

What is Economics?

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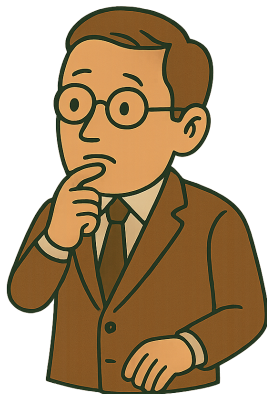


Introduction

- Nice to meet you; I'm Charlie!
- I am a data scientist, with a PhD in Economics!
- I am an Associate Professor in Data Science and Informatics.
- I have taught a wide variety of economic and social sciences.
- I publish many things across economics and social sciences.
- I have presented my work at leading economics conferences.
- I am specifically interested in methods development.

ECONOMICS IS A SOCIAL SCIENCE, NOT A PHYSICAL SCIENCE.

— Jim Stanford



Economics is technically a Social Science...

- Economics is a social science.
- It is different to other social sciences, like sociology and political science.
 - This is because it is *immensely* technical.
 - Economists often use tools closer to the physical sciences.
- This talk is about what economics is and – just as importantly – is not.

Misconceptions about Economics



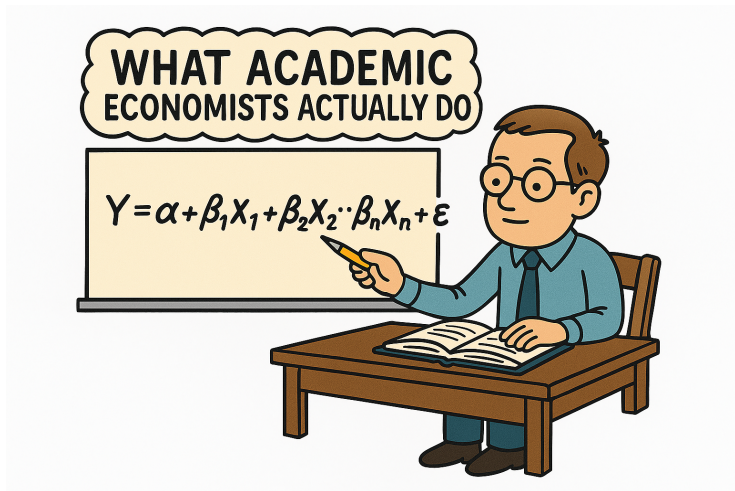
Misconceptions about Economics

- When I was a high school student, I definitely had a misconception about what economics actually is.
 - Economics is not:
 - Accounting
 - Business Studies
 - Management
 - Marketing
- However, economists will often approach – in a technical way – problems within these disciplines.

What Economics actually is

- Economists use mathematical and statistical tools to study:
 - The allocation of resources within a society.
 - This may include issues related to inequality, or welfare.
 - At what rate should we extract natural resources?
 - The interactions of agents within this reallocation.
 - How do agents optimally negotiate?
 - 'Emergent Phenomenons' arising from this reallocation.
 - In the process of allocating resources, how do economies grow?
 - How do prices change?

What Economics actually is



Types of Economics

- This is a really wide range of questions.
- Economics is usually split up into 'disciplines', or 'subfields'.
- There are three core disciplines:
 1. **Microeconomics**
 2. **Macroeconomics**
 3. **Econometrics**
- There are also a large number of sub-fields within these three these.
- Lets talk about each of them in turn.

Microeconomics

- Microeconomics involves how individual agents and firms ‘optimize’.
- This involves a range of types of questions:
 - How do people make choices about labour and leisure?
 - How do they choose which actions maximize their happiness?
 - How do they choose – for example – what to buy s.t. budget constraints?
 - How are contracts optimally negotiated?
 - What strategy moves are most effective?
 - How do agents interact with one another (in dynamic settings)?
 - How should industries be regulated and ‘organised’?

Macroeconomics

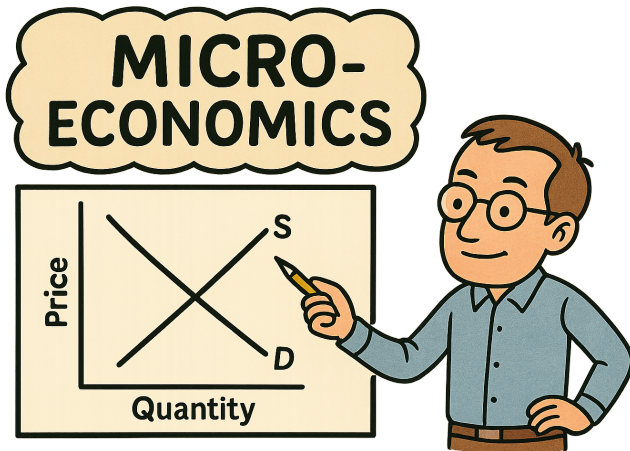
- Macroeconomists study things at the aggregate level.
- This may include things like:
 - Changes in prices as a whole.
 - Economic growth.
 - Movements in asset prices (stocks, bonds, houses).
- More so than micro, there is a strong temporal element to macro.
- There is often a strong policy element, be it fiscal or monetary.
- They will typically do this with complex – and often large – models.

Econometrics

- Econometricians apply statistics to economic problems.
- They do things like:
 - Derive ‘estimators’ for how to estimate specific things.
 - Build simulations to test properties of their models.
 - Develop methods which attempt to get at ‘causality’.
 - Predict economic variables of interest.
- This often involves writing a lot of ‘statistical programming’.

Theoretical and Empirical Work

- Each economic discipline is *typically* split into two parts:
 1. **Theoretical** work in the fields of Micro, Macro and Metrics tries to develop an understanding of how economic systems should work in theory.
 2. **Empirical** work tries to test these theories (and estimators, metrics, etc) with real-world and simulated data.
- The theoretical work is often deeply mathematical.
- The empirical work is often very sophisticated.
- Lets see three examples of sub-fields in Micro, Macro, and Metrics.



Micro Subfield I: Game Theory

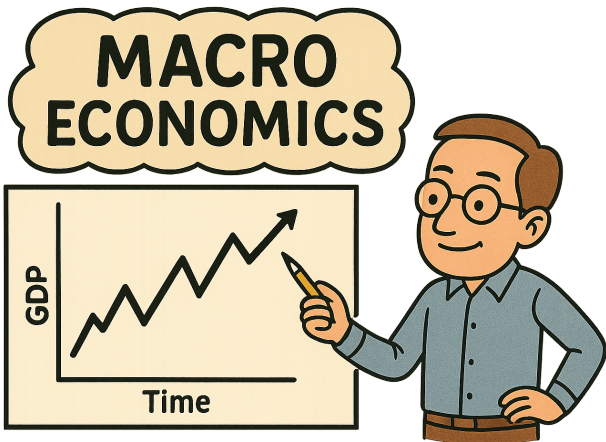
- **Game Theory:** A mathematical study of strategic decision making.
- **Players:** Individuals or groups making decisions in the game.
- **Strategies:** Plans of action chosen by players to achieve their goals.
- **Payoffs:** Rewards or outcomes players receive based on their strategies.
- **Nash Equilibrium:** No player can benefit by changing their strategy.
- **Zero-Sum Games:** One player's gain is another player's loss.
- **Applications:** Used in economics, politics, biology, and more.

Micro Subfield II: Industrial Organisation

- **Industrial Organization:** How do firms compete and operate in markets?
- **Market Structure:** The organization of a market based on the number of firms, product types, and entry barriers.
- **Monopoly:** Market structure with a single firm dominating.
- **Oligopoly:** Market structure with a few large firms.
- **Competition:** Rivalries among firms to attract customers.
- **Market Power:** The ability of a firm to influence the price of its product.
- **Regulation:** Policies that aim to promote competition/protect consumers.

Micro Subfield III: Experimental Economics

- **Experimental Economics:** Economic behavior through experiments.
- **Lab Experiments:** Controlled arenas where variables can be manipulated.
- **Field Experiments:** Real-world settings with treatments.
- **Behavioral:** Decision making, deviating from traditional theories.
- **Incentives:** Rewards/penalties used to influence participants' choices.
- **Applications:** Improve policies, markets, and understand consumer behavior.



Macro Subfield I: Monetary Economics

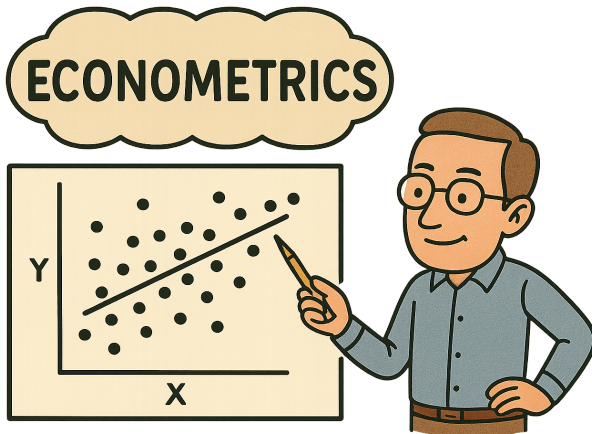
- **Monetary Economics:** money, banking, and financial systems.
- **Money:** A medium of exchange, store of value, and unit of account.
- **Central Banks:** managing currency, money supply, and interest rates.
- **Monetary Policy:** Actions to control inflation and unemployment.
- **Inflation:** The rate at which prices change.
- **Interest Rates:** The cost of borrowing money, set by central banks.
- **Financial Markets:** Platforms where people trade items of value.

Macro Subfield II: Economic Growth

- **Economic Growth:** Increase in a country's production of goods/services.
- **GDP:** The total value of all goods and services produced.
- **Capital:** Machinery, buildings, and technology used in production.
- **Labor:** Workforce contributing to production.
- **Innovation:** New ideas and technologies driving growth.
- **Productivity:** Efficiency of production processes.
- **Infrastructure:** Roads, bridges, and other essential systems.

Macro Subfield III: Asset Pricing and Financial Markets

- **Asset Pricing:** Determining the value of financial assets.
- **Financial Markets:** Platforms for buying and selling assets.
- **Stocks:** Ownership shares in a company.
- **Bonds:** Loans made to companies or governments.
- **Risk:** The potential for losing investment value.
- **Return:** The profit made from an investment.
- **Diversification:** Spreading investments to reduce risk.



Metrics Subfield I: Panel Data Econometrics

- **Panel Data:** Data on multiple entities over multiple time periods.
- **Balanced Panel:** Each entity has the same number of observations.
- **Unbalanced Panel:** Different entities have varying numbers of observations.
- **Fixed Effects Model:** Controls for entity-specific traits.
- **Random Effects Model:** Assumes entity-specific effects are random.
- **Dynamic Panel Data:** Includes lagged dependent variables as predictors.
- **Challenges:** Handling missing data/ensuring proper model specification.

Metrics Subfield II: Time Series Econometrics

- **Time Series Data:** Observations of a variable over time.
- **Trend:** Long-term movement in a time series.
- **Seasonality:** Regular pattern repeating at specific intervals.
- **Autocorrelation:** Correlation of a time series with its own past values.
- **Stationarity:** Property where statistical properties are constant over time.
- **ARIMA Models:** AutoRegressive Integrated Moving Average for forecasting.
- **Unit Roots:** Test for stationarity and time series dynamics.

Metrics Subfield III: Causal Inference

- **Causal Economics:** Analyzing cause-and-effect relationships.
- **Causation vs. Correlation:** Differentiating cause from association.
- **Counterfactuals:** What if scenarios without intervention.
- **Experiments:** Randomized trials to prove causality.
- **Instrumental Variables:** Addressing endogeneity.
- **Difference-in-Differences:** Comparing pre-and post-treatment effects.
- **Propensity Matching:** Pairing similar units to estimate effects.

WHAT ECONOMICS UNDERGRADUATES WILL LEARN

- **MATHEMATICS**
- **STATISTICS**
- **ECONOMIC
INTUITION**
- **PHILOSOPHY
OF SCIENCE**



What will you learn? Mathematics

- As we have already discussed, economics is extremely quantitative.
- Undergraduates are often surprised with the amount of mathematics.
- Almost all econ degrees include a 'maths for economics' sequence.
- The most commonly used mathematical tools involve:
 - Abstract mathematics.
 - Advanced Calculus.
 - Advanced Linear Algebra.
- You *may* learn computational techniques to solve numerical problems.

What will you learn? Statistics

- As we have already discussed, economics is extremely quantitative.
- There is a lot of empirical measurement of things.
- Once things are measured, they need to be:
 - Explored (Exploratory Data Analysis).
 - Cleaned (to remove outliers, and transform the data).
 - Statistically modeled (to generate economic insights)
- You *will* certainly learn about statistical programming (R, Stata).

What will you learn? Logic, philosophy, and intuition

- You will also develop your economic thinking.
- This will be through the formalization of economic problems.
- Gain intuition on solving economic problems.
- You will learn about different economic philosophies.
- Many courses have classes in economic history.
- You will also learn about things like deductive reasoning.

Typical Structure of Undergraduate Economics

- **Year One:**

- Economics 101, Mathematics for Economics, Introduction to Statistics, Research Design, Optional Class.

- **Year Two:**

- Microeconomics I-II, Macroeconomics I-II, Econometrics I-II, Further Mathematics for Economists, Optional Class.

- **Year Three:**

- Advanced Macroeconomics *or* Advanced Microeconomics *or* Advanced Econometrics, Optional Classes, Dissertation.

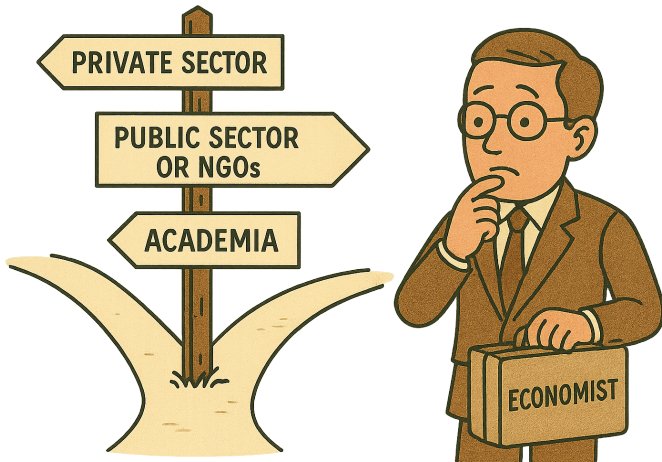
Where to study?

- In general, my advice for undergraduate applications is to try and get into the highest ranked program you can.
- Departments in the US are typically stronger for Economics, and hold most of the world's top 50 rankings.
- In the UK; Cambridge, LSE and Warwick are especially strong for undergraduate economics.
- Oxford does not have a 'straight' economics undergraduate degree.
- My advice would be to do a joint major in Economics and Mathematics!

The Structure of Economics Courses in the UK and US

- In the UK and US, it's typical to 'major' in economics for undergrad.
- However, three/four years doesn't provide enough term for mastery.
- For that reason, many people then choose to take a masters degree.
 - Can be in pure economics, or something like 'Development Economics'.
 - Students can choose to study for an MSc, MRes or MPhil degree.
- This – grades permitting – puts students in good shape for PhD applications.
 - Most PhDs at top universities in economics are funded.
 - In the UK; research proposal required (less important in US).
 - In the US, you will take a further two years of taught courses.
- Note the negative marginal return of a PhD in economics!

Well, now you're an economist. What do you do?



Private Sector

- A large number of economists go to work in the private sector.
- This includes positions at:
 - Investment banks and hedge funds (JP Morgan).
 - Consultancy companies (Earnest and Young).
 - Think tanks (e.g. The Institute for Fiscal Studies).
 - Large technology companies (Microsoft, Amazon).
- Economists are usually competitive in the labour market.

Government, Central Banks, Regulators, NGOs

- In central and local **government**:
 - Many economists work on public finance.
- In **Central Banks**:
 - Economists work on real-time analysis of the economy.
 - They will assess the functionality of markets.
- In **Regulation**:
 - Many economists will go to work at market regulators.
- In **Non-Government Organisations**:
 - Economists also work at places like the World Bank and the WHO.

Academia

- Many economists do a PhD to enter into academia.
- What does an academic economist do?
 - They conduct theoretical and/or empirical research.
 - They teach (including research supervision).
 - They do administration (to help organise the university).
 - They provide advice to government/comment to media.
- Working in academia is a challenging, yet rewarding job.

LET'S TEST OUR ECONOMIC INTUITION



Economic Puzzle One

Problem Setup: There are two ice cream sellers who want to sell ice cream on a beach which is 1km long, with the sun distributed evenly across it. The first ice cream seller locates himself in the centre of the beach.

Puzzle: Where should the second ice cream seller locate, if they both want to maximize profit?

Economic Puzzle Two

Problem Setup: You can buy any convex combination of two assets: sunglasses and umbrellas. Assume that you have a reliable weather forecasting model which is predicting that next year the weather will be equally sunny as it is rainy.

Problem Setup: How much of each asset should you buy? Why?

Economic Puzzle Three

Puzzle: I offer to give you £5 now, or give you the promise to pay you £6 in one year's time (assume no inflation).

Puzzle: Which will option will you choose? Is it rational?

Economic Puzzle Four

Problem Setup: Two fast food restaurants, Burger Town and Snack Shack, are next to each other on a busy street. One day, Burger Town starts offering free toys with every meal. Surprisingly, Snack Shack also gets more customers, even though they didn't change anything.

Puzzle: Why might Snack Shack get more customers when Burger Town gives away toys? What might be going on in people's minds? Think about how people make decisions, how crowds influence choices, and what happens when more people visit an area.

Questions?

I would be very happy to answer any questions which you might have!