

**COURSE DATA****Data Subject**

<b>Code</b>	44163
<b>Name</b>	Quantitative methods in economy
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	5.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
2203 - M.U. en Política Económica y Economía Pública	Faculty of Economics	1	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2203 - M.U. en Política Económica y Economía Pública	3 - Quantitative methods in economy	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
MENEU GAYA, ROBERT	257 - Business Mathematics
VILA LLADOSA, LUIS EDUARDO	110 - Applied Economics

**SUMMARY**

The subject of Quantitative Methods in Economics is structured in two parts. In the first, Mathematical methods and models, the student should be able to manage systems of equations, optimization models, ordinary differential equations and difference equations as useful tools to analyze the static equilibrium and the behavior, over time, of any economic situation. To facilitate the calculation, computer programs will be used, which will also show the usefulness of the graphic descriptions. Special emphasis will be placed on the concept of stability that, with other formalities, will be handled in several master's subjects. Likewise, it will address how to analyze several dynamic systems that occur simultaneously.

The second part is dedicated to an introduction to multilevel analysis. It is intended that the student knows a series of quantitative analysis techniques that allow him to make the most of the information sources (questionnaires, databases, etc.) and the economic models; be able to choose the most appropriate one for the resolution of a certain research problem; be able to apply it rigorously; know how to extract all the information provided and, finally, be able to effectively communicate their results.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

Basic knowledge of mathematics and solid knowledge of the regression model and statistical inference.

## OUTCOMES

### 2203 - M.U. en Política Económica y Economía Pública

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Capacidad para preparar, redactar y exponer en público informes y proyectos sobre política económica y economía pública de manera clara y coherente, defenderlos con rigor y tolerancia y responder satisfactoriamente a críticas sobre los mismos.
- Desarrollar la capacidad crítica, impulsar la inquietud y el interés investigador; buscar, ordenar, analizar y sintetizar la información económica, seleccionando aquella que resulta pertinente para la toma de decisiones en política económica.
- Desarrollar la capacidad de trabajo en equipo, coordinación de tareas, liderazgo y compromiso con el grupo en el desarrollo de actividades de análisis de los problemas económicos y sus soluciones.
- Tomar decisiones tanto individuales como colectivas en su labor profesional y/o investigadora relacionada con la resolución de problemas propios de la política económica y la economía pública.
- Integrar las nuevas tecnologías de la información y de la comunicación en su labor profesional y/o investigadora relacionada con el análisis de la intervención del estado en la economía.
- Saber participar en debates y discusiones, dirigirlos y coordinarlos y ser capaces de resumirlos y extraer de ellos las conclusiones más relevantes y aceptadas por la mayoría.
- Saber cómo proyectar sobre problemas concretos sus conocimientos y saber resumir y extraer los argumentos y las conclusiones más relevantes para su resolución.



- Ser capaz de definir, expresar y resolver de forma sistemática problemas económicos complejos.
- Valorar la técnica de análisis cuantitativo avanzada más adecuada en función del problema económico a resolver.
- Comprender y utilizar de manera rigurosa un determinado método estadístico.
- Aplicar eficazmente el software de análisis estadístico avanzado.
- Interpretar y comunicar los resultados derivados de la aplicación de un determinado método estadístico.

## LEARNING OUTCOMES

After completing the subject Quantitative Methods in Economics, the student should be familiar with the dynamic analysis of economic situations in both discrete and continuous time, as well as studying the stability of the systems analyzed. To avoid the calculation difficulties inherent to these techniques, computer programs will be managed to facilitate the work and emphasis will be placed on the graphic and qualitative solutions of the economic models. In addition, economic interpretations of quantitative results and their formal expression will be emphasized.

Likewise, the student will acquire a deep knowledge of advanced statistical methods, being able to select, based on the methodological requirements of each of them, the most appropriate to tackle the economic problem to be solved. In order to obtain the corresponding estimates, the student will be instructed in the management of advanced statistical software. In this way the student will know and be able to obtain the estimates of the statistical models studied, make projections and inferences of the different variables analyzed and develop scenarios. Finally, the student, at the conclusion of the course, will be able to interpret and communicate, from a technical-economic point of view, the results in the estimation of his model.

## DESCRIPTION OF CONTENTS

### 1. Introduction and static analysis

Mathematics and Economy  
Statics, comparative statics and dynamics  
Introduction to Mathematica  
Static analysis through systems of equations  
Static analysis through mathematical optimization  
Exercises

### 2. Dynamical Analysis in discrete time

First order difference equations  
Solution with Mathematica of a first order difference equation  
Stationary equilibrium and dynamic stability of the equilibrium  
Systems of difference equations  
High order difference equations



Examples of economic models and exercises

### 3. Continous dynamic analysis

First order differential equations  
Solution with Mathematica of a first order differential equation  
Stationary equilibrium and dynamic stability of the equilibrium  
Systems of differential equations  
High order differential equations  
Examples of economic models and exercises

4.

5.

6.

## WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	50,00	100
Development of individual work	5,00	0
Study and independent work	10,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	7,50	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	12,50	0
Resolution of case studies	20,00	0
<b>TOTAL</b>	<b>125,00</b>	

## TEACHING METHODOLOGY

The master class with active participation will be the teaching-learning method used to transmit the theoretical content of the subject. This methodology will allow to take advantage of the master class and favor the participation of the students and the teacher-student interaction. The empowerment of the participation and the discussion in the class is necessary so that the student is directly involved in the learning of the content.





When the content of the class is of a practical nature, the teacher will propose to the students practical cases (real -based on the reading and discussion of published scientific articles- or fictitious -based on a databank-) that they must solve by applying the concepts learned in theoretical classes. The practices will be developed following different teaching strategies according to the theoretical contents discussed, although fundamentally they will be based on the resolution of problems and simulation of scenarios.

Likewise, in the practical sessions the professor will propose one or several activities to be solved by the students that will cover the different subjects of the subject, with the purpose that the student acquires the competences enumerated in this academic guide. These activities will be part of the evaluation of the subject.

## EVALUATION

The evaluation of the subject will distinguish the part of Mathematics and the part of Statistics. It is necessary to pass each part separately to calculate the final grade of the subject, which will be the simple mean of the final grade of each part.

The evaluation of the Mathematics part will be continuous and will consist of 4 exams taken in the classroom during the last 30 minutes of the 3rd, 5th, 8th and 10th class. The exams will take the form of tasks that are sent through the virtual classroom. To obtain the final grade through continuous assessment, each exam must be passed and the simple mean of the four grades is the final grade, so the mathematics part can be passed through continuous assessment. In case of suspending any of the four exams, the final exam of both the first and the second call will serve as a recovery of the suspended part(s).

The continuous evaluation of Statistics is based on solving and discussing exercises and/or on the result of individual tests taken in class, plus a research report that must be handed in at the end of the term.

## REFERENCES

### Basic

- Sydsaeter, K. and Hammond, P. (2016). Essential Mathematics for Economic Analysis. Ed. Pearson (5th. ed.). S 51 SYD
- Chiang, A. C. y Wainwright, K. (2006). Métodos fundamentales de Economía Matemática. México DF:McGraw-Hill (4ª Edición). S 330.4 CHI
- Stock, J.H. y Watson, M.M. (2012). Introducción a la Econometría. 3º Edición. Madrid:Prentice-Hall.
- Calvo, C. y Ivorra, C. (2015): An introduction to economic dynamics. Tirant lo Blanch. [https://trobes.uv.es/view/action/uresolver.do?operation=resolveService&package\\_service\\_id=410852359000625](https://trobes.uv.es/view/action/uresolver.do?operation=resolveService&package_service_id=410852359000625)
- Meneu Gaya, R. (2019). Apuntes de Métodos Matemáticos en Economía. Disponible en aula virtual.
- Cebolla Boado, H. (2013 ) Introducción al análisis multinivel. Cuadernos Metodológicos 49. CIS.



- Snijders, T.A.B. & Bosker, R. (1999) Multilevel analysis: An introduction to Basic and applied Multilevel Analysis. Sage.
- Vila, L.E. (2022). Apuntes de análisis multinivel. Disponible en aula virtual.

#### **Additional**

- Lectura de artículos de revistas científicas.
- Fernández, C.; Vázquez, F. J. y Vegas, J. M. (2003). Ecuaciones Diferenciales y en Diferencias. Sistemas Dinámicos. Ed. Thomson. CI 517.9 FER
- Goldstein, H. (2010) Multilevel Statistical Models. Arnold.
- Gelman, A. & Hill, J. (2007) Data analysis Using Regression and Multilevel/Hierarchical Models. Cambridge University Press.