum drinking age law. Such a law might reduce alcohol consumption in minors. You impose a constraint on a group (minors) - making it harder for them to drink - and they’ll drink less. But this argument is based on group choice - the group drinks less. If we think of the group as composed by individuals - each one choosing rationally - we need to ask ourselves why it is rational for each one of them to drink. A possibility is that alcohol consumption is a manifestation of preferences for risky and rebellious behavior. In this case, making drinking illegal would make it even more a risky rebellious choice and hence would give minors a new incentive to drink. In this case a minimum drinking age law might even exacerbate under-age drinking. But suppose that the law punishes drinking with such severity that in fact it reduces the incentives of minors to drink. In this case, in equilibrium, they will satisfy their demand for risk and rebellion with some other substitute behavior. Let’s say bungee-jumping from tall buildings. Then, to evaluate

\(^3\)The word ”chaotic” also has a precise meaning in the mathematics of dynamical systems that is not well represented by its meaning in common parlance.
the effect of a minimum drinking age law it is not enough to see the effects on drinking, but rather the equilibrium effects on bungee-jumping - which might be worse than drinking - might be considered. ... Now is the time for you to be impressed about how deep the economic method (individual choice + equilibrium) can get with ease and speed.

2 Theory, Models, and Empirical Analysis

An economist is the only professional who sees something working in practice and then seriously wonders if it works in theory (Ronald Reagan)

Nothing is less real than realism. Details are confusing. It is only by selection, by elimination, by emphasis that we get to the real meaning of things (Georgia O’Keeffe)

Models are theoretical exercises of abstraction: ignoring many details in order to focus on the most important elements of the problem. There is no such thing as the right degree of abstraction for all analytic purposes. The proper degree of abstraction depends on the objective of the analysis. A model that is a gross oversimplification for one purpose may be needlessly complicated for another. A map might be an appropriate metaphor for a model: we rarely need 1:1 maps; and sometimes we need a map of the whole American continent, sometimes one of the upper east side of NYC.

Models are not necessarily mathematical models. The following example (taken from Krugman, Development, Geography, and Economic Theory, 1995, MIT Press; Ch. 3) illustrates this point:

Dave Fultz at the University of Chicago in the late 40’s showed that a dishpan filled with water, on a slowly rotating turntable, with an electric heating device bent around the outside of the pan provides a good representation of the basic pattern of weather. The dishpan was built to model the temperature differential between the poles and the equator and the force generated by the earth’s spin (abstracting from most of the intricacies and complexities of the earth geography) and was successfully shown to exhibit phenomena which could be interpreted as tropical trade winds, cyclonic storms of the temperate regions, and the jet stream.

\footnote{Thanks to Andrea Moro for suggesting, and in turn to Narayana Kocherlakota for discovering, the quotation.}
But often models are in fact mathematical models: the most sophisticated weather forecasts nowadays require the estimation of the parameters of a large number (very large, hundreds) of equations. Most economic models, in particular, are mathematical models.\(^5\) This is in part due to the fact that math is a very efficient language for abstract arguments (especially, because it facilitates the manipulation of complex logical arguments and the identification of logical and conceptual mistakes in abstract arguments). But also, mathematics, especially when coupled with fast computers, allows the constructions of models which can be used as laboratories, that is, mathematical imitation-economies that generate simulated data which can be compared with actual data from real economic systems (R. E. Lucas, ‘Methods and Problems in Business Cycle Theory,’ *Journal of Money, Credit, and Banking*, 12, 1980, Part 2, develops this point with clarity).

Models can therefore be tested with the methods of statistics and econometrics. While models are not easily ”falsified” because their implications are mostly not deterministic but rather stochastic (statistical, if you wish; more on this later), econometric analysis supports some models against others and in the end guides economic theorizing. For instance in the theory of economic decision and in game theory, ample evidence of deviations from rationality has significantly affected the models economists use. Also, the econometric evidence regarding real effects of monetary policy (e.g., of liquidity injections) has severely affected macroeconomic theory as well as actual monetary policy.

3 Debates

*Why does public discussion of economic policy so often show abysmal ignorance of the participants? Why do I so often want to cry at what public figures, the press, and television commentators say about economic affairs* (Robert M. Solow).

Politicians and reporters are fond of pointing out that economists can be found on both sides of many issues of public policy.\(^6\) If economics is a


\(^6\) In the words of Winston Churchill:

If you put two economists in a room, you get two opinions, unless one of them is Lord Keynes, in which case you get three opinions.
science, why do economists quarrel so much? After all, physicists do not debate whether the earth revolves around the sun or vice versa.

The question reflects a misunderstanding of the nature of science! Disputes are normal at the frontier of any science. Clearly, nowadays physicists do not argue whether the earth revolves around the sun but they did (quite vociferously). They do now argue however how useful is superstring theory, though their disagreement on this matter goes mostly unnoticed to the public because only few of us understand what they are talking about. When physicists debate about issues that politicians and the general public care about and think they understand, the outcome is the same, as is it obvious e.g., on the issues regarding the causes (and even the existence) of global warming.

Disputes about economics are generally aired to the public and thus all sorts of people are eager to join in the ensuing debates, relying on their common sense. Unfortunately, common sense is not always a reliable guide in economics since many economic relationships are counterintuitive. Hopefully, by the end of our course we will have a better sense of when common sense works and when it fails.7

4 Predictions

Many economic commentators have observed in the course of the last few years that few economists have anticipated the financial market crisis in the fall of 2008. This is fact true, though a handful of economists did in fact publish warnings about an impending crisis. These economists include Nouriel - a.k.a. Doctor Doom - Roubini (NYU Stern School of Business and RGE Monitor), Robert Shiller (Yale University), Raghu Rajan (University of Chicago Booth School of Business).

A cursory look at the time-serie of the Dow Jones Industrial Index (one of the most common U.S. stock market indexes), may make it seem as if at least in the last quarter of 2008 the impending crisis had been clearly manifesting itself. In fact crying wolf in the last quarter of 2008, predicting a crisis would have been easy enough (with a guarantee of getting it right with about 50% probability). But this is not what we mean by predictions

7Besides, economists tend to agree on many issues, not lastly e.g., the economic gains of free trade.
in economics. A good example of what we mean is contained in R. Rajan’s paper, ‘Has financial development made the world riskier?,’ presented at the Federal Reserve Bank of Kansas City’s Annual Jackson Hole Symposium in 2005, while head of the IMF. He did not just predict a crisis, but he provided a coherent analysis of the reasons for a possible impending crisis. This is the crux of the matter.

Let me try and better explain with a metaphor what I mean when I talk of *generating predictions out a coherent analysis.*

Inter Milan will soon be playing A.C. Milan at San Siro. I predict Inter Milan will win. How did I come up with this prediction? Three possibilities:

1. I am an A.C. Milan fan and superstitiously (like any Italian) I believe that saying that Inter Milan will win brings bad fortune to it.
2. A tarot reader/an oracle told me.
3. By selling Kaka’ A.C. Milan has no valid attacking midfielder. A.C. Milan’s game will have to start in the defensive side of their midfield, with A. Pirlo. Inter Milan, on the other hand, can play a solid 4-3-1-2, with W. Sneijder behind the attackers. This will allow Inter Milan to press A.C. Milan in its half, stopping A.C. Milan’s source of play in A. Pirlo. Inter Milan’s two new great forwards, D. Milito and S. Eto’o will do the rest.

Ok, you do not need to know everything about Italian soccer to understand what I am talking about. And you guessed it, generating predictions out a coherent analysis means doing as in predictions of type 3.

Generating predictions out of a coherent analysis, not just predicting, is the objective of economics as a discipline. You might already guess that by a coherent analysis economists mean the outcome of a model. It must also be added that economic models are typically stochastic models, that is they predict stochastic processes over time. In other words, economic models do predict the time path a quantity of interest, say the Dow Jones index, but predict the probability associated to each possible time path of the index.

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8 Soccer fans will notice that the example is dated: teams change players too often for me to keep up. But the meaning of the example remains valid.

9 Even in the context of soccer predictions, when I say *I predict Inter Milan will win* I mean something like *I predict that Inter Milan has higher chances of winning.*
If an event, say a financial crisis, has a very small probability of occurring - it does not mean it can’t occur. If it does occur, it does not mean that the model predicting a very small probability associated to the event is wrong. Several investment banks had in fact predicted very accurately what would have happened if real estate prices would have stopped growing (or, God forbid, started to decline); they just associated a very low probability to the event that real estate prices would start declining.

Stochastic models are a way to explicitly admit one’s inability to predict with certainty. In this sense, stochastic prediction are, in some sense, an admission of partial failure.

Consider the example of a fair coin throw. It is typically modelled as a stochastic process in which the event Heads occurs with probability 1/2 and the same for Tails. But I could construct a model of the dynamics of a coin, depending e.g., on the initial position of the coin (Heads or Tail), the weight of the coin, the force the thumb operates on the coin, ... With such a model, and with the observation of my determining variables, I could probably predict the outcome of the coin throw with more precision, or maybe even predicting it with relative certainty. You see then the sense in which modeling the coin throw as a stochastic process is an admission of failure: I cannot construct a model of the dynamics of a coin (or I rely on approximations, which is something else we do not want to get into here).

Finally, a quick and dirty comparison between predictions in economics and in other disciplines can be useful as an illustration. A couple of examples will be enough.

Classical physics is very successful in developing deterministic predictions (and in testing them). But remember however that not all physics is about forecasting the trajectory of a bullet, which can be done with a certain deterministic precision thanks to Newton. Quantum theory broke the certainty spell for physicists - to the point of leading A. Einstein to famously complain that God does not play dice. And then physicists are better scientists (no doubts about this). Or may-be they also have it easier (Max Plank apparently thought so: Professor [Max] Planck, of Berlin, the famous originator of the Quantum Theory, once remarked to me that in early life he had thought of studying economics, but had found it too difficult!,” John Maynard Keynes, 1933.)

Also, in other hard sciences, meteorologists produce stochastic predictions about the weather, vulcanologists about eruptions, geologists about earthquakes,...

Anthropology as a discipline is methodologically centered on collecting data and stressing differences across human cultures. For the most, anthrop-
pologists refuse to order data through models. Anthropological accounts tend to be exceptionally interesting, but, without the use of models, predictions are impossible (nor are they an aim of anthropologists). Ever heard anybody saying, In that unexplored forest there has to be two, possibly three, hunter and gatherer tribes whose system of religious beliefs is animistic and one which is evolving towards monotheism? Nonetheless, we owe to anthropologists a much deeper understanding of human nature; this is what they are after, with great success.

Sociology and most of political science\(^{10}\) have similar, while much less extreme, methodological characteristics as anthropology. A large part of political science, for instance, is \textit{comparative}, essentially a detailed institutional analysis of different political systems.

In medicine, a doctor can (and will) tell you that smoking increases your chances to develop lung cancer, but cannot tell you if and when you will develop one, nor that you won’t if only you stop smoking. Similarly, an economist can (and will) tell you that allowing large leverage ratios in financial markets (investing with borrowed money) increases the chances of a financial crisis, but cannot tell you if and when one will occur, nor that it won’t if only we strike a stringent regulation on financial markets.

Having said all this, there is another reason why only few economists have anticipated the financial market crisis in the fall of 2008: our theory of asset prices predicts that asset prices are not predictable, in the sense that we can only say that riskier assets have higher returns on average (this is not a joke, nor an empty theory - you will understand what I mean later on in the course when we’ll do finance). Furthermore, economists do not have an established theory of asset pricing bubbles and hence tend to underestimate the probability that a sustained growth in an asset price is a bubble. Many economists are back to the blackboard studying bubbles these days. As it should be.

\(^{10}\)A sizeable and growing part of political science has essentially adopted the method of economics. Rational choice political scientists, so they are called, are not distinguishable from economists, though they sit in different academic departments. This is not the case for sociology. Rational choice sociologists are few still leave in reservations next to Native Americans.
5 Empirical analysis

Many observers (social scientists, journalists, people you cannot refrain from talking when they should not,...) complain that economics as a discipline reduces to useless theoretical/mathematical exercises. This is simply false. It is most probably the distorted view of a tribe whose system of beliefs include tenet that *any math is too much math!*

Even a superficial look at a good economics journal (*Econometrica, American Economics Review, Journal of Political Economy, Quarterly Journal of Economics,...*) will give you the (correct) impression that economics is an applied discipline, addressing well-defined real world problems. For instance, these are the titles of recent issues, June and August 2010, of the *Journal of Political Economy* and *Quarterly Journal of Economics*, respectively.\(^\text{11}\)

Does Professor Quality Matter? Evidence from Random Assignment of Students to Professors

Innovation, Firm Dynamics, and International Trade

Housing Externalities

Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings

Competition and the Structure of Vertical Relationships in Capital Markets

Estimating Welfare in Insurance Markets Using Variation in Prices

Measuring Beliefs and Rewards: A Neuroeconomic Approach

Monetary Non-Neutrality in a Multisector Menu Cost Model

Regulation and Distrust

Improved Access to Foreign Markets Raises Plant-Level Productivity... for Some Plants

Sex and Science: How Professor Gender Perpetuates the Gender Gap

\(^{11}\)I have not selected the issues to make the point. They were the last issues available when I wrote this chapter.
Can Exchange Rates Forecast Commodity Prices?

Counterparty Risk in Financial Contracts: Should the Insured Worry about the Insurer?

The Geographic Determinants of Housing Supply

School Choice with Consent

Muslim Family Law, Prenuptial Agreements, and the Emergence of Dowry in Bangladesh

No papers on Hilbert spaces nor on Martingales or Matrix algebra per se (though all these mathematical concepts are indeed used by economists when deemed useful). If you opened the journals, however, you would find a lot of equations - often statistical analyses of data (which economists call econometrics).

Statistical analyses in economics are commonplace. They are also typically difficult. This is because economists generally do not have access to controlled randomized experiments, the typical instrument of empirical analysis of the hard sciences and of medicine and pharmacology. Let me illustrate.

A test of the effects of a new drug e.g., for hypertension involves selecting a group of subjects with the same medical characteristics - a fraction of which are chosen randomly to receive the drug (the others typically receives a placebo). Since the subjects have ex-ante the same characteristics, any differential outcome in the two groups after the experiment is reasonably interpreted to be an effect of the drug. An economist willing to test the effects of monetary policy e.g., on employment, on the other hand, cannot use anything like a controlled randomized experiment: all individuals in the economy are affected by the policy, no two groups with the same characteristics can be selected.

As a consequence, economists have had to develop sophisticated methods to try and identify relationships of cause-effect in the data.\textsuperscript{12} We shall talk about these methods in a subsequent chapter.

\textsuperscript{12}Recently, economists have been able to design randomized experiments regarding the effects of small scale policies in development, like, for instance, the effect of a new school in an isolated village. In these contexts they can in fact select villages with similar characteristics and then choose randomly some of them to set up a school in. The Abdul Latif Jameel Poverty Action Lab at MIT is at the forefront of these methods.
6 Some successful results

At the cost of appearing cocky, let me finish the chapter by listing some examples of important non-obvious results of economics which illustrate its intellectual success as a discipline:

- The characterization of gains from trade in general and of international trades in particular. This is the Invisible hand result (or First Welfare Theorem).

- Comparative advantage (and not absolute advantage) determines trade flows between countries: a country which is less productive than any other one at producing all tradable goods will still find international trade markets where to sell some of its products.

- Risk adjusted returns in financial markets are unpredictable. This is the No-arbitrage theorem.

- Several "neutrality" or "equivalence" results (careful! these results hold under restrictive assumptions - somewhat like "in the vacuum" results in physics - and hence never in real economies, but are fundamental benchmarks that, when not recognized, induce important logical mistakes):
  
  i) Doubling the amount of money in an economy has no real effects; equivalently, dividing all prices by a third (multiplying the value of a Dollar by three) has no real effects. This is called Monetary neutrality.

  ii) Given government expenditures in the present and future, how they are financed, e.g., by taxing now, or by taxing later, or by printing money (inflation) has no real effects. This is called Ricardian equivalence.

  iii) Given a firm’s production plan in the present and in the future, how is the firm financed, e.g., by equity or debt, has no effect on its value. This is the Modigliani-Miller theorem.

- The Malthusian theory of fertility, that is, economies will not grow because fertility growth will eat up all income growth, is inconsistent with individual rationality.
- Evolutionary theory in biology can be accurately represented by the methods of game theory. The same for Foraging theory.

- Altruistic (or cooperative) behavior is consistent with individual rationality in a well-defined series of conditions. This is the Folk theorem.

- Value and equilibrium prices coincide (once "value" is properly defined). This is the Theory of value.

- The study of the effects of economic policy is logically and empirically flawed when not embedded in equilibrium analysis. This is called the Lucas Critique.

- Many empirical relationships and many stable correlations have been uncovered by means of statistical and econometric techniques. Examples include, the effects of taxes on labor supply, the determinants of business cycles, the determinants of asset prices, and many many many others.

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7 Fun readings

Of course all is relative, including "fun." But it is typically "fun" to see people fight. So here’s some fightings between economists.

Some of you might have heard about freakonomics, the concept, the book(s), the movie, the blog, the t-shirts, etc. If you have not, start from the blog, at

http://www.freakonomics.com/blog/

But then also read about the real pre-cursor of the idea that the economic method is successful much outside economics proper:


On Freakonomics, you also want to read Ariel Rubinstein’s critique:


But then read also J.H. Cochrane, *How did Paul Krugman get it so wrong?*, University of Chicago, mimeo.

Finally, read A. Rolnick, ‘Interview with Thomas Sargent,’ The Region, September 2010, for a cruel (but deserved) stabbing of Krugman.