SYLLABUS

Course: Python and Data Science for Economics

Textbooks/Resources:
A First Course in Quantitative Economics with Python (Sargent, Stachurski)
Python Data Science Handbook (Jake VanderPlas)
Data Visualisation with Python (Gilbert Tanner's blog)

Textbooks are for reference only and physical copies need not be purchased. The online versions of all of these are available for free.

Course Description:
Modern economic analysis is heavily reliant on data and computational resources. It is critical to be able to make the best use of these resources in order to be able to solve problems of practical as well as academic relevance. This course is meant to bridge the gap between theory and practice using Python. In this course, we will revisit the foundational concepts of statistics and econometrics with a focus on applications. Students will learn to utilize the vast resources of Python to real-world data analysis problems.

Modality and Logistics:
The course will be taught through lectures twice a week of 1.5 hrs each. Students may opt to attend lectures virtually or in-person. Lecture videos shall also be posted along with slides and other teaching materials each week.

There will be worksheets and assignments to be completed and submitted every week for evaluation. There will be a final project to be completed in groups of 4/5 students. The groups are to be formed autonomously but in case of mismatches, the instructor may intervene and re-arrange them.

Students may discuss anything relevant to the course outside class during either the Office Hours (Mon, Thu 10-11.30 am) or may set up a time via email.

Classes: Tue, Fri 2-3.30 pm, BRB 1.102 (map link)
Zoom link:
Course discord:

Grading:
There will be a total of 8 assignments in this course. The assignments will have both analytical and programming components. For the programming parts, the codes may be e-mailed to me or submitted to Canvas. For the analytical portion, you may submit the assignments in-class or submit screenshots on Canvas. You are encouraged to work independently but discuss with your peers and instructors if need be.

SYLLABUS

Each assignment must be submitted at the latest by the Friday 11.59 pm of the corresponding week. Assignments may be accepted up to one week after the due date but would incur 10% penalty.

The final-grade weightage for the assessments is as follows:

1. Assignments (8) - 40%
2. Project - 60%

Project Evaluation:
The project would be due the last Friday before the Finals week. A group member must submit the Github link to the project complete with the README file detailing the scope and the details of the project. There will be group presentations during the finals week.

The projects will be scored on:

1. Originality
2. Execution of coding and Analysis
3. Presentation of results
4. Clarity of concepts and code

Course Outline:

The goal of this course is to introduce Master's level students to programming and data analysis in Python, revisit some core concepts in data science and bayesian statistics and then apply them to real-world problems.

Learning outcomes:

At the end of this course, the student is expected to be proficient in:
(i) Basic programming in python
(ii) Using Python data structures effectively
(iii) Practical application of statistical inference in economic and business problems

And develop intermediate skills in:
(i) Mathematical modeling
(ii) Solving economic models
(iii) Application of linear algebra
(iv) Optimization
(v) Statistics theory

Course Timeline
Module I: Programming in Python

Week 1&2
Basics of Python: Data Structures, Control Flow, Shell scripting, Using Git and GitHub

SYLLABUS

Week 3&4
Introduction to Data Analysis with Numpy and Pandas, Exploratory Data Analysis and Visualization, Review of Statistics and Probability

Module II: Data Science concepts
Week 5&6
Linear Regression, Estimation and Optimization, Likelihood Hypothesis testing, Fisher Information, Bias-Variance tradeoff, Model selection and Shrinkage

Week 7&8
Classification: Naive Bayes, k-means clustering/regression, Decision trees, Random Forests and Gradient boosting

Week 9&10
Panel data methods and fixed effects, Simple time-series models and forecasting, Backtesting and Model Validation, Information Criteria and degrees of freedom

Week 11&12
In-class project discussion and brainstorming

Week 13&14
Final presentations

SYLLABUS

Course: Principles of Macroeconomics

Course Description

This course introduces the economic analysis of the aggregate economy. We begin with the microeconomic foundations of supply and demand to understand how markets function and clear the concept of general equilibrium in Macroeconomics. We then transition to the Economic Measurement learning how to measure national output (GDP), the cost of living (Inflation), and the health of the labor market (Unemployment). The final third of the course focuses on the tools of policy—Fiscal and Monetary—and how they influence long-run growth and short-run stability.

Required Text

- *Principles of Macroeconomics* by N. Gregory Mankiw (Current Edition).
- *Macroeconomics* by Olivier Blanchard

Weekly Schedule

Module I: Micro Foundations & Markets

- **Week 1: The Ten Principles & Thinking Like an Economist**
    - Opportunity cost, marginal thinking, and the role of incentives.
- **Week 2: Supply and Demand**
    - The Law of Demand and the Law of Supply.
    - Market Clearing: Equilibrium, Surpluses, and Shortages.
- **Week 3: Elasticity and its Application**
    - Tariffs, quotas and taxes:
- **Week 4: Markets and Welfare**
    - Economic Surplus

Module II: Economic Measurement

- **Week 5: Measuring a Nation's Income (GDP)**
    - The three ways to measure GDP: Expenditure, Income, and Value-Added.
- **Week 6: GDP Continued: Real vs. Nominal**
    - The GDP Deflator and common fallacies (The Broken Window).
- **Week 7: Measuring the Cost of Living**
    - The Consumer Price Index (CPI) and correcting economic variables for inflation.

- **Week 8: Unemployment: Keynes and the Great Depression**
    - Defining the Labor Force, frictional vs. structural unemployment, and the natural rate.

Phase III: The Real Economy in the Long Run

- **Week 9: Production and Growth**
    - Productivity, factors of production, The Solow model (introductory).
- **Week 10: Saving, Investment, and the Financial System**
    - The Loanable Funds market: How S=I.
- **Week 11: The Monetary System**
    - What is money anyway? The Federal Reserve and the banking system.

Phase IV: Short-Run Economic Fluctuations

- **Week 12: Aggregate Demand and Aggregate Supply (AD-AS)**
    - Model-framework that helps us think about Business Cycles
- **Week 13: The Influence of Monetary and Fiscal Policy**
    - The Theory of Liquidity Preference and the Multiplier Effect.
- **Week 14: The Short-Run Trade-off between Inflation and Unemployment**
    - The Phillips Curve and Macroeconomic Stabilization
- **Week 15: Monetary and Fiscal Policy**
    - Rules vs. Discretion, Inflation Targeting, Deficits and Surpluses

---

Grading

Component	Weight	Description
Problem Sets	20%	Bi-weekly assignments (involving some basic programming/data analysis component)
Midterm 1	25%	Covers Module I (Micro foundations).
Midterm 2	25%	Covers Module II & III (Macro Data & Long Run).
Final Exam	30%	Cumulative, with a focus on Module IV (Policy & AD-AS).

Learning Objectives

By the end of this course, students will be able to:

1. Understand macroeconomic aggregates and the concept of general equilibrium
2. Calculate Real GDP and Inflation using raw price and quantity data.

3. Analyze the impact of a Fed monetary policy using the AD-AS model.
4. Understand the links between productivity, technology and economic growth.
5. Reason about macroeconomic developments using mathematical models.

Course Policy

- There are a *total* of 4 late days across all homeworks, with no more than 2 late days per homework.
- HWs submitted after all late days are exhausted will be awarded 50% points if submitted within 24 hrs after the late days are exhausted and 0% after that.

Academic Integrity and the use of Artificial Intelligence tools

All students enrolled in this course are subject to the University's Academic Integrity standards. Any form of plagiarism will invite serious penalties. The students must submit their own work for all assignments. While students are encouraged to seek help from others, the teaching assistants and myself, putting assignment problems through AI (such as ChatGPT, Gemini) is not allowed. The purpose of course assignments and projects is to develop your thought process and problem-solving capabilities. Getting somebody else to solve the assignments defeats that purpose. You may use resources available on the internet or AI tools to develop your understanding of a topic. If you do take help from a source, make sure to cite it.