Année universitaire 2024/2025

Quantitative Economic Analysis - 296 - 2nd year of master's degree

Crédits ECTS : 60

LES OBJECTIFS DE LA FORMATION

The Quantitative Economic Analysis track offers excellent training in economic research, which enables students to analyze a broad range of contemporary economic issues in depth. Entirely taught in English, the curriculum draws on advanced quantitative methods, including innovative methods used to process massive volumes of data. It will allow you to pursue a doctoral program or embrace a career as a professional economist in the public, semi-public, or private sector, in France or abroad.

Skills acquired:

- Acquire high-quality training in economic research and reflect on public and private stakeholders' decision-making procedures, in the various economic fields: health, public policies, macroeconomics, finance, economic development, …
- Address economic issues by identifying the specific attributes of public and private stakeholders involved and offering expertise in economic, statistical, or econometric analysis
- Learn how to manage and analyze qualitative and quantitative data, whatever the size of the database
- Select the appropriate statistical and econometric tools and put them to use to obtain reliable and robust answers to an economic problem within the public or private sphere
- Identify and help to produce groundbreaking scientific output in your specialization within the economic sciences
- Report on economic, statistical and/or econometric results to different audiences, orally and in writing

The Master in Quantitative Economics allows interested students to engage in the PhD Research Track of the PSL Graduate Program in Economics.
The PhD Research Track is a 2-year training (M1 Quantitative Economics – Master 2 Quantitative Economic Analysis track) for students who plan to pursue their PhD studies. In addition to validating all the courses included in the M1 QE and then the M2 QEA, being enrolled in the PhD Research Track asks for a research internship in a research center attached to a university, an international organization, or an administration in M1 or M2. The objective is to allow interested students to have a first experience in a research environment as early as the Master's degree.

The fact of having followed the PhD Research Track will be considered as an asset by the PSL SDOSE Doctoral School's Admissions Committee when examining applications, in particular for a doctoral contract (3-year financing of a PhD thesis).

PRÉ-REQUIS OBLIGATOIRES

- Applicants should hold a postgraduate degree (Master degree equivalent to 60 ECTS), from either the Master 1 in Quantitative Economics or another Master at Université Paris-Dauphine-PSL, or another university in France or abroad; or an equivalent diploma from an Institute of Political Studies (IEP), a Grande Ecole in business or engineering, or an equivalent recognized Grand Etablissement, in France or abroad.
- Applicants should have an academic background in the following fields: Economics, mathematics applied to economics, and computer science applied to economics.
- B2-level mastery of English is required. This must be attested by a certificate of achievement from one of the following tests: TOEFL iBT (minimum score of 90), IELTS (minimum score of 6.5), GMAT (min score650) or GRE (GMAT equivalent min score of 650). English-native candidates or students who have followed an international training in English of at least one year over the last two years and who have passed the corresponding exams are exempted. Applicants whose studies for their postgraduate degree have been undertaken wholly or mainly at a university located outside the EU must supply GRE/GMAT General Test scores in all cases.

POURSUITE D'ETUDES

The Quantitative Economic Analysis track offers excellent training in economic research, which also aligns with the real needs of the public and private decision-making world. The curriculum combines cutting-edge specialization courses in economics with advanced quantitative methods, including innovative methods in data science. In addition to fundamental quantitative techniques in economics, the program features courses based on advanced database processing, as well as operational research and decision-making support. These areas are at the leading edge of current economic research and directly relevant to the questions entailed in economic decision-making, in the private and public sectors alike.

In this respect, the Quantitative Economic Analysis track is perfectly suited to students who want to pursue a research specialization by completing a thesis in a PhD program. The excellent instruction provided by the QEA track, entirely in English, enables interested students to apply to prestigious doctoral programs, either as part of PSL Research University, or at other universities in France or abroad. You will also be able to embrace a career as professional economist in public, semi-public institutions, including international organizations, as well as in private businesses in various sectors (banking, insurance, health industry, energy, …)

PROGRAMME DE LA FORMATION

- Semestre 3
  - AQME CERTIFICATE (9 ECTS)
    - Machine Learning
    - Introduction to Matlab programming
    - Python for data science
  - Cours obligatoire (theory S3)
    - Behavioral economics and bounded rationality
    - Experimental Economics
    - Advanced Game Theory
  - Block 1
    - Methods for public policy evaluation
  - Block 2
    - Advanced Macroeconometrics
    - Bayesian techniques in macroeconomics
  - Options II - choose one
    - Asset pricing theory
    - Inequality and redistribution
    - Environement and sustainability
  - Mandatory courses (Social and Public Policies)
    - Methods for public policy evaluation
    - Labor, education and public policies
    - Inequality and redistribution
    - Health, welfare and health behavior
  - Options - Choose one
    - Behavioral economics and bounded rationality
    - Experimental Economics
    - Environement and sustainability
    - Advanced Game Theory
  - Mandatory courses (Macro & FInance)
    - Advanced Macroeconometrics
    - International Trade & International Macroeconomics
    - Key challenges for Advanced macroeconomics
  - Options I - choose one
    - Bayesian techniques in macroeconomics
  - Options II - choose two courses among these

        - Asset pricing theory
        - Behavioral economics and bounded rationality
        - Quantitative International Economics
        - Environement and sustainability
    - Track Recherche PG ECO
        - Machine Learning
        - Introduction to Matlab programming
        - Python for data science
- Semestre 4
    - Data science course (3ECTS) optional course : one to choose for 3 ECTS
        - NLP for economic decisions
        - Machine Learning for Economists
    - mandatory courses (Theory)
        - Master Thesis Defense
        - Mater Thesis support seminar
        - PhD Proposal / Internship
    - Specialization field : Theory - choose two courses among these
        - Banking economics
        - Computational social choice
        - Incremental learning, game theory and applications
    - Mandatory courses (Social and Public Policies)
        - PhD Proposal / Internship
        - Master Thesis Defense
        - Mater Thesis support seminar
        - Advanced Health economics
        - Policies in developing countries
    - Mandatory courses (Macro & FInance)
        - PhD Proposal / Internship
        - Master Thesis Defense
        - Mater Thesis support seminar
        - Banking economics
        - Advanced environmental macroeconomics

DESCRIPTION DE CHAQUE ENSEIGNEMENT

Advanced Game Theory

ECTS : 3

Description du contenu de l'enseignement :

The course is divided into two parts.
The first part is devoted to so-called “noncooperative games” and concentrates on multistage games with incomplete information played by Bayesian players. The agents’ rationality is analyzed through various solution concepts, capturing backward and/or forward induction. These solution concepts are applied to strategic information transmission and communication.
In the second part, we will first focus on a particular class of games of strategic information transmission, the class of unidimensional cheap talk sender receiver-games, and then introduce recent models on the choice of an information structure by a designer (or principal) for an agent or a set of agents who interact strategically in an asymmetric information setting.

Compétence à acquérir :

After having attended the classes, the students will be able to read recent academic papers applying game theory to various area of economics and to make use of game theory in their future research work.

Advanced Health economics

ECTS : 3

Advanced Macroeconometrics

ECTS : 6

Advanced environmental macroeconomics

ECTS : 3

Asset pricing theory

ECTS : 6

Description du contenu de l'enseignement :

In this course, we will discuss a wide range of topics ranging from optimal portfolio, the CAPM, factor models, consumption-based asset pricing, and arbitrage pricing, to more special ones including asymmetric information, and limits to arbitrage.

1. Optimal Portfolio Theory and the CAPM
2. Factor Models
3. Decision Making under Uncertainty
4. Consumption-based Asset Pricing
5. Arbitrage Pricing
6. Dynamic Asset Pricing
7. Asymmetric Information and Asset Prices
8. Limits to Arbitrage

Compétence à acquérir :

Master the theoretical concepts of asset pricing

Mode de contrôle des connaissances :

Evaluation: assignment 20%, final exam 80%

Banking economics

ECTS : 3

Description du contenu de l'enseignement :

This course provides students with an in-depth introduction to banking economics. Students will be taken through the main challenges in Banking (financial stability, fire sales phenomena, regulation and moral hazard…) by studying some of the key papers in the literature and learning their main modelling techniques. Both long-lasting and more recent issues will be addressed, with a particular focus on the set of problems and debates that arose during the 2007-2009 Great Financial Crisis. Once equipped with the key concepts of banking theory, students will be introduced to the main policy instruments available to regulators for dampening the above-mentioned problems. We will study the nature and role of the Basel III agreements, as well as discuss their possible costs and benefits. We will also study the impact of other types of regulatory activities, notably stress tests and disclosures, and explain how policies aimed at market beliefs are complementary to those aimed at banks' balance sheet and operational decisions.

Compétence à acquérir :

Students will get acquainted to the modern modelling tools for Banking economics. They will see how these tools allow to shed light on both traditional banking issues (bank runs, moral hazard) and more recent ones (shadow banking, regulatory arbitrage). We will then study how regulation can help in addressing these issues and aim at understanding the raison-d'être of several policy instruments, ranging from the Basel III rules to stress test results disclosure strategies.

Mode de contrôle des connaissances :

Presentation 50% Written exam 50%

Bayesian techniques in macroeconomics

ECTS : 3

Behavioral economics and bounded rationality

ECTS : 3

Description du contenu de l'enseignement :

The objective of the course is to present the most important themes in behavioral economics.

- Reference-dependent utility, with and without risk
- Probabilistic judgement and the treatment of information
- Time preferences
- Attention and inattention
- Social preferences

The course itself will focus on models and their empirical validity.
By choice, the course will not be principally about experimental protocols - yet protocols are explained occasionally - but rather on main ideas, results, and debates.
The diverse applications will be treated all along.

Compétence à acquérir :

The topic has reached a certain degree of maturity and it is part of an aspiring economist culture. After attending the classes, the students will be able to read the cutting-edge research on the topic. Given the variety of ways by which standard (non behavioral) models can be tweaked, the course is not intended to promote a particular view, but to help would-be modelers to better motivate their choices.

Mode de contrôle des connaissances :

- MCQs all along the classes (30%).
- Final written exam (70%).

Bibliographie, lectures recommandées :

Highly recommended for the fascinating and lively excursion across almost all topics: Daniel Kahneman's 2011 book, *Thinking Fast and Slow.*
The main reference is the *Handbook of Behavioral Economics*, Elsevier, 2018 and 2019. All chapters are dense. Some of them are heavily used for the lectures.

Computational social choice

ECTS : 3

Environement and sustainability

ECTS : 3

Description du contenu de l'enseignement :

Global warming and the related environmental and social issues raise serious concerns for the welfare of our current and future generations. Such changes require to develop new approaches and solutions to address these key issues so that they can become and remain sustainable. The course Environment and Sustainability will introduce students to key theories and models related to the environment, sustainability, societal issues, and the United Nations' Sustainable Development Goals.

1. Introduction: challenges for sustainability toward the net-zero economy

2. Sustainability: definition and examples

3.Sustainability: theoretical challenges

4.Climate Change: definition and examples

5.Climate Change: theoretical challenges

6.Climate Change policies

7.The energy transition

Compétence à acquérir :

Students will be able to critically evaluate the complex drivers and consequences of global environmental problems for different societal groups, applying academic concepts and theories. They will develop in-depth knowledge in specialist areas of environment and sustainability and gain critical thinking skills. Finally, attendees will be able to assess the effectiveness, equity and trade-offs of different sustainability goals and policies.

Mode de contrôle des connaissances :

Final Exam (written dissertation)

Bibliographie, lectures recommandées :

Dasgupta, Sir Partha. "The Economics of Biodiversity The Dasgupta Review Abridged Version." (2021).
Richard S. J. Tol, Climate Economics: Economic Analysis of Climate, Climate Change and Climate Policy Edward Elgar Publishing, 2019 - 234 pages
Selected Videos from https://rtol.github.io/ClimateEconomics/video/

Experimental Economics

ECTS : 3

Health, welfare and health behavior

ECTS : 3

Incremental learning, game theory and applications

ECTS : 3

Inequality and redistribution

ECTS : 3

Description du contenu de l'enseignement :

In most developed countries, inequality has been rising in recent decades, becoming a key political issue at the center of the public debate. This course aims at understanding the historical evolution of between- and within-country inequality from the late 19th century until today, and what are the key drivers explaining this evolution. How to adequately measure inequality? How does globalization impact global inequality? What is the effect of technological change on labor income inequality? What is the role of public policies in mitigating these effects? We will review economic theories and use up-to-date empirical techniques to address these questions. Through the presentations of recent research papers, students will also get acquainted with the multiple dimensions of inequality (e.g. gender inequality, racial inequality, inequality in education outcomes, etc.).

Compétence à acquérir :

At the end of the course, students should be able to:

- Describe the evolution of income inequality in developed and developing countries since the 19th century
- Identify and describe the drivers of the change in labor and capital inequality
- Understand and use models to rationalize the change in labor and capital inequality
- Understand and design policy tools that can mitigate inequality through redistribution

Mode de contrôle des connaissances :

Assessment will be based on a presentation (30%), a final written exam (65%) and participation in class (5%). The presentation will consist in presenting in class a research paper addressing the question of inequality. The final exam will be a mix of short questions about concepts seen in class and question where the student will be asked to develop his own analysis using the concepts seen in class.

Bibliographie, lectures recommandées :

A specific reading list is provided at the start of each session.

International Trade & International Macroeconomics

ECTS : 3

Description du contenu de l'enseignement :

The course covers the recent advances in international trade and macroeconomics with an emphasis on the role of firm heterogeneity. Starting from recent models of international trade with heterogeneous firms (Melitz 2003; Chaney 2008) and its effects on the labor market, the course will rely on the theoretical modelling of the New Open Economy Macroeconomy framework (Obstfeld & Rogoff, 1995), which embeds explicit microfoundations in a dynamic general equilibrium perspective. The first part of the course will provide students with the essential tools to study the optimal international strategy of firms with different levels of productivity. The second part of the course studies the recent advances in international macroeconomics that

incorporate these elements from the international trade literature, by modeling the role of the extensive margin of trade à la Melitz (2003) in an international macroeconomic setting.

Compétence à acquérir :

The objective of the course is to introduce some key topics of interest in the field of international trade and international macroeconomics and to provide students with the modelling framework to address them. A specific focus will be made on the role of firm heterogeneity in shaping international trade flows as well as macroeconomic fluctuations in an international set-up. The students will be trained to read leading research articles on these issues. After attending the classes, the students will have a sharp understanding of the optimal international strategy of firms, and how such trade microfoundations shed new light on long-standing or novel questions in international macroeconomics. They will also master the cutting-edge research at the frontier between international macroeconomics and international trade, and how to think about economic policy in this global framework.

Mode de contrôle des connaissances :

Final exam: 60%

Home assignment: 40%

Bibliographie, lectures recommandées :

There is no textbook for this course. We will base entirely on published academic papers, based on the (yet non-definitive) list of papers.

Common core paper - compulsory reading

· Melitz, M. (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica* 71: 1695-1725

Part I: International trade

· Brainard, S.L. (1997) "An Empirical Assessment of the Proximity- Concentration Trade-off Between Multinational Sales and Trade," *American Economic Review*, 87(4), pages 520-544 (suggested reading)

· Melitz, M., Helpman, H. and S. Yeaple (2004) "Export Versus FDI with Heterogeneous Firms", *American Economic Review* 94: 300-316 (compulsory reading).

· Pavcnik (2002) "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants", The Review of Economic Studies 69, January 2002, pp. 245-76 (suggested reading).

· Trefler D. (2004) "The Long and Short of the Canada-U.S. Free Trade Agreement", *American Economic Review* 94: 870-895 (compulsory reading).

· Helpman H. and Itskhoki (2010) "Labour Market Rigidities, Trade and Unemployment", *Review of Economic Studies*, 77(3): 1100-1137 (compulsory reading).

· Kovak, B. (2013) "Regional Effects of Trade Reform: What is the Correct Measure of Liberalization", *American Economic Review*, 103(5): 1960-1976 (compulsory reading).

· Autor D., Dorn D., and G. Hanson (2013) "The China Syndrome: Local Labor Market Effects of Import Competition in the United States", *American Economic Review*, 2013, 103(6), 2121–2168 (compulsory reading).

· Kovak, B and R. Dix-Carneiro (2017) "Trade Liberalization and Regional Dynamics", *American Economic Review*, 107(10): 1908-2946 (suggested reading).

Part II: International Macroeconomics

Trade, trade integration and international macroeconomics

· Backus, David K.; Kehoe, Patrick J.; Kydland, Finn E. (1995), "International Business Cycles: Theory and Evidence", in Cooley, Tom (ed.), Frontiers of Business Cycle Research, Princeton University Press

· Ghironi, Fabio, and Marc Melitz. 2005. "International Trade and Macroeconomic Dynamics with Heterogeneous Firms." Quarterly Journal of Economics 120: 865-915

Firm heterogeneity, firm dynamics and international fluctuations

· Barratieri, Alessandro, Cacciatore, Matteo, Ghironi, Fabio; « Protectionism and the business cycle », Journal of International Economics, vol. 129, 2021, p. 1-21

· Monetary policy, firm heterogeneity, and product variety, Hamano, Masashige and Zanetti, Francesco, European Economic Review, Vol. 104, 2022

· Cacciatore M., Ghironi F., "Trade, unemployment, and monetary policy", Journal of International Economics, 2021

Trade, granularity and business cycles

· The Micro Origins of International Business-Cycle Comovement, Julian di Giovanni, Andrei A. Levchenko and Isabelle Mejean, American Economic Review, Vol 108, 2018

· Large Firms and International Business Cycle Comovement, 2017, American Economic Review P&P, 107(5):598-602, J. di Giovanni, A. Levchenko and I. Méjean

· Volatility in the small and in the large: The lack of diversification in international trade, Francis Kramarz, Julien Martin and Isabelle Méjean, Journal of International Economics, Volume 122, January 2020

The macro consequences of economic

Introduction to Matlab programming

ECTS : 0

Key challenges for Advanced macroeconomics

ECTS : 3

Labor, education and public policies

ECTS : 3

Description du contenu de l'enseignement :

This course will present an overview of topics in Labour and Education. The first part of the course will cover 4 topics related to wage determination and unemployment insurance, which are at the frontier of current research in labour economics. More specifically, we will consider the returns to education, the fundamentals of wage determination, the forms and consequences of labour market discrimination and unemployment insurance. The course will cover both the theoretical and empirical aspects of all topics. It will also systematically discuss the relevant policy implications. The second part of the course will review the reasons for government intervention in Education, and will then cover three main types of interventions: demand side policies (financial and information interventions), supply side policies (school resources) and policies aimed at reducing inequalities (affirmative action).

Provisional schedule

1. Labour I: Returns to education

2. Labour II: Wage determination and minimum wage

3. Labour III: Labour market discrimination

4. Labour IV: Unemployment insurance

5. Education I: demand side policies (financial and information interventions)

6. Education II: supply side policies (school resources)

7. Education III : policies aimed at reducing inequalities (affirmative action)

Compétence à acquérir :

The first objective of the course is to equip the students with the tools that will allow them to understand the contemporary labour market and the relevant public policies. With this aim, it will first provide students with advanced knowledge of the determinants of wages, both from a theoretical and an empirical perspective. At the end of the course, the students will be able to identify the mechanisms underlying wage setting within firms and will have a good understanding of the main quantitative methods used by labour economists. They will also be able to contribute to the design of public policies related to labour market discrimination, unemployment insurance, etc.

The second objective of the course is provide students with a critical analysis of government intervention in education. It will present an overview of the main types of education policies, together with in-depth empirical analysis of the impact of specific policies. At the end of the course, the students will be able to identify the market failures and equity issues that concern education, and the type of policies that may be considered to solve them. They will also have a good understanding of the main quantitative methods used by economists to evaluate the impact of educational policies and contribute to the social debate on education.

This class will be useful to students who want to do a PhD dissertation in the field of applied labour economics and education

economics as well as to students who plan to work in institutions that produce studies and policy recommendations regarding education and the labour market, such as the OECD, Ministries of Labour, the ILO, etc.

Mode de contrôle des connaissances :

Written and oral assessment

During the course, students will be asked to present an article chosen in the reading list of the course. This presentation will be graded. A final exam will take place during the exam week. The final grade will be computed as a weighted average of the oral presentation (30%) and written exam (65%) grades, as well as a grade to account for participation (5%).

Bibliographie, lectures recommandées :

Tito Boeri and Jan Van Ours, *The Economics of Imperfect Labour Markets*, 2nd edition, Princeton University Press, 2013.

Articles listed on the reading list provided at the start of the course

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Machine Learning

ECTS : 9

Description du contenu de l'enseignement :

The course gives a thorough presentation of the machine learning field and follows this outline:

1. general introduction to machine learning and to its focus on predictive performances (running example: k-nearest neighbours algorithm)
2. machine learning as automated program building from examples (running example: decision trees)
3. machine learning as optimization:
    1. empirical risk minimization
    2. links with maximum likelihood estimation
    3. surrogate losses and extended machine learning settings
    4. regularisation and kernel methods (support vector machines)
4. reliable estimation of performances:
    1. over fitting
    2. split samples
    3. resampling (leave-one-out, cross-validation and bootstrap)
    4. ROC curve, AUC and other advanced measures
5. combining models:
    1. ensemble techniques
    2. bagging and random forests
    3. boosting
6. unsupervised learning:
    1. clustering (hierarchical clustering, k-means and variants, mixture models, density clustering)
    2. outlier and anomaly detection

Compétence à acquérir :

After attending the course the students will

- have a good understanding of the algorithmic and statistical foundations of the main machine learning techniques
- be able to select machine learning techniques adapted to a particular task (exploratory analysis with clustering methods, predictive analysis, etc.)
- be able to design a model selection procedure adapted to a particular task
- report the results of a machine learning project with valid estimation of the performances of their model

Mode de contrôle des connaissances :

- quizzes and tests during the course
- machine learning project

Machine Learning for Economists

ECTS : 3

Description du contenu de l'enseignement :

Economic science has evolved over several decades toward greater emphasis on empirical work. Ever increasing mass of available data ('big data') in the past decade is likely to have a further and profound effect on economic research (Einav and

Levin, 2014). Beyond economic research, governments and the industry are also increasingly seeking to use 'big data' to solve a variety of problems, usually making use of the toolbox from machine learning (ML).

The question we ask in this course is the following : What do we (not) learn from big data and ML as economists? Is ML merely applying standard techniques to novel and large datasets? If ML is a fundamentally new empirical tool, how does it fit with what we know? In particular, how does it fit with our tools for causal inference problems? As empirical economists, how can we use big data and ML? We'll discuss in detail how ML is useful to collect new data, for prediction in policy, and to provide new tools for estimation and inference.

Compétence à acquérir :

Course objectives:

1. Present a way of thinking about ML that gives it its own place in the econometric toolbox.

2 Develop an intuition of the problems to which it can be applied in economics, and its limitations.

3 Data challenge in health policy.

Mode de contrôle des connaissances :

Grading:

1. In-class pairwise presentation of an academic paper (20% of overall grade).

2. Data challenge project : written report + in-class presentation (80% of overall grade).

Bibliographie, lectures recommandées :

- Mullainathan, Sendhil and Jann Spiess (2017). "Machine learning: An applied econometric approach". In: Journal of Economic Perspective 31.2, pp. 87-106.
- Kleinberg, Jon et al. (2015). "Prediction policy problems". American Economic Review 105.5, pp. 491-495.
- Athey, S. (2017): "Beyond prediction: Using big data for policy problems", Science 355, 483–485.
- Kleinberg, J., Lakkaraju, H., Leskovec, J., Ludwig, J. and S. Mullainathan (2018): "Human Decisions and Machine Predictions", The Quarterly Journal of Economics, Volume 133, Issue 1, Pages 237–293.
- Susan Athey, Guido W. Imbens. 2019. Machine Learning Methods That Economists Should Know About. Annual Review of Economics 11:1, 685-725.
- Athey, Susan, and Guido Imbens. 2016. "Recursive Partitioning for Heterogeneous Causal Effects". PNAS 113(27): 7353–60.
- Belloni, A., V. Chernozhukov, S. Mullainathan and J. Spiess and C. Hansen.(2014): "High-Dimensional Methods and Inference on Structural and Treatment Effects" Journal of Economic Perspectives, Volume 28, Number 2 – Spring 2014, Pages 29–50

Master Thesis Defense

ECTS : 15

Mater Thesis support seminar

Methods for public policy evaluation

ECTS : 6

Description du contenu de l'enseignement :

This course explores different topics in applied microeconometrics at advanced level for public policy evaluation. It focuses on causal inference and how econometrics can help identify causality. It discusses the advantages and limitations of particular types of approaches/tools that are used in econometrics. It covers the following topics: Causal inference and identification, Randomized experiment, Regression and causality, Instrumental variables approach and Regression discontinuity designs. The course will review the theory underlying those different techniques and will discuss the recent studies that have applied these methods to make causal inference.

Compétence à acquérir :

The objective of the course is to provide students the econometric methods aiming at identifying causal relationships. These methods are widely applied in economics to assess the effects of policy interventions and other treatment on interest. After attending the classes, the students will be able to have a deep understanding and a critical view on studies aiming at identifying causal effects and to apply those methods for their own research.

Mode de contrôle des connaissances :

Written exam (70%) + Short empirical paper (20%) + Active participation in class (10%)

Bibliographie, lectures recommandées :

Mostly Harmless Econometrics, Joshua Angrist and Jörn-Steffen Pischke

Econometric Analysis of Cross-section and Panel Data, Jeffrey Wooldridge

Microeconometrics. Methods and Applications, A. Colin Cameron and Pravin K. Trivedi

NLP for economic decisions

ECTS : 3

PhD Proposal / Internship

ECTS : 6

Policies in developing countries

ECTS : 3

Python for data science

ECTS : 3

Description du contenu de l'enseignement :

The course is organised as follows.

1 - Introduction to Python Programming

This first part introduces the fundamentals of Python programming. It covers topics such as working with basic built-in types (numbers, strings, booleans, ...), control flow statements, writing reusable code (functions), handling errors and exception that can occur during the execution of Python code, advanced data structures (lists, sets, dictionaries, ...), ...

2 - Scientific Computing With NumPy

This part focuses on using NumPy, a scientific computing package that provides a wide assortment of useful and highly-optimized routines for working with multi-dimensional arrays (matrices, tensors, ...), linear algebra, statistics and random simulation, and much more.

3 - Processing Tabular Data With pandas

The third part of the course is dedicated to pandas, a fundamental Python package when it comes to data science and data analysis. pandas provides functionalities for efficient manipulation of data frames, i.e., tabular data (stored in csv files, Excel sheets, ...). With the help of pandas, you can easily conduct tasks such as data cleaning (filling missing data, replacing outliers, ...), reshaping, merging, ...

4 - Visualizing Data With Matplotlib and seaborn

The last part of the course is a quick introduction to data visualization functionalities in Python using the Matplotlib and seaborn packages. Data visualization is a very powerful tool for making sens of large volumes of data, identifying patterns, and extracting useful insights that can help understand and solve real-world business cases.

Compétence à acquérir :

By the end of this course, you will be able to

- Write and understand entry-level to intermediate-level code in the Python programming language
- Use NumPy for scientific computing and efficient manipulation of multi-dimensional arrays and matrices
- Use pandas to load, manipulate, and analyze tabular data
- Use Matplotlib and seaborn to visualize data

Mode de contrôle des connaissances :

You will be evaluated based on a team project (conducted in pairs) in which you will apply the knowledge and skills you acquired during the course. The project takes the form of an exploratory data analysis in which you will work on a tabular data set in order to extract valuable insights that can help solve a business problem.
The expected deliverables of the project are:

- A 5–10 pages report;

- The source code (Jupyter notebooks or Python scripts) of your work, either in a Github repository or as a zip file.

You are expected to present your main findings during a 10-minutes presentation, which will be followed by approximatively 5 minutes of questions.

Quantitative International Economics

ECTS : 3

Description du contenu de l'enseignement :

This lecture covers advanced topics in international economics with a special emphasis on quantitative techniques employed in international trade. This course is divided into two main components: the first part introduces important concepts and provides the theoretical foundations of the structural gravity equation. The second part deals with partial and general equilibrium trade policy analysis with structural gravity

Compétence à acquérir :

- Enhance their understanding of economic methods and data sources for trade policy analysis.
- Applying international trade models and provides recommendations on how to obtain reliable partial and general equilibrium estimates for the effects of trade policy.

Mode de contrôle des connaissances :

Home works

Bibliographie, lectures recommandées :

- Head K. and T. Mayer, 2014. "Gravity Equations: Workhorse,Toolkit, and Cookbook", Handbook of International Economics, 4th ed, 4:131-195.
- Gravity Cookbook website
- Costinot, A., and A. Rodríguez-Clare, 2014. "Trade Theory with Numbers: Quantifying the Consequences of Globalization", Handbook of International Economics, 4th ed, 4:131-195.
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