ADVANCED COURSES IN ECONOMIC ANALYSIS:

THE MEASUREMENT OF FIRMS' EFFICIENCY AND PRODUCTIVITY

Subal Kumbhakar
Alfons Oude Lansink
Luis Orea
José Luis Zofío

21th-25th May, 2018

PRESENTATION

Introduction

This document describes the specific content of the course entitled "**The Measurement of Firms' Efficiency and Productivity"**. The course is organized by the *Oviedo Efficiency Group* (Universidad de Oviedo, UO) and the *Department of Economic Analysis: Economic Theory and Economic History* (Universidad Autónoma de Madrid, UAM), which has been offering in last years a series of "Advanced Courses in Economic Analysis" that address key methodological issues of interest for researchers in economics. The course is taught primarily in English, by a combination of local scholars from the UO and UAM as well as invited professors from international leading institutions. The course is offered to the graduate students, researchers, young scholars and professional economists working in national and international institutions.

Course date

Starting day: May 21, 2018
Ending day: May 25, 2018

Potential Attendants

The course is oriented toward students that should have or be doing postgraduate studies in Economics or Business with a good academic record, or be involved in their PhD project students in Economics or Business. Postdoctoral researchers, scholars, and professional economists working for private companies, sectorial regulators and economic consultancies are also welcome. Exceptionally, some undergraduate students, who have already pass more than 200 credits ECTS, and have a good record. All students must have a high level of written and spoken English, since most of the materials and the course are in English.

Programme

The advanced course "The Measurement of Firms' Efficiency and Productivity" is organized into three parts.

PART 1: Theoretical background and benchmarking techniques (21th – 22th May)

Once the theoretical framework to study economic efficiency has been summarized, this part of the course outlines the most popular Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) techniques to undertake efficiency and productivity analyses. As firms produce multiple outputs using multiple inputs, the concept of distance function will be used to represent firm's technology and establish best practice. The existence of dual relationships between particular distance functions (input, output, directional or generalized), and their supporting economic functions (cost, revenue, profit and profitability), offers the researcher the possibility of choosing the perspective of the firms that is best suited for the analysis.

PART 2: Productivity change (22th – 23th May)

This part of the course relies on the distance function representation of the technology to present alternative definitions of temporal productivity change. The popular Malmquist productivity and Luenberger productivity indicators and their decomposition into several terms explaining productivity change (including an environmental component) will be first introduced, as well as their relationship to traditional−price or value based−definitions such as those of Fisher and Bennet. We close this part with a revision of several approaches proposed in the applied literature to account for the role of adjustment costs in investments when measuring firms' productivity (efficiency).

PART 3: Advanced topics in SFA (24th – 25th May)

This part of the course introduces the students into recent SFA models that allows controlling for many unobserved environmental characteristics of the sector that affect firms' production/costs (e.g., geography, climate network characteristics). This issue is particularly important in the case of incentive regulation and benchmarking of electricity, gas, and water networks where the results of efficiency analysis have important financial implications for the firms. Possible differences among firms using different technologies are also addressed using both cross-sectional and panel data (in particular, using latent class models and panel data frontier models that distinguish between persistent and transient efficiency. Obtaining reliable (and fair) measures of firms' efficiency requires controlling for endogenous regressors. Both single and system models are introduced to address this issue.

Specific objectives

The course's main objective is promoting the advanced knowledge in benchmarking (frontier) analysis techniques with a practical and "learn by doing" approaches.

Participants will learn in the method sessions the theories concerning efficiency and productivity measurement. The lab sessions will include applications of the theory, computer analyses using standard software with actual data sets. Applications to various economic sectors will be considered such as agriculture, banking, chain management and electricity distribution.

In particular, after successful completion participants are expected to be able to:

- Characterize efficiency and productivity (growth) from a primal, dual and distance function perspective.
- Assess the appropriate use of benchmarking approaches given the data and problem setting, understanding the advantages and disadvantages of SFA and DEA techniques.
- Use SFA and DEA techniques to allocate scarce resource among competing ends, and identify the firm scale of operations.
- Use SFA and DEA techniques for benchmarking, identifying best practices and sources of inefficiency in order to plan for performance enhancement/gains.
- Use frontier models to measure technical, allocative, and scale efficiency levels and productivity growth.
- Delineation of variable and quasi-fixed factors and their treatment in efficiency and productivity.
- Implement the main parametric and non-parametric frontier models using both cross-sectional and panel data.
- Use econometric models to address advanced topics in efficiency and productivity change measurement, such us controlling for omitted variables, unobserved heterogeneity, and endogenous regressors.

The course has the following secondary objectives:

- To promote learning in the presentation of scientific results in the format of an academic journal, posing hypotheses, designing models needed by selecting the appropriate specification and presenting the results effectively.
- To promote interaction between students and local and invited scholars, creating a comfortable atmosphere for scientific consultations, and encouraging the development of joint research and specific research approach and future doctoral dissertations.

Course Materials

- Bogetoft, P., and Otto, L. (2010). *Benchmarking with DEA, SFA, and R* (Vol. 157). Springer Science & Business Media.

- Fried, H.O., Lovell, C. K., and Schmidt, S. S. (Eds.). (2008). *The measurement of productive efficiency and productivity growth*. Oxford University Press.

- Kumbhakar, S.C., Wang, H.J., and Horncastle, A.P. (2015*). A practitioner's guide to stochastic frontier analysis using Stata*. Cambridge University Press.

- Orea, L. and Zofío, J.L. (2017), "A primer on the theory and practice of efficiency and productivity analysis", Efficiency Series Papers, ESP 05/2017, Oviedo Efficiency Group, Department of Economics, University of Oviedo.

- Parmeter, C.F., and Kumbhakar, S.C. (2014). *Efficiency analysis: a primer on recent advances*. Foundations and Trends® in Econometrics, 7(3–4), 191-385.

Participants should make sure they have these books before the course starts (books are not included in participation fee). Reading materials prepared by the authors will be sent to participants in advance of course. Articles and other accompanying materials will be distributed during the course.

Assumed prior knowledge

1) *Theory*: Microeconomic theory at the graduate level such as the treatment in H. Varian, Microeconomic Analysis, W.W. Norton.

2) *Methods*: Econometric theory (cross-section and panel data) and applications at the graduate level to include topics in ML and system estimation are required. Linear programing and Dynamic optimization is also recommended.

2) *Software*: Some experience using Matlab, STATA and R. Good introductory materials for each one of these software can be found in: Matlab (http://people.brandeis.edu/~pmherb/MatlabBootCamp/; https://es.mathworks.com/discovery/linear-programming.html; STATA (https://sites.google.com/site/econometricsacademy/econometrics-software/stata), and R (https://sites.google.com/site/econometricsacademy/econometrics-software/r).

All students must have a high level of written and spoken English, since most of the materials and the course are in English.

Venue

The sessions will be held in the School of Economics and Business, located at Calle Francisco Tomas y Valiente, 5, 28049, Madrid, Spain. The exact rooms will be announced later.

Accommodation

Attendants can find a wide supply of hotels in Madrid. According to the connections of the university by train, it is recommendable a hotel near to any of the stations in line C4 of the short-distance trains ("Cercanías" in Spanish) as this line includes the station of the University ("Cantoblanco Universidad"). Former attendants to these advaced courses preferred hotels close to stations "Atocha", "Sol", "Nuevos Ministerios" or "Chamartin".

Alternative options for accommodation can be found in the following links:

- UAM-student residence: It is located within the campus (<10 minute walk to the Economic and Business School). More info: http://www.resa.es/eng/Residences/Erasmo.
- Other student residences ("colegios mayores") linked to the UAM and located in Madrid. Usually, these student residences are conceived for longer stays, but sometimes they offer rooms for visiting scholars. More info: http://www.uam.es/estudiantes/colegios.

Faculty

Visiting professors (60% of teaching load):

- Subal Kumbhakar is a Distinguished Researcher Professor in Economics at the State University of New York at Binghamton (USA). His main area of research is applied microeconomics with a focus on estimation of efficiency in production. He uses production, cost, and profit function approaches to estimate economic efficiency. He has formulated a variety of panel data models to measure efficiency, which he has applied to a wide variety of topics covering agriculture, manufacturing, banking, airlines, electricity generation/distribution, public sector enterprises, etc. His current research includes semi and nonparametric panel data models with and without efficiency. Subal is a Fellow of Journal of Econometrics (1998). He holds an Honorary Doctorate degree (Doctor Honoris Causa) from Gothenburg University, Sweden (1997). Subal is currently a co-editor of Empirical Economics. He is serving as a Board of Editors and/or associate editors of high quality journals, such as Journal of Productivity Analysis, International Journal of Business and Economics, Journal of Regulatory Economics, or Applied Econometrics. Subal is the co-author (with Knox Lovell) of the prestigious book *Stochastic Frontier Analysis* (2000).

- Alfons Oude Lansink is the head of the Business Economics group of Wageningen University and director of the Wageningen Graduate school of Social Sciences (WASS). His research evolves around three main themes, i.e. dynamic technical and economic efficiency and productivity analysis; sustainable performance of food supply chains and agribusiness; and economics of plant health and invasive species. He has published over 220 refereed journal articles and has acted as guest editor of leading international refereed economics journals. Also, he was previously a member of the editorial board of Agronomy Journal and the European Review of Agricultural Economics. He is also currently a visiting professor of the Wroclaw University of Economics (Poland) and adjunct professor of the University of Florida.

UAM and OEG faculty (40% of teaching load including grading, etc.):

- Luis Orea is full professor in Department of Economics at Oviedo University since 2016. He is chair of the Oviedo Efficiency Group (OEG) since 2010, one of the leading research groups in the world in the fields of efficiency and productivity measurement. His main research is focused on productivity and efficiency analysis, econometric modelling, regulation and competition policy, agricultural economics, and energy economics. Among his most relevant publications from the theoretical perspective we can highlight its contribution to productivity growth decomposition using a generalized Malmquist index. Another of his key contributions (collaborating with Peter Schmidt, Christine Amsler and Antonio Álvarez) that allows testing the so-called scaling property in a heteroscedastic stochastic frontier model. He has published (co-authored with Subal Kumbhakar) one of the most cited references in the empirical literature using latent class frontier models. Moreover, he has published several papers using this model in order to examine different topics, such as the selection of the proper orientation to measure firms' inefficiency, or to control for unobserved differences in banks' technology, electricity distribution utilities' technology or consumers' demand.

- José Luis Zofío is Professor of Economics since 2014 in the Department of Economic Analysis at Universidad Autónoma de Madrid. Currently he is visiting professor at Erasmus University Rotterdam and Erasmus Research Institute of Management (Netherlands). His main area of research is applied microeconomics with a focus on estimation of efficiency and productivity both parametric and non-parametric frontier techniques, spatial and trade Economics, transport economics (in particular, infrastructure and accessibility issues), and cultural and institutional economics (copyright industries). He has acted several times as consultant to the World Intellectual Property Organization (WIPO). He is associate editor of "Revista de Economía Aplicada", and has acted as referee for international academic journals, such as Regional Science and Urban Economics, European Economic Review, Ecological Economics, Journal of Productivity Analysis, European Journal of Operational Research, OMEGA-International, Journal of Management Science, Journal of the Operational Research Society, Journal of Environmental Management, etc.

- Teaching Assistants: Adrian Caballero (Ph.D. student) and Javier Barbero, (Ph. D.). They will assist the Directors of the course on the organization and development of the program.

Directors

- Inmaculada Álvarez-Ayuso. Associate Professor at Department of Economic Analysis: Economic Theory and History at Universidad Autónoma de Madrid. +34914972858. Email: inmaculada.alvarez@uam.es
- José Luis Zofío. Full Professor at Department of Economic Analysis: Economic Theory and History at Universidad Autónoma de Madrid. +34914972406. Email: jose.zofio@uam.es
- Luis Orea. Full Professor at Department of Economics at University of Oviedo. +34985106243. Email: lorea@uniovi.es

Certification and outline of the course in hours

The organizers (Universidad Autónoma de Madrid) will issue a certificate of attendance. The overall course workload amounts to 90 hours approximately, of which 35 are lecture attendance time, while the remaining 55 hours correspond to personal study time, and solving problems sets and the home exam. These include familiarization with the software (Matlab, STATA, R) previous to the start of the course, and the home exam after the end of the course.

Further information

- On course content please contact the course organisers Luis Orea (lorea@uniovi.es) and José Luis Zofío (jose.zofio@uam.es).
- For details about the logistics, accommodation, registration, fees, study materials, etc. please contact the course organizer Inmaculada Álvarez using the course e-mail address: ace.economics@uam.es.

STRUCTURE

Short structure

PART 1: Theoretical background and benchmarking techniques (21ᵗʰ – 22ᵗʰ May)

- Session 1. Theoretical framework.
- Session 2. Empirical background.
- Session 3. Computer lab using cross-sectional DEA and SFA models.

PART 2: Productivity change (22ᵗʰ – 23ᵗʰ May)

- Session 4. Productivity measurement.
- Session 5. Measuring dynamic productivity.
- Session 6. Computer lab using static and dynamic productivity models.

PART 3: Advanced topics in SFA (24ᵗʰ – 25ᵗʰ May)

- Session 7. System SFA models.
- Session 8. Computer lab using single and multiple-equation SFA models.
- Session 9. Accounting for unobserved heterogeneity in SFA models.
- Session 10. Computer lab using SFA models with unobserved heterogeneity.

Long structure

PART 1: Luis Orea and José Luis Zofío. Theoretical background and benchmarking techniques (21ᵗʰ – 22ᵗʰ May)

- **Session 1. Theoretical framework. Monday (3 hours):**
    - Production, Distance, Cost, and Profit functions
    - Duality and overall economic efficiency: technical and allocative efficiency.

Core references:
- Bogetoft and Otto (2010, Ch. 2 & 3).
- Kumbhakar et al. (2015, Ch. 2).

Complementary references:
- Fried et al. (2008, sec. 1.3).
- Orea and Zofío (2017, Ch. 1 & 2).

- **Session 2. Empirical background. Monday (4 hours):**
  - Data Envelopment Analysis.
  - Stochastic Frontier Approach.

- Core references:
  - Thanassoulis et al. (2008).
  - Parmeter and Kumbhakar (2014, Ch. 2).

Complementary references:
- Bogetoft and Otto (2010, Ch. 4 & 7).
- Orea and Zofío (2017, Ch. 3).
- Kumbhakar et al. (2015, Ch. 2)
- Fried et al. (2008, sec. 1.5 & 1.6).
- Greene (2008).

- **Session 3. Computer lab using cross-sectional DEA and SFA models. Tuesday (4 hours):**
  - Introduction to MATLAB for nonparametric frontier analyses.
  - Estimation of simple DEA models in MATLAB.
  - Introduction to STATA and R for stochastic frontier analyses.
  - Estimation of simple SFA models in STATA.
  - Construction and maximization of likelihood functions of SFA models in R.

  Software:
  - MATLAB toolbox: Álvarez et al. (2016).
  - STATA codes: own elaboration and Kumbhakar et al. (2015, Appendix E1-E3).
  - R codes: own elaboration and Bogetoft and Otto (2010, Appendix A).

PART 2: Alfons Oude Lansink, and José Luis Zofío. Productivity change (22th – 23th May)

- **Session 4. Productivity measurement. Tuesday (3 hours):**
  - Malmquist index and Luenberger indicator.
  - The decomposition of total factor productivity change.
  - Environmental efficiency and productivity.

Core references:
- Färe et al. (2008).
- Kumbhakar et al. (2015, cap. 11).

Complementary references:
- Orea and Zofío (2017, Ch. 8).
- Kumbhakar et al. (2015, Ch. 11).

- Fried et al. (2008, sec. 1.7 & 1.8).

- **Session 5. Measuring dynamic productivity**. **Wednesday (3 hours):**
  o Dynamic technical and cost inefficiency.
  o Nonparametric estimation of structural dynamic models.
  o Nonparametric estimation and decomposition Dynamic Productivity Indicators.

  <u>Core references</u>:
  - Silva et al. (2015).
  - Oude Lansink et al. (2015).

  <u>Complementary references</u>:
  - Kapelko et al. (2014).

- **Session 6. Computer lab using static and dynamic productivity models. Wednesday (4 hours):**
  o Introduction to MATLAB for TFP decompositions using a static perspective.
  o Estimation of dynamic inefficiency models in R.
  o Introduction to R for TFP decompositions using a dynamic perspective.

  <u>Software</u>:
  - MATLAB toolbox: Balk, Barbero and Zofío (2018).
  - STATA codes: own elaboration and Kumbhakar et al. (2015, cap. 11).
  - R codes: own elaboration.

PART 3: Subal Kumbhakar and Luis Orea. Advanced topics in SFA (24th – 25th May)

- **Session 7. Endogeneity and system approach**. **Thursday (3 hours):**
  o Endogeneity issues in frontier models.
  o The cost/profit system approach.
  o The primal system approach.
  o Endogeneity issue when firms maximize returns to the outlay.

  <u>Core references</u>:
  - Kumbhakar et al. (2015, Ch. 8 & 9).

  <u>Complementary references</u>:
  - Parmeter and Kumbhakar (2014, Ch. 4).

- **Session 8. Computer lab using single and multiple-equation SFA models. Thursday (4 hours):**
  o Estimation of two-step SFA models with instrumental variables in R.
  o Introduction to STATA for parametric TFP decompositions using a static perspective.
  o Cost/Primal system estimation of SFA models in STATA.

  <u>Software</u>:
  - STATA codes: own elaboration and Kumbhakar et al. (2015, Appendix E4 & E6).
  - R codes: Own elaboration.

- **Session 9. Accounting for unobserved heterogeneity in SFA models**. **Friday (3 hours):**
  - o Latent class frontier models.
  - o The zero inefficiency stochastic frontier model.
  - o Panel data models: transient vs persistent inefficiency.
  - o Determinants of persistent and transient inefficiency.

  Core references:
  - Badunenko and Kumbhakar (EJOR 2017)
  - Parmeter and Kumbhakar (2014, Ch. 6 & 7).

  Complementary references:
  - Kumbhakar et al. (2015, Ch. 10).

- **Session 10. Computer lab using SFA models with unobserved heterogeneity. Friday (4 hours):**
  - o Estimation of LCSF and ZISF models in STATA/R.
  - o Estimation of simple panel data SFA models in STATA.
  - o Estimation of transient and persistent inefficiency in STATA.

  Software:
  - STATA codes: own elaboration and Kumbhakar et al. (2015, Appendix E5).
  - R codes: Own elaboration.

Notes:

- **Computer labs:** Problem sets where students will put into practice the topics taught in the course using the computer software Stata, Matlab and R.

- **Take home practice:** students will have one additional week to apply the concepts learned during the course, either through the analysis of an original question, or reproducing the results of a relevant paper in the literature previously studied in the course.

References

- Álvarez, I., Barbero, J. and Zofío, J. L. (2016), "A Data Envelopment Analysis Toolbox for MATLAB," Working Papers in Economic Theory 2016/03, Universidad Autónoma de Madrid (Spain), Department of Economic Analysis (Economic Theory and Economic History).

- Badunenko, O. and Kumbhakar, S.C. (2017), Economies of Scale, Technical Change and Persistent and Time-Varying Cost Efficiency in Indian Banking: Do Ownership, Regulation and Heterogeneity Matter?, *European Journal of Operational Research,* 2017, 260: 789-803.

- Bogetoft, P., and Otto, L. (2010). *Benchmarking with DEA, SFA, and R* (Vol. 157). Springer Science & Business Media.

- Färe, R., Grosskopft, S., and Margaritis, D. (2008). in Fried, H. O., Lovell, C. K., & Schmidt, S. S. (Eds.). (2008). *The measurement of productive efficiency and productivity growth*. Oxford University Press, Chapter 5.

- Fried, H. O., Lovell, C. K., and Schmidt, S. S. (2008), "Efficiency and Productivity", in Fried, H. O., Lovell, C. K., & Schmidt, S. S. (Eds.). (2008). *The measurement of productive efficiency and productivity growth*. Oxford University Press.

- Fried, H. O., Lovell, C. K., and Schmidt, S. S. (Eds.). (2008). *The measurement of productive efficiency and productivity growth*. Oxford University Press.

- Greene, W. (2008), "The Econometric Approach to Efficiency Analysis", in Fried, H. O., Lovell, C. K., & Schmidt, S. S. (Eds.). (2008). *The measurement of productive efficiency and productivity growth*. Oxford University Press.

- Kapelko, M., Oude Lansink, A., Stefanou, S.E. (2014). Assessing dynamic inefficiency of the Spanish construction sector pre- and post-financial crisis (2014) *European Journal of Operational Research*, 237 (1), pp. 349-357.

- Kumbhakar, S. C., Wang, H. J., and Horncastle, A. P. (2015*). A practitioner's guide to stochastic frontier analysis using Stata*. Cambridge University Press.

- Kumbhakar, S.C. (2011), Estimation of production technology when the objective is to maximize return to the outlay, *European Journal of Operation Research,* 208, 170-176.

- Orea, L. and Zofío, J. L. (2017), "A primer on the theory and practice of efficiency and productivity analysis", Efficiency Series Papers, ESP 05/2017, Oviedo Efficiency Group, Department of Economics, University of Oviedo.

- Parmeter, C. F., and Kumbhakar, S. C. (2014). *Efficiency analysis: a primer on recent advances*. Foundations and Trends® in Econometrics, 7(3–4), 191-385.
- Thanassoulis, E., Portela, M.C.S. and Despic, O. (2008). in Fried, H. O., Lovell, C. K., & Schmidt, S. S. (Eds.). (2008). The measurement of productive efficiency and productivity growth. Oxford University Press, Chapter 3.

- Oude Lansink, A.G.J.M.; Stefanou, S.E.; and Serra, T. (2015). Primal and dual dynamic Luenberger productivity indicators. European Journal of Operational Research 241 (2). - p. 555 – 563.

- Silva, E., Lansink, A.O., and Stefanou, S.E. (2015). "The adjustment-cost model of the firm: Duality and productive efficiency". *International Journal of Production Economics*, 168, 245-256.

SCHEDULE

Time table

Monday, 21th May

9:30-11:00	Session 1A. Theoretical framework.
11:00-11:30	Coffee break
11:30-13:00	Session 1B. Theoretical framework.
13:00-15:00	Lunch
15:00-17:00	Session 2A. Empirical background.
17:00-17:30	Coffee break
17:30-19:30	Session 2B. Empirical background.

Tuesday, 22th May

9:30-11:30   Session 3A. Computer lab using cross-sectional DEA and SFA models.
11:30-12:00   Coffee break
12:00-14:00   Session 3B. Computer lab using cross-sectional DEA and SFA models.
14:00-16:00   Lunch
16:00-17:30   Session 4A. Productivity measurement.
17:30-18:00   Coffee break
18:00-19:30   Session 4B. Productivity measurement.

Wednesday, 23th May

9:30-11:00   Session 5A. Measuring dynamic productivity.
11:00-11:30   Coffee break
11:30-13:00   Session 5B. Measuring dynamic productivity.
13:00-15:00   Lunch
15:00-17:00   Session 6A. Computer lab using static and dynamic productivity models.
17:00-17:30   Coffee break
17:30-19:30   Session 6B. Computer lab using static and dynamic productivity models.

Thursday, 24th May

9:30-11:00   Session 7A. System SFA models.
11:00-11:30   Coffee break
11:30-13:00   Session 7B. System SFA models.
13:00-15:00   Lunch
15:00-17:00   Session 8A. Computer lab using single and multiple-equation SFA models.
17:00-17:30   Coffee break
17:30-19:30   Session 8B. Computer lab using single and multiple-equation SFA models.

Friday, 25th May

9:30-11:00   Session 9A. Accounting for unobserved heterogeneity in SFA models.
11:00-11:30   Coffee break
11:30-13:00   Session 9B. Accounting for unobserved heterogeneity in SFA models.
13:00-15:00   Lunch
15:00-17:00   Session 10A. Computer lab using SFA models with unobserved heterogeneity.
17:00-17:30   Coffee break
17:30-19:30   Session 10B. Computer lab using SFA models with unobserved heterogeneity.

GRADING CRITERIA

Grading will be based on the following criteria:

Criterium	Grade
Problem sets and home exam (a series of problem sets for the application of the programming techniques to a real economic problem, with subsequent grading of the results obtained)	50%
Attendance, punctuality and participation in class:	50%

REGISTRATION, FEES AND OFFERED PLACES

Registration

- The application form and the application guidelines can be found in **Annex I and II** at the end of this document. They soon will be available at the UAM courses website: www.uam.es/ace.economics/

- Registration should be made by sending an email to Inmaculada Álvarez using the course email address: ace.economics@uam.es, indicating in the "**Subject"** the course reference name to which you want to apply: **"Code. Efficiency"**. Attached to this email you should also send the **Application Form** and a **CV**.

- Applications will be evaluated by strict order of arrival.

- Accepted candidates will receive an email with further details regarding the payment process through a Bank account on behalf of the **Fundación de la Universidad Autónoma de Madrid**, which will manage all the payments as well as the delivery of receipts.

- **Deadline for the payment and registration is April 15, 2018**.

- All the accepted applicants should send to ace.economic@uam.es the receipt of the payment.

- The local organizers of the course will also send an invoice to the address indicated in the registration form.

Offered places

The maximum number of participants is set at 40, the minimum at 12.

Cancellations

Cancellations may be made free of charge until 1 month before the start of the course (May 21st). Cancellation fee of 100 % applies if participants cancel the course less than 1 month prior to the course. The organisers have a right to cancel the course not later than 1 month before the course starts (e.g., if the minimum number of students is not met). The participants will be notified of any changes at their e-mail addresses.

Fees

The course addresses different rates depending on the category of the attendants and their affiliation:

- For post-graduate students enrolled in the *Master in International Economics* (UAM) or in the doctorate program (*Economía y Empresa*), associated to this master, the course fee is €150. This fee will be also applied to members of the *Oviedo Efficiency Group*, and students coming from the *Master in Economics: Instruments of Economic Analysis* or its doctorate program (jointly offered by Universidad de Oviedo, Universidad de Cantabria, and Universidad del País Vasco).
- For other students/scholars from the UAM and other universities or academic Institutions, the course fee is €250.
- For other participants the course fee is €350. The course fee does not include books. It includes additional training material and coffee/tea.

This structure gives rise to the following final prices.

Category	Registration April 15th 2018
− post-graduate students enrolled in the *Master in International Economics* (UAM) or in the doctorate program (*Economía y Empresa*) associated to this master − *Oviedo Efficiency Group*, and students coming from the *Master in Economics: Instruments of Economic Analysis* or its doctorate program (jointly offered by Universidad de Oviedo, Universidad de Cantabria, and Universidad del País Vasco)	**150 €**
Other students/scholars from the UAM and other universities or academic Institutions	**250 €**
People from other institutions	**350 €**

ANNEX I. APPLICATION FORM

I apply for the following course:

Course _____

(add the name and dates)

1. Personal Information	
First name (s):	
Family/surname:	
Gender: female male	
Nationality:	

2. Contact Information	
Street address:	
Post/Zip code:	
City:	
State:	
Country:	
Telephone:	
Fax:	
E-mail address:	

3. Language *(English is normally the language of the Advanced courses of Economics at UAM):*				
Languages	Writing Level	Reading Level	Speaking Level	Comprehensive Level
English				
Spanish				

4. Education	
a. Full title of any University degree:	
Full name of the issuing University:	
Country of issue:	Date issue:
b. Full title of any University post-graduate :	
Full name of the issuing University:	
Country of issue:	Date issue:

5. Current Position
Current occupation:
Other relevant professional experience:
Other information that the Advance Courses in Economics should take into account in considering your application:

ANNEX II. APPLICATION GUIDELINES

Advances Courses in Economics (ACE-UAM)

1. Selection criteria

- Priority will be given to students with a completed Bachelor's degree in Economics or Business (or any other discipline with high skills in mathematical and statistical analysis), and a good academic record. Preferably, students should have or be doing postgraduate studies in Economics or Business. Special focus will be put on their qualifications in subjects related to the module, and capabilities related to the quantitative analysis and the macroeconomic analysis skills.

- The selection process will take into account the applicant's background in economic analysis, statistics and econometrics.

- All students must have a high level of written and spoken English, since most of the materials and the course are in English.

2. Fees and grants

The course addresses different rates depending on the category of the attendants and their affiliation: This structure gives rise to the following final prices.

Category	Registration April 15th 2018
− post-graduate students enrolled in the *Master in International Economics* (UAM) or in the doctorate program (*Economía y Empresa*) associated to this master − *Oviedo Efficiency Group*, and students coming from the *Master in Economics: Instruments of Economic Analysis* or its doctorate program (jointly offered by Universidad de Oviedo, Universidad de Cantabria, and Universidad del País Vasco)	150 €
Other students/scholars from the UAM and other universities or academic Institutions	250 €
People from other institutions	350 €

Those applicants qualified for the grants must indicate so in their application form. They will be required to certify their current affiliation after the payment.

3. Application process

- The application form and application process are described at the courses website: www.uam.es/ace.economics/

- Interested applicants must send an email to ace.economics@uam.es, indicating in the "**Subject**" the course reference name to which you want to apply: **"Code. Efficiency"**. Attached to this email you should also send the **Application Form** and **a CV**.

- Applications will be evaluated by strict order of arrival.

- Accepted candidates will receive an email with further details regarding the payment process through a Bank account on behalf of the **Fundación de la Universidad Autónoma de Madrid**, which will manage all the payments as well as the delivery of receipts.

- The accepted process will finish once that the payment (if required) is done.

- The deadlines for the registration and the payments are indicated in the website.

- All the accepted applicants should send to ace.economic@uam.es the receipt of the payment. When sending this confirmation, those who would take advantage of any of the discounts considered in the following table should demonstrate the corresponding requirement by supporting a document confirming the current academic situation (at the UAM or in another university).