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WORKSHOP**
ON EFFICIENCY
IN EDUCATION,
HEALTH AND OTHER
PUBLIC SERVICES

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BOOK OF ABSTRACTS

THURSDAY, SEPTEMBER 8, KEYNOTE 1, 9:30-10:30	3
IMPROVING ON EVOLUTION? UPDATED GUIDELINES FOR EFFICIENCY MEASUREMENT IN HEALTH CARE	3
<i>Bruce Hollingsworth</i>	3
THURSDAY, SEPTEMBER 8, 11:00-12:15.....	3
CAN THE GEOGRAPHIC DISTRIBUTION OF COLLEGE STUDENTS BE MORE EFFICIENT? IMPACT OF ENROLLMENT CAP POLICY ON COLLEGE ACCESS IN JAPAN.....	3
<i>Takeshi Yanagiura, Shinji Fukushima and Takeshi Higeta</i>	3
COMPETITIVE EFFECTS OF CHARTER SCHOOLS: EVIDENCE FROM A NATIONALLY REPRESENTATIVE SAMPLE	4
<i>M. Danish Shakeel, Katharina Werner and Paul Peterson</i>	4
MEASURING AND EXPLAINING SCHOOL PERFORMANCE: EVIDENCE ON SCHOOL VALUE-ADDED MODELS IN ITALY	4
<i>Tommaso Agasisti, Chiara Masci and Mara Soncin</i>	4
THE EFFECTS OF MUNICIPAL MERGERS ON EXPENDITURES AND OUTPUTS: EVIDENCE FROM ITALY	5
<i>Tommaso Agasisti, Alice Bertoletti and Francesco Porcelli</i>	5
EU MUNICIPAL WASTE MANAGEMENT PERFORMANCE EVALUATION: AN AHP-GPSI-BASED COMPOSITE INDICATOR	6
<i>Laura Carosi, Giovanna D'Inverno, Giulia Romano</i>	6
THE ROLE OF INFRASTRUCTURE, FIRMS' EFFICIENCY AND THEIR SURVIVAL: EVIDENCE FROM A COMBINED PRODUCTIVITY-DURATION APPROACH.....	6
<i>Pierluigi Toma</i>	6
THURSDAY, SEPTEMBER 8, KEYNOTE 2, 13:45-14:45	6
EFFICIENCY IN HIGHER EDUCATION. A LONG (AND TROUBLED) TALE	6
<i>Andrea Bonaccorsi</i>	6
THURSDAY, SEPTEMBER 8, 14:50-16:05.....	7
EFFICIENCY AND EFFECTIVENESS OF PRIMARY EDUCATION IN TERMS OF EQUITY IN OLD AND POST-SOCIALIST EU MEMBER STATES.....	7
<i>Dovilė Stumbrienė, Rimantas Želvys, Julius Žilinskas, Rita Dukynaitė and Audronė Jakaitienė</i>	7
HOW MUCH EDUCATIONAL DATA IS COLLECTED AND HOW MUCH IS USED? CASE OF LITHUANIA.....	8
<i>Audrone Jakaitiene, Rimantas Zelvys and Rita Dukynaite</i>	8
PREDICTING DROPOUT IN HIGHER EDUCATION ACROSS BORDERS: EXPLORING THE COMMON ELEMENTS BETWEEN ITALY AND THE NETHERLANDS	8
<i>Melisa Diaz Lema, Melvin Vooren, Chris van Klaveren, Ilja Cornelisz, Marta Cannistra and Tommaso Agasisti</i>	8
ATTAINMENT OF HIGHER EDUCATION GOALS IN SOUTH AFRICA'S PUBLIC UNIVERSITIES: A MULTIDIMENSIONAL ANALYSIS.....	9
<i>Oleg Badunenko and Lindikaya Myeki</i>	9
MEASURING THE EFFICIENCY OF THE ITALIAN UNIVERSITIES: A STOCHASTIC FRONTIER ANALYSIS	10
<i>Gaetano Francesco Coppeta</i>	10
A COMPARISON OF THE SLACKS BASED MEASURE ENVIRONMENTAL EFFICIENCY RANKING WITH THE PEOPLE & PLANET'S UNIVERSITY LEAGUE RANKING	10
<i>Boon Lee and Jill Johnes</i>	10
THURSDAY, SEPTEMBER 8, 16:20-17:35.....	11
THE PRODUCTIVITY OF COLOMBIAN PUBLIC SCHOOLS AND ITS DETERMINANTS IN A VALUE-ADDED PERSPECTIVE: AN EMPIRICAL ANALYSIS 2014-2019	11
<i>Tommaso Agasisti, Juliana Arias, Gloria Bernal and Luz Karime Abadía</i>	11

IS IT POSSIBLE TO BE RESILIENT AND EFFICIENT IN ONE OF THE MOST UNEQUAL COUNTRIES IN THE WORLD?	11
<i>Sebastian Estrada, Diego Prior, Victor Gimenez Garcia and Tommaso Agasisti</i>	11
IMPACT EVALUATION IN A MULTI-INPUT MULTI-OUTPUT SETTING: EVIDENCE ON THE EFFECT OF ADDITIONAL RESOURCES FOR SCHOOLS	12
<i>Kristof De Witte, Giovanna D'Inverno and Mike Smet</i>	12
JUDICIAL EFFICIENCY AND COURT ORGANIZATION: A DATA ENVELOPMENT ANALYSIS	12
<i>Greta Falavigna and Roberto Ippoliti</i>	12
EVALUATION OF LABOUR MARKET ACTIVE POLICY REFORM: EMPLOYMENT OUTCOMES OF EMPLOYMENT REHABILITATION SERVICES	12
<i>Renee Pesor and Kaire Pöder</i>	12
AN INNOVATIVE BENEFIT-OF-THE-DOUBT APPROACH FOR HEALTH SYSTEM EFFECTIVENESS: A GLOBAL CASE STUDY ON AMENABLE MORTALITY	13
<i>Giovanna D'Inverno, João Vasco Santos, Ana S. Camanho</i>	13
FRIDAY, SEPTEMBER 9, KEYNOTE 3, 9:15-10:15	13
THE ASSESSMENT OF EDUCATION SYSTEMS' EFFICIENCY AND PERFORMANCE IN PRACTICE: CHALLENGES AND WAYS FORWARD	13
<i>Gabriela Sicilia</i>	13
FRIDAY, SEPTEMBER 9, 10:45-12:00	14
INDIVIDUALISM, HUMAN CAPITAL FORMATION, AND LABOR MARKET SUCCESS.....	14
<i>Katharina Hartinger, Sven Resnjanskij, Jens Ruhose and Simon Wiederhold</i>	14
DOES ICT IMPROVE EDUCATION OUTCOMES AND EFFICIENCY? A PANEL DATA ANALYSIS THROUGH OECD PISA DATA	14
<i>Muhammad Mujiya Ulkhaq, Giorgia Oggioni, Rossana Riccardi and Kristof De Witte</i>	14
CAREER GUIDANCE TO LESSEN INEQUALITIES IN EDUCATION.....	15
<i>Tommaso Agasisti, José M. Pastor, Ángel Soler and Iván Vicente</i>	15
CHALLENGING THE USE OF KERNEL METHODS TO ESTIMATE SIMILARITY FOR CONDITIONAL DEA. A MONTE CARLO SIMULATION.....	15
<i>Anna Mergoni</i>	15
MODELLING PRODUCTION TECHNOLOGIES WITH SEVERAL PARALLEL PROCESSES: AN APPLICATION TO HIGHER EDUCATION	16
<i>Grammatoula Papaioannou and Victor Podinovski</i>	16
RANK-TWO PROGRAMS INVOLVING LINEAR FRACTIONAL FUNCTIONS	16
<i>Riccardo Cambini and Giovanna D'Inverno</i>	16
FRIDAY, SEPTEMBER 8, 12:10-13:00	17
OCCUPATIONAL ACCIDENTS AND SICK LEAVE DURATION IN THE SPANISH EDUCATION SECTOR.....	17
<i>Laura María García Carrizosa and Pablo Arocena</i>	17
LEVERAGING HOME READING TO STRENGTHEN LITERACY OUTCOMES.....	17
<i>Brooks Bowden, Johanna Bernard and Rebecca Davis</i>	17
PUBLIC INVESTMENTS IN AGRICULTURE: EFFICIENCY, SUSTAINABILITY AND ENVIRONMENTAL RISKS	18
<i>Chiara Colamartino, Anna Rita Dipierro and Anna Mergoni</i>	18
THE MEASUREMENT OF ASSET MANAGEMENT ACHIEVEMENTS OF PORTUGUESE WATER COMPANIES	18
<i>Hermilio Vilarinho, Ana Camanho, Henriqueta Novoa and Giovanna D'Inverno</i>	18
OPTIMAL HARVESTING UNDER MARINE RESERVES AND UNCERTAIN ENVIRONMENT	19
<i>M'hamed Gaïgi, Vathana Ly Vath and Simone Scotti</i>	19

Thursday, September 8, Keynote 1, 9:30-10:30

Improving on evolution? Updated guidelines for Efficiency Measurement in Health Care

Bruce Hollingsworth

Affiliation: Lancaster University (UK)

This presentation reflects upon making efficiency measurement in the area of health care useful. It builds upon options discussed previously concerning guidelines published for the undertaking of studies in this area, the purpose of which was to make studies more useful to policy makers and those involved in service delivery. Previous work looked at these in terms of revolution and evolution, and recommended the latter. If the revolution has happened, and evolution is underway, can we improve and refine the guidance with what we have learned?

Thursday, September 8, 11:00-12:15

Can the Geographic Distribution of College Students be More Efficient? Impact of Enrollment Cap Policy on College Access in Japan

Takeshi Yanagiura, Shinji Fukushima and Takeshi Higeta

Affiliations: University of Tsukuba (Japan), Taisho University (Japan)

This study examines whether an enrollment cap policy leads to a more efficient geographic distribution of college students using data from Japan. In 2016, the national government reduced the enrollment cap of large-size private universities (i.e., institutions with more than 8,000 enrollment) from the previous level of 130% of total capacity stipulated in the government contract to 120% in 2016 and 110% in 2018 to address uneven enrollment distribution between rural and urban areas. This successive capacity cap reduction targeted private universities in large cities, which would lose the entire government appropriations for the next year if they failed to adhere to the cap. This sudden rule change has caused a near-panic reaction among urban universities, which drastically reduced the number of admitted students not to surpass the cap.

However, it is unclear how this policy affected students. What happened to students whom those universities would have otherwise admitted? This study aims to answer this question. We employ synthetic difference-in-differences (Arkhangelsky et al., 2021) to identify the causal effect of the policy using high-school-level college admission data over the last 30 years. The treatment group consists of high schools in rural areas with a limited choice set of institutions nearby. High schools in urban cities, where students have a variety of institutions to choose from, comprise the control group. Then we compare the differences in the fraction of students whom urban institutions admit between treatment and control groups and before and after the policy. We found that rural high school students became less likely to be admitted by urban institutions but instead attended lower-quality institutions nearby. In contrast, students from urban high schools remained enrolled in urban cities without lowering the quality. The result implies that the policy caused an undermatching problem (Hoxby & Avery, 2012) for rural students.

Competitive effects of charter schools: Evidence from a nationally representative sample

M. Danish Shakeel, Katharina Werner and Paul Peterson

Affiliations: University of Buckingham (UK), Harvard university (USA)

Charters differ from district schools in that they are not operated directly by a government entity such as a school district. Instead, charters, like private schools, are operated by nonprofit organizations that have autonomy from certain provisions of a state's legal code. The topic of charter school effectiveness has been fiercely debated among policymakers. Critics of charter schools claim that the presence of charters in a district lowers the test score performance of students in traditional public schools.

This paper merges over four million math and reading test observations from the nationally representative Main NAEP between 2005-2017 with data from the National Alliance for Public Charter School (NAPCS) on school-district level to analyze the competitive effects of charter schools. The Main NAEP dataset provides the school district identification for each charter and traditional public school in its survey, and it also provides student background characteristics such as ethnicity, gender, and socioeconomic status. The NAPCS data includes information on the charter schools in each district, including the years in operation, racial composition of attending students, management organization, and locale.

No prior analysis has used nationally representative student-level data to study the competitive effects of charter schools. We intend to estimate effects in fixed effect models to account for multiple sources of potential bias. Thus, our research will contribute to scientific understanding of this topic and will inform policy and/or practice. While findings are preliminary at the time of submission, we have obtained all necessary data and plan to present findings at the time of the conference.

Measuring and Explaining School Performance: Evidence on School Value-Added Models in Italy

Tommaso Agasisti, Chiara Masci and Mara Soncin

Affiliations: Politecnico di Milano (Italy)

School performance estimates have been largely used as a tool to increase school accountability worldwide. Especially in the Anglo-Saxon context, there is a long-lasting tradition of measuring and using school value-added for high-stakes reasons (Sass, 2008) or to support school choice (Allen and Burgess, 2011). Despite the wide adoption, the issue of the stability of school performances, as well as the definition of the most precise methodological approach is still debated (see Schiltz et al., 2018; Agasisti and Minaya, 2019). Moreover, depending on the set of variables included in the model, gross versus net school effects can be assessed. The current research exploits the administrative datasets provided by INVALSI (National Evaluation Committee for Education) on lower secondary schools in Italy. The availability of a broad set of individual, class and school-level characteristics makes possible to sort out the impact of other factors and to focus on the school value-added between the primary school (grade 2 and 5) and the last year of lower secondary school (grade 8). As a first step, the use of multilevel models allows to identify the portion of variation associated to each level of analysis and to assess school effects. Moreover, the possibility to link INVALSI data to a rich set of information coming from the Ministry of Education about school funding, teachers' characteristics and parents' involvement represents a novelty of the study and gives the possibility to explain, as a second step, the variability of school effects. In so doing, the paper contributes to the stream of literature on school performance measurement

and provides evidence that can support the use of school value-added measures for policy reasons.

The effects of municipal mergers on expenditures and outputs: Evidence from Italy

Tommaso Agasisti, Alice Bertoletti and Francesco Porcelli

Affiliations: School of Management, Politecnico di Milano (Italy), JRC - European Commission (Spain), Università degli Studi di Bari Aldo Moro (Italy)

During the last decades, several Western countries have undertaken reforms aimed at merging municipalities to exploit potential economies of scale and increase their efficiency (Fox and Gurley, 2006). The literature offers controversial evidence on the effect of these policies on the costs and efficiency of municipalities (Blesse and Baskaran, 2016). Some studies associate a reduction in the expenditures due to the municipal mergers (Blom-Hansen et al., 2016; Reingewertz, 2012), while others affirm a lack of statistically significant effects (Fritz and Feld, 2015; Allers and Geertsema, 2014; Moio and Uusitalo, 2013).

In 2012, Italy undertook reforms that aim at providing financial incentives to foster mergers of municipalities (i.e., Decreto Legge n. 95/2012). Following a voluntary mechanism, municipal mergers have been concentrated between 2015 and 2016, in which around 130 mergers have been undertaken. However, until now, there is no empirical evidence of the effect of these mergers on the efficiency of Italian municipalities. By addressing this gap, the present paper investigates municipal mergers in Italy. As an important element of novelty, the empirical analyses take into consideration the heterogeneity between clusters of municipalities and services of municipalities. Moreover, in addition to costs, this study looks at the effect of mergers on the outputs - which are often under-investigated in the literature.

In particular, we examine the following research questions:

- What are the effects of municipal mergers on expenditures and outputs of Italian municipalities?
- How do these effects differ among different services and clusters of municipalities?

The empirical analyses are based on SOSE (Soluzioni per il Sistema Economico S.p.a.) data, which provide a rich set of information on all the municipalities in Italy (except for Sicily and Sardinia regions). The data examined consider the mergers undertaken between 2010 and 2016 – covering almost all the mergers that occurred in Italy during the last decade. The context described can be studied by adopting a quasi-experimental design. In particular, we employ a difference-in-difference methodology that allows us to compare the merged municipalities (treated group) with no-merged ones (control group). After estimating the aggregated effects of mergers on costs and outputs, the paper provides disaggregated results by services and clusters. More specifically, we consider four clusters of municipalities (based on the SOSE definition) and six services - namely: administrative services, waste, police, land and viability, education and social Services). In terms of aggregated effects, our findings show that mergers are associated with an increase in the outputs. Controversially, no significant change in the expenditures can be associated with the reform. However, the results vary remarkably across services and clusters. Services that are usually associated with economies of scale, such as Administrative Services and Waste, seem to have reduced their expenditures, while the ones characterised by a high labour intensity (i.e., Education, Social Services and Police) seem to have increased both their expenditures and their outputs. Small municipalities located in hilly or flat areas represent the group most advantaged by the mergers. This group has both increased the outputs and decreased the expenditures. By contrast, municipalities located in mountain areas seem to have been penalised by the reform. Indeed, the results show that they have increased their expenditures without benefits in terms of outputs. Finally, for municipalities with a high level of commuting, the results show inconclusive evidence, with both an increase in the outputs and expenditures.

The paper offers relevant contributions by informing policymakers about the effects of municipal

mergers on the costs and the outputs of different services and types of municipalities. Thus, our findings suggest effective instruments to enhance the efficiency of Italian municipalities.

EU municipal waste management performance evaluation: An AHP-GPSI-based composite indicator

Laura Carosi, Giovanna D'Inverno, Giulia Romano

Affiliations: University of Pisa (Italy)

In this paper a new composite indicator is devised by integrating the Goal Programming Synthetic Indicator (GPSI) methodology with the Analytic Hierarchy Process (AHP). The proposed approach is used to evaluate to which extent European countries fulfill the European Union (EU) requirements in terms of municipal waste management. Taking into account the EU Waste Hierarchy, a dashboard of indicators is identified together with a set of targets that European countries are supposed to meet.

Indicators, targets and their relative importance in the dashboard have been discussed and validated by a team of experts

Two Goal Programming Synthetic Indicators are computed taking into account two different perspectives. The first one rewards the countries with good performance in the higher level of the Waste Hierarchy, while the second one penalizes countries whose infringements are in the lower part of the Waste Hierarchy.

Hence two different systems of aggregating weights are identified by means of the Analytic Hierarchy Process and accordingly two scenarios are explored.

The analysis is performed using Eurostat data on 28 European countries from 2013 to 2018. For each year, countries are assessed in terms of their ability to keep the right waste management track delineated by the Waste Hierarchy principles. Countries' ranking over time is first obtained and then interpreted in light of countries policies and achievements, deriving policy suggestions to improve waste management strategy able to reach the expected results.

The role of Infrastructure, firms' efficiency and their survival: evidence from a combined productivity-duration approach

Pierluigi Toma

Affiliations: University of Salento (Italy)

Being able to forecast firms' decline is paramount in economics. In this paper, we investigate the main factors that lead companies to failure. By tracking a sample of agri-food firms in Italy, we compare different and very innovative inefficiency indicators with the most important and established financial variables in the literature. The inefficiency measures proposed account for the level of an infrastructural endowment at a territorial level. Through a semi-parametric approach, this paper demonstrates that infrastructures influence the productivity of firms, which in turn is the main determinant of firms' survival. This has strong policy and managerial implications.

Thursday, September 8, Keynote 2, 13:45-14:45

Efficiency in higher education. A long (and troubled) tale

Andrea Bonaccorsi

Affiliation: University of Pisa (Italy)

Higher education is one of the fields in which models and tools of efficiency analysis have found large application. Higher education institutions (HEIs) produce a variety of outputs (research, education, third mission) using a variety of inputs (academic and non-academic staff, funding, infrastructure). Efficiency analysis provides a suitable analytical framework for the study of these peculiar input-output relations: it does not require the formulation of a production function (as it usually happens in the theory of production in economics), it can deal with a large heterogeneity of both inputs and outputs of HEIs and does not depend on monetary measures for aggregation. But the history of efficiency analysis in higher education is characterized by several difficulties. The keynote will discuss some of them: curse of dimensionality, lack of robustness, availability of microdata, cross-country comparability, lack of measures for input and/or output quality, poor attention to conditions of disposability in the institutional landscape. I will travel through these issues and show the available solutions, or the lack thereof. This journey will also open an interesting research agenda for the future.

Thursday, September 8, 14:50-16:05

Efficiency and effectiveness of primary education in terms of equity in old and post-socialist EU member states

Dovilė Stumbrienė, Rimantas Želvys, Julius Žilinskas, Rita Dukynaitė and Audronė Jakaitienė

Affiliations: Vilnius University (Lithuania)

The attitude of the EU member states towards the issue of equity is to a certain extent determined by the principles on which national education systems are based and the current socio-economic situation of the countries. More than thirty years have passed since the fall of the Berlin Wall, but the socialist heritage still exercises its influence on education. In any comparative analysis one should bear in mind the specific model of socialist education in the Central and Eastern European regions. The research aims to evaluate the effectiveness and efficiency of primary education from the perspective of equity in old and post-socialist EU member states. We decided to focus on primary education because the first manifestations of selectivity and segregation could be observed as early as the first phase of formal schooling. The effectiveness and efficiency of primary education from the perspective of equity were assessed of 15 EU member states, which took part in the IEA TIMSS 2015 and PIRLS 2016 international student achievement studies. The Data Envelopment Analysis approach based on a directional distance function model with both desirable and undesirable outputs was used to measure effectiveness and efficiency. The research findings lead to the conclusion that old and post-socialist EU member states move towards different positions for ensuring equity in primary education. Post-socialist countries demonstrate higher efficiency with a lower level of effectiveness compared to old EU member states. However, post-socialist countries do not represent a single Central and Eastern European position to ensure equity in primary education. Some of the post-socialist countries demonstrate high efficiency without achieving a high level of effectiveness. We assume that most probably the efficiency is achieved not by any sophisticated policy measures, but just by the limited financial possibilities of the post-socialist country.

How Much Educational Data is collected and how much is used? Case of Lithuania

Audrone Jakaitiene, Rimantas Zelvys and Rita Dukynaite

Affiliations: Vilnius University (Lithuania), Ministry of Education, Science and Sports of Republic of Lithuania (Lithuania)

During the last few decades one can observe a massive increase of data collection and practical application in different domains of education. Williamson (2017) points out two main trends in contemporary education – “datafication” and “digitization”. „Governing by numbers“ appears to be one of the key policy instruments of the Global Educational Reform Movement, which has become the leading trend of educational change during the last several decades (Sahlberg, 2016). There are numerous research publications which analyze cases of governing education through data. Researchers often focus on the pros and cons of the usage of data acquired by initiating large-scale comparative studies. We review various sources, such as information systems, registers and ILSA, of educational data in Lithuania. It has been shown that a lot of data has already been collected and that more is being accumulated. According our rough estimate about 20% of the information gathered is used for policy purposes and even less in re-search. We note that most of the data collected is useful for the economic paradigm. We discuss case studies showing that national population-based studies and international achievement studies may send different messages and cannot be considered in isolation.

Predicting dropout in higher education across borders: Exploring the common elements between Italy and the Netherlands

Melisa Diaz Lema, Melvin Vooren, Chris van Klaveren, Ilja Cornelisz, Marta Cannistra and Tommaso Agasisti

Affiliations: Politecnico di Milano (Italy), Vrije Universiteit Amsterdam (The Netherlands)

Preventing student dropout in higher education has become of major interest in the educational policy agenda due to the societal and personal costs associated with dropping out. For most universities, low dropout rates and high graduation rates are an indicator of effective student retention strategies and high-quality instruction, reinforcing the institution’s attractiveness and competitiveness.

Although there are many studies focusing on factors that may have an impact on the propensity of dropping out of individual students, cross-country evidence is limited. This is partially due to the fact that the available data throughout Europe and the rest of the world on dropout rates are diverse in terms of country- and institution-specific availability, data collection methods, definitions, and usage. Nonetheless, many higher education institutions have been collecting student-level data for dropout prediction, intervention, and evaluation on a regular basis in recent years. This study aims to gain a better understanding of the dropout phenomenon by performing an integrated comparative study involving student-level data of two universities located in two different European countries: the Netherlands and Italy. In particular, this research examines whether common dropout predictors are exchangeable across the Italian and the Dutch context by testing the predictive capacity of ad-hoc models built in the other university-country setting at three distinct stages of students’ university careers. Results show that prediction improves dramatically once data on university performance becomes available, making the predictive capacity of models across different context exchangeable. This study contributes to the need of creating a European common arena for discussing issues related to study success.

Attainment of Higher Education Goals in South Africa's Public Universities: A Multidimensional Analysis

Oleg Badunenko and Lindikaya Myeki

Affiliations: Brunel Univeristy London (UK), University of the Free State (South Africa)

In 2009, South Africa's government administration recognized the pressing need to introduce long-term planning. To set this in motion the National Planning Commission (NPC) was established by the Presidency to draft the National Development Plan in 2010. However, the drafting of the plan was preceded by the release of the Commission's Diagnostic Report in 2011. This was subsequently, followed by the launch of the National Development Plan (NDP) vision 2030 in 2012, as an overarching policy guiding document for the entire country and its diverse sectors. Chapter nine of the NDP recognizes the importance of universities for nation-building, and their roles include; education and training of people with high-level skills for employment needs of both public and private sectors; knowledge production and talent development for economic growth, technological innovation, and societal leadership (Jansen 2018). In 2013, the White Paper for Post-School Education and Training (WPPSET) was a specific policy produced to support the notable aspirations of the NDP on higher education (Department of Higher Education and Training 2013). One of its objectives is to establish more places for people to learn, more types of courses and qualifications, attain more financial support for students, and better-quality education and training. It puts forward the target of 2.5 million head-count enrolments in technical and vocational education and training (TVET) colleges, 1.0 million in community colleges 0.5 million in private higher education institutions, and 1.6 million head-count in public universities (Department of Higher Education and Training 2013). However, there are uncertainties about the achievement of these targets on the set time, due to the decline in state budget allocation for higher education and high student dropouts. This implies that a deeper understanding of higher education efficiency is essential to realize these targets, especially in public higher education.

Public higher education is an important sector of the post-school education and training system in South Africa. It consists of 26 public universities classified into eleven traditional universities, nine comprehensive universities, and six universities of technology (Department of Higher Education and Training 2019). They are spread across the country's nine provinces with their size and shape influenced by several policy instruments. For instance, the extensive report of the National Commission on Higher Education (NCHE) (1996) - setting out proposals to reform the higher education sector post-1994; (Department of Higher Education and Training 1997) has formalized the recommendations of the NCHE report as policy target; Higher Education Act of 1997 - which provided for the establishment of the Council on Higher Education (CHE); National Plan for Higher Education of 2001 – responsible for mergers and restructuring of universities between 2003 and 2005; National Qualifications Framework of 2008, National Development Plan vision 2030 and White Paper of 2013 (Department of Higher Education and Training 2013). These universities command 75% translated as 1.07 million student enrollments in the post-school education sector (Department of Higher Education and Training 2021). Going forward, the quality of their output and efficiency is likely to be affected by the fourth industrial revolution (4IR) technologies that have now been entrenched by the Covid-19 pandemic leading to a re-visitation of the delivery modes of education; an increasing number of cyberattacks in universities; the growing demand for affordable, accessible and quality education; decolonization of the curriculum; prioritization of science, technology and mathematics (STEM) because of future job requirements; a decline of research funding, and the growth of private higher education market.

The study applies the modern frontier method to evaluate how the deregulation of the higher education sector in South Africa has impacted the attainment of the 5 goals set by the Department of Higher Education and Training (DHET). Those 5 goals are (i) Access, (ii) Quality, (iii) Diversity of Academics, (iv) Success Rates, and (v) Operational Efficiency. Our preliminary results show that the universities are quite successful in achieving the 5 goals in the short-term (transient

attainment). However, they are less successful over the long term. Traditional universities turn out to be the least successful, followed by comprehensive universities. The universities of technology are the best in achieving all 5 goals set by DHET.

Measuring the efficiency of the Italian universities: A stochastic frontier analysis

Gaetano Francesco Coppeta

Affiliations: Department of Economics Marco Biagi, University of Modena and Reggio Emilia

Stochastic frontier analysis (SFA) has been widely used to measure the ability of universities to eliminate inefficiency. Recent econometric developments have improved SFA models in estimating efficiency measures, leading to a large variety of models that might yield very different results. The current literature embodies four generations of panel SFA models which is progressively improving estimation results by allowing the inefficiency term to vary over time, separating heterogeneity from inefficiency, and distinguishing between heterogeneity, transient inefficiency, and persistent inefficiency. To identify the best model specification, we compare the performance of several panel data models by selecting one model for each generation in order to understand how the choice of a model may suggest different policy recommendations. In addition, the paper aims to contribute to the ongoing debate on the choice of the appropriate indicator for research output. Most studies represent the universities' research output through indicators based on publications or research grants. Collecting data from MIUR's National Statistical Office, Scopus (SciVal) and financial statements, we construct a panel dataset of 57 Italian public universities over the period 2010-2019. The dataset is used to specify an output-oriented distance function with two inputs (number of students, and number of academic and non-academic staff) and two outputs (number of graduates and several research outputs). We compare efficiency results obtained using three bibliometric measures (number of publications; publications in the top 10% of the citation percentile; publications in the top 10% field-weighted) and research grants. The findings confirm that the four-component model (GTRE) improves efficiency estimation through considering heterogeneity and persistent inefficiency. Furthermore, efficiency estimates do not vary much with changes in the bibliometric indicator used.

A Comparison of the Slacks Based Measure Environmental Efficiency ranking with the People & Planet's University League ranking

Boon Lee and Jill Johnes

Affiliations: Queensland University of Technology (Australia), University of Huddersfield (UK)

Recent times have seen the proliferation of University League rankings for performance measurement related to societally beneficial outcomes associated with sustainability. However, these league rankings that focus on societally beneficial outcomes ignore the primary purpose of HEIs, namely teaching and research with their positive outcomes for society, which suggests that rankings are likely to be biased. With the growing social policies placed on HEIs to engage in reducing carbon emission as noted in the Higher Education Funding Council for England (HEFCE) report 'Carbon reduction target and strategy for higher education in England', and the Higher Education Sustainability Initiative (HESI) in 2012, HEIs are slowly pressured to meet these so-called carbon footprint targets while producing graduates, attracting research income and delivering research. It is therefore prudent to measure HEI performance that incorporates both carbon emissions and teaching and research outcomes to derive a meaningful ranking. The current study measures the environmental efficiency levels of UK HEIs in 2018-19 using a slacks-based measure (SBM) model that incorporates bad output. It aims to compare the rankings derived

from this application with the People and Planet's University League ranking. The study also identifies sources of efficiency of UK HEIs and provides policy recommendations.

Thursday, September 8, 16:20-17:35

The productivity of Colombian public schools and its determinants in a value-added perspective: an empirical analysis 2014-2019

Tommaso Agasisti, Juliana Arias, Gloria Bernal and Luz Karime Abadía

Affiliations: Politecnico di Milano (Italy), Instituto Tecnológico Metropolitano de Medellín (Colombia), Pontificia Universidad Javeriana (Colombia)

Identifying how efficient are public schools, that is, the academic performance they can generate with the available inputs, is a relevant information for designing public policies to improve education quality. In this vein, schools must provide evidence that they are pursuing and obtaining their goals at the best possible level, given the resources available. Such attention is even more necessary in current circumstances, in which tight public budgets are challenged by various potential alternative uses, such as health care or social welfare (Rubin, 2019). Moreover, international studies demonstrate that student achievement in some countries is lower than in others that employ similar levels of funding, so the former are requested to find more efficient ways to improve their performance with the given resources (Woessmann, 2016) – see, for the case of developing countries, Agasisti & Zoido (2019).

Using a two-stage Data Envelopment Analysis (DEA) and the Malmquist index, this study measures the efficiency of public schools in Colombia and their productivity evolution. The sample includes 3,854 public schools and standardized test records in 9th and 11th grade for the period 2014-2019. The findings reveal that, on average, schools could increase their outputs (math and language performance) by 18.5% with the current inputs. While the productivity remains relatively stagnant in the overall period, the schools increase their productivity between 2016 and 2018, which was counterbalanced by stronger negative system-level technical change in other years. The increase in productivity can be associated to the instauration of two policies: the nationwide scholarship Ser Pilo Paga (which exhorted high achievers low-income students to do more effort in the exit examinations) and the Synthetic Index of Educational Quality (that provides incentives to schools that showed academic progresses).

Is it possible to be resilient and efficient in one of the most unequal countries in the world?

Sebastian Estrada, Diego Prior, Victor Gimenez Garcia and Tommaso Agasisti

Affiliations: Universitat Autònoma de Barcelona (Spain), Politecnico di Milano (Italy)

This article analyzes the resilience of 9751 schools in the Colombian educational system and its relationship with educational efficiency between 2014 and 2019, considering both the differences between the public and private sectors, as well as regional differences. The empirical analysis of the present study is carried out using two stages. First, to estimate the students categorized as resilient, a multilevel model with random intercept and slope is estimated. After, Order-m models are used to estimate efficiency. It is found a negative relationship between the number of resilient students and the efficiency of schools (24% in public and 5% private sector). In addition, It is a better relative performance in the private sector than in the public, with an average difference of 5%.

Impact evaluation in a multi-input multi-output setting: Evidence on the effect of additional resources for schools

Kristof De Witte, Giovanna D'Inverno and Mike Smet

Affiliations: KU Leuven (Belgium), University of Pisa (Italy)

This paper proposes an innovative approach to evaluate the causal impact of a policy change in a multi-input multi-output setting. It combines insights from econometric impact evaluation techniques and efficiency analysis. In particular, the current paper accounts for endogeneity issues by introducing a quasi-experimental setting within a conditional multi-input multi-output efficiency framework and by decomposing the overall efficiency between 'group-specific' efficiency (i.e., reflecting internal managerial inefficiency) and 'program' efficiency (i.e., explaining the impact of the policy intervention on performance). This framework allows the researcher to interpret the efficiency scores in terms of causality. The practical usefulness of the methodology is demonstrated through an application to secondary schools in Flanders, Belgium. By exploiting an exogenous threshold, the paper examines whether additional resources for disadvantaged students impact the efficiency of schools. The empirical results indicate that additional resources do not causally influence efficiency around the threshold.

Judicial efficiency and court organization: a Data Envelopment Analysis

Greta Falavigna and Roberto Ippoliti

Affiliations: Research Institute on Sustainable Economic Growth of National Council Research of Italy (Italy), University of Bielefeld (Germany)

According to literature (Falavigna et al., 2015 and 2018; Mattsson and Tidån, 2019; Peyrache and Zago, 2016), court organization is one of the main drivers of judicial efficiency. This manuscript focuses on the Italian judicial system and on how to shape a policy reform aimed at increasing court efficiency, taking both the available human resources and the judicial expenditure generated by this production process into account. On the one hand, the authors identify the benchmarks and show how model definition may mislead policy makers tackling this reform process, while, on the other hand, they discuss the main drivers of judicial inefficiency. In detail, the authors propose a comparative analysis of technical efficiency scores computed using Data Envelopment Analysis, adopting the same output (number of settled cases) and two alternative sets of inputs (judicial expenditure and human resources). According to the results, without considering the information extracted from the two complementary benchmark analyses, the DMUs identified as false benchmarks are equal to 35%, causing policy makers to be misled in the reform process. As for the determinants of court performance, it may be possible to improve the efficiency of judicial districts by working on judicial procedures, as well as hiring selected humane resources. Consequently, these are the areas in which policy makers may successfully take action. Coherently with current literature (Falavigna and Ippoliti, 2021), policy implications concern the opportunity to adopt the proposed models and the collected benchmarks to reform the judicial system, improving its technical efficiency and maintaining the public budget under control.

Evaluation of labour market active policy reform: Employment outcomes of employment rehabilitation services

Renee Pesor and Kaire Põder

Affiliations: Estonian Busienss School (Estonia)

This study examines the effect of employment rehabilitation services reform on employment outcomes of people with various sensory/communicative, physical, and mental impairments in Estonia. The reform in 2016 transferred working-age persons with reduced working capacities from social services and passive labour market policies to active labour market policies, which included different rehabilitation services. The reform concerned about 100 000 people with special needs and was triggered by the ideological shift from welfare provision by unemployment benefits and early retirement pensions to the active provision of labour market services to support the work-life. For investigating the effect of rehabilitation services on employment outcomes, we used a database of over 11 000 clients, who received services, such as physiotherapy, psychological counselling, speech therapy, etc. All these are treated clients, and the caveat of the data is that there is no control group, neither in terms of those who have a legal right for the services and did not apply nor those who applied, however, were not approved. Propensity score matching (PSM) was applied to overcome the self-selection bias.

The descriptive evidence shows two distinct groups who enroll in the rehabilitation services -- older (median age 50) females with physical or compound impairments; and younger (median age 30) males with mental or sensory impairments. By applying PSM, a matched sample was obtained, which included 883 individuals that have completed employment rehabilitation and a control group of 883 individuals that discontinued the service. These groups were identical in terms of gender, age, education, working capacities, place of residence, as well as the severity of the disability. Fixed effects panel regressions, applied to this matched sample, indicated that upon completing the rehabilitation service, employment increased by 2.6 months more when compared to the control group that discontinued the service. In the light of this finding cost-effectiveness of the policy is highly debatable.

[An innovative Benefit-of-the-Doubt approach for health system effectiveness: A global case study on amenable mortality](#)

Giovanna D'Inverno, João Vasco Santos, Ana S. Camanho

Affiliations: University of Pisa (Italy), Public Health Unit, ACES Grande Porto VIII - Espinho/Gaia, ARS Norte (Portugal), University of Porto (Portugal)

Many different indicators can be used for health system effectiveness. Using composite indicators is a good way to summarize them all. One example of such efforts is the Healthcare Access and Quality Index from the Global Burden of Diseases study, for which different causes of mortality amenable to health care are summarized in this index through principal component analysis and exploratory factor analysis. While these approaches use the variance of the indicators, they do not consider room for improvement, i.e. distance to the frontier. In this study we propose an innovative Benefit-of-the-Doubt approach as a solution for combining frontier analysis and composite indicators, using amenable mortality estimates for 188 countries.

[Friday, September 9, Keynote 3, 9:15-10:15](#)

[The assessment of education systems' efficiency and performance in practice: challenges and ways forward](#)

Gabriela Sicilia

Affiliation: University of La Laguna (Spain)

The systematic assessment of the education systems' efficiency and performance is a crucial tool to promote the quality and equity of education and design successful interventions. Among other

purposes, it allows quantifying the schools' potential improvements, identifying the best practices to learn from them, as well as analysing the impact of interventions and public policies. Although this is a widespread practice in the academic context, it is still overlooked by policymakers and managers in most education systems, largely due to the difficulties of its practical implementation. The aim of this research is to address some of the fundamental empirical and methodological challenges to provide a roadmap to guide the assessment of schools' efficiency and performance using frontier methods in practice. For each of this issue, we discuss its implications and suggest an alternative direction to tackle it or a way forward.

Friday, September 9, 10:45-12:00

Individualism, Human Capital Formation, and Labor Market Success

Katharina Hartinger, Sven Resnjanskij, Jens Ruhose and Simon Wiederhold

Affiliations: Catholic University of Eichstaett-Ingolstadt (Germany), CESifo (Germany), Kiel University (Germany)

There is an ongoing debate about the economic effects of individualism. We establish that individualism leads to better educational and labor market outcomes. Using data from the largest international adult skill assessment, we identify the effects of individualism by exploiting variation between migrants at the origin country, origin language, and person level. Migrants from more individualistic cultures have higher cognitive skills and larger skill gains over time. They also invest more in their skills over the life-cycle, as they acquire more years of schooling and are more likely to participate in adult education activities. In fact, individualism is more important in explaining adult skill formation than any other cultural trait that has been emphasized in previous literature. In the labor market, more individualistic migrants earn higher wages and are less often unemployed. We show that our results cannot be explained by selective migration or omitted origin-country variables.

Does ICT Improve Education Outcomes and Efficiency? A Panel Data Analysis through OECD PISA Data

Muhammad Mujiya Ulkhaq, Giorgia Oggioni, Rossana Riccardi and Kristof De Witte

Affiliations: University of Brescia (Italy), KU Leuven (Belgium)

The role of information and communication technologies (ICT) in education is well established. There seems to be a consensus among scholars and practitioners that ICT enables the educational process to be managed efficiently [1]. Regarding the efficiency measurement of educational institutions, there is a large literature examining this issue [2]. However, limited studies addressed the influence of ICT on both the education outcomes and efficiency. Therefore, this study aims to investigate this issue using the OECD PISA data of 2009 to 2018 waves. We used the "four-component model" of stochastic frontier analysis in the panel data setting [3], [4]. The model separates school effects, persistent and time-varying inefficiency, as well as statistical noise. We used three models as each dependent variable reflects the PISA score of mathematics, science, and reading literacy, respectively. Result shows that the influence of ICT infrastructure variables (i.e., ratio of computers to the number of students and ratio of computers connected to the internet) on the education outcomes is marginal. On the other hand, student's lifestyle related

to ICT variables, i.e., frequency of using digital devices: (i) outside school for entertainment purposes, (ii) at school for general purposes, and (iii) outside school for school-work activities, are found to be significant influence the education outcomes in all three models. As determinants of inefficiency, the ICT-related life-style variables partially have significant influence; ratio of computers connected to the internet has significant influence in all models; but ratio of computers to the number of students does not significantly have influence on inefficiency in all models. This study is expected to allow more purposeful policy recommendations as well as expand the literature regarding efficiency measurement in education.

Career guidance to lessen inequalities in education

Tommaso Agasisti, José M. Pastor, Ángel Soler and Iván Vicente

Affiliations: Politecnico di Milano (Italy), University of Valencia (Spain)

There is an extensive evidence of the socioeconomic background effect in the students' educational performance during secondary education. This effect is a clear example of the inequality of opportunity that can be found inside education, related to the Roemer's idea about the circumstances. These inequalities can be classified as primary or secondary inequalities, being the first one related directly to the educational performance and the second one to the path choice.

The primary inequalities are related to the effect of the socioeconomic background on the cognitive skills. The secondary inequalities are those that could explain part of the reasons why some students, given the same performance, choose different paths. This is related to the rational choice theory since individuals try to take the best possible decisions with the available resources, having the most disadvantaged individuals and families less and worse information.

To pursuit the equality of opportunities in education, alleviating the effect of the Roemer's circumstances, the career guidance should be the protagonist giving learning support. We understand like career guidance the definition provided by the OECD in the Career Guidance Policy Review: "services intended to assist people, of any age and at any point throughout their lives to make educational, training and occupational choices and to manage their careers".

In the present study we analyze the effect of having a career guidance counsellor employed at secondary schools in variables related to the aspirations, motivation and soft-skills but also to cognitive skills like mathematics, reading and science. To do that, we use the OECD PISA 2018 sample, where new variables about career guidance can be found. The methodology proposed is the propensity score matching with a multilevel second stage. This approach is not widely employed but is extremely useful in our case, because our individuals are nested in schools and these are nested in countries.

We find a positive and statically significant effect of the career guidance on the variables commented before, but only for disadvantaged students for the OECD sample. This result confirms the mechanism proposed in the literature: providing career guidance, improves the information, increasing the expectations and with this, the motivation, with a clear effect on the educational performance. Therefore, this is the first time that this mechanism is confirmed, working only for disadvantaged students, and showing the importance of the career guidance for the equality of opportunities in education.

Challenging the use of kernel methods to estimate similarity for conditional DEA. A Monte Carlo simulation

Anna Mergoni

Affiliations: KU Leuven (Belgium)

In this paper, we want to test the accuracy of non-parametric efficiency estimation when the separability function does not hold. We present different scenarios in which the environmental variables affect a Cobb Douglas the production function and, through a Monte Carlo simulation, we challenge the use of kernel methods to estimate similarity for conditional DEA. In particular, we consider two classes of alternative approaches: distance functions and regression base measures. The accuracy is estimated via three measures: the mean absolute deviation, the Spearman correlation and the percentage of efficient units correctly identified.

Modelling production technologies with several parallel processes: An application to higher education

Grammatoula Papaioannou and Victor Podinovski

Affiliations: Loughborough University (UK)

In this paper, we consider the assessment of efficiency of a large sample of UK universities using the recently developed multicomponent variable and constant returns-to-scale (MVRS and MCRS) DEA models. We view each university as a combination of three component processes consisting of medical, science and non-science departments, respectively. Departmental costs are regarded as component-specific inputs. Undergraduate and postgraduate students are regarded as component-specific outputs. Centralized costs are considered as a shared input whose exact allocation to the three components (groups of departments) is unknown. Similarly, published papers are regarded as a shared output whose exact allocation to the three component processes is also unknown. Both the MVRS and MCRS models allow convex combinations and (in the case of MCRS) scaling of component processes with the weights and scaling factors independent of the other processes. Because we do not know the proportions in which the shared inputs and outputs are allocated to each process, such shared measures in the resulting units are set at the most conservative levels that are possible for any allocation of the shared measures. Our results show that the MVRS and MCRS models provide demonstrably better differentiation on efficiency than the conventional DEA models.

Rank-two programs involving linear fractional functions

Riccardo Cambini and Giovanna D'Inverno

Affiliations: University of Pisa (Italy)

Linear fractional functions are widely used in applications, for example in DEA models and efficiency models. In this light, bicriteria programs are assuming an important role in generalizing the applicative models. Efficient optimal solutions can be obtained by scalarizing the bicriteria objective function, thus obtaining a rank-two program involving linear fractional functions. We present some preliminary results concerning a solution method for these very programs, that is to say rank-two programs involving linear fractional functions.

Friday, September 8, 12:10-13:00

Occupational accidents and sick leave duration in the Spanish education sector

Laura María García Carrizosa and Pablo Arocena

Affiliations: Universidad Autonoma de Barcelona (Spain), Universidad Pública de Navarra (Spain)

Any accident at work produces medical and administrative expenses, additional costs associated with the hiring and replacement of the absent worker, productivity losses, and the payment of disability benefits. In the education field, teacher absence often has other indirect negative consequences, such as the interruption of the learning process and the effect on student motivation and performance. The costs of an accident are directly associated with the duration of the worker's sick leave: the longer the incapacity period, the higher the economic costs to the company and society. The time it takes for an injured worker to return to work after an accident is determined primarily by the severity of the injuries and the subsequent medical recovery process. However, the injured worker often may extend the duration of sick leave beyond the time needed to recover health. Thus, the decision to return to work is conditioned by the worker's attendance motivation and the organizational context.

This paper analyzes the determinants of teachers' duration of sick leave due to occupational accidents. We formulate a stochastic frontier model where the duration of sick leave is regressed on multiple explanatory variables related to injury type and accident severity, individual characteristics, and contextual factors. The one-sided component of the error term in the stochastic frontier specification indicates the inefficiency in sick leave duration, i.e. the excess of days beyond the estimated maximum recovery time.

We use a dataset with all occupational accidents causing sick leave in the education sector in Spain from 2015 to 2020. Preliminary results show significant differences in absence duration across teachers. Specifically, teachers in public schools return to work significantly later than those in private. Moreover, preschool and special education teachers show higher efficiency, indicating their return to work is shorter than teachers at other educational levels.

Leveraging Home Reading to Strengthen Literacy Outcomes

Brooks Bowden, Johanna Bernard and Rebecca Davis

Affiliations: University of Pennsylvania (USA)

Students who end third grade behind on literacy development tend to stay behind their peers throughout the rest of their academic career. This is a critical policy issue, one that indicates the provision of additional resources in early grades to avoid gaps in later grades. Resource constrained schools may have to leverage external resources, such as parent time, to support their students. By engaging families in home-based reading that is informed by teacher practice and coordinated with in-school efforts, schools can promote early literacy development in a cost-sensitive manner.

In this paper, we build on a multi-site randomized controlled trial of a kindergarten literacy curriculum to explore the importance of home inputs in the production of early literacy development. Our data include longitudinal data on literacy development from 715 students in 58 kindergarten classrooms, teacher surveys, and reading log data.

First, we examine the effect of the curriculum on teacher assignment of home reading. We find that treatment classrooms report nearly one hour more of home reading a week compared with students in the business-as-usual condition.

Second, we explore the role of exposure to high classroom levels of home reading assigned

through the curriculum on children's literacy development. Home reading was not randomly assigned so we use a principal stratification method to estimate upper and lower bounds of the effects of being in a high home reading classroom. We apply a series of assumptions which suggest that among the compliers, being placed in a high home reading classroom increased on grade-level status between 4 and 11 percentage points. Together, our findings suggest that teacher assigned home reading presents an opportunity to efficiently improve early student literacy as the costs of home reading are shared with families.

Public investments in Agriculture: Efficiency, Sustainability and Environmental risks

Chiara Colamartino, Anna Rita Dipierro and Anna Mergoni

Affiliations: LUM University Giuseppe Degennaro (Italy), KU Leuven (Belgium)

In this research, we want to investigate the relationship between efficiency, sustainability and environmental risks in the agricultural sector. Specifically, our goal is to assess whether efficiency and sustainability are complementary or competing targets and to explore to what extent the sustainability of the agricultural sector can represent a risk or a tool to protect the country from environmental risks. From the European budgetary perspective, understanding the mechanism between these three areas is fundamental. To do so, we first assess the efficiency of the sector at the regional level in Europe by means of a non-parametric frontier estimation technique. This approach allows us to benchmark the performance of the different regions in a multi-inputs and multi-outputs setting, without making assumptions about the functional form of the agricultural production function. Second, we investigate if the countries characterised by higher efficiency do it at the cost of lower performances in terms of sustainability. Finally, we study whether there is a relationship between the sustainability of the agricultural sector of a country and its environmental risk.

The measurement of Asset Management achievements of Portuguese water companies

Hermilio Vilarinho, Ana Camanho, Henriqueta Novoa and Giovanna D'Inverno

Affiliations: Faculty of Engineering - University of Porto (Portugal), University of Pisa (Italy)

This research assesses the performance of Portuguese water supply companies operating at the bulk level. The focus of the analysis is the asset management practices and the condition of infrastructures, based on the information conveyed by the indicators collected by the Portuguese regulator (ERSAR - Entidade Reguladora dos Serviços de Água e Resíduos).

Two Benefit-of-the-Doubt (BoD) Composite Indicators are developed to highlight different aspects of asset management approaches. The first reflects organisations' performance in maintaining their infrastructures at acceptable operational levels, and the other reveals their maturity in asset management practices. Robust and conditional approaches for estimating the BoD indicators are explored, allowing to obtain results with statistical significance that account for the effect of contextual variables on the companies' performance.

This study will provide innovative ways of using the information collected by the Portuguese water regulator to gain better insights into companies' performance regarding the management of assets. The study will explore data for a five year period, to assess the trends and promote improvements in the sector. Recent benchmarking studies of water and wastewater utilities have employed data from regulatory authorities in Portugal and in Italy. The present study extends previous works using BoD Composite Indicators by considering a perspective focused on the management of infrastructures and sustainability of the use of assets and resources.

Optimal harvesting under marine reserves and uncertain environment

M'hamed Gaïgi, Vathana Ly Vath and Simone Scotti

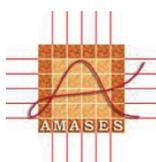
Affiliations: École Nationale d'Ingénieurs de Tunis, ENIT-LAMSIN, Université de Tunis El Manar (Tunisia), Laboratoire de Mathématiques et Modélisation d' Evry, Université Paris-Saclay, CNRS, Univ Evry, ENSIIE (France), University of Pisa (Italy)

Persistence in the literature is the perception of an inherent trade-off between ecological conservation and economic harvesting goals. Overexploitation may lead to resource destruction, including extinction. Conservation measures should be decided and implemented. A standard ecological response is to impose no-take areas or marine reserves. In this paper, our objective is to study a harvesting management problem under the constraints of a no-take area, which we formulate mathematically as a bi-dimensional singular stochastic control problem. Using dynamic programming theory, we characterise our value function as the unique solution to a HJB equation. We also describe the optimal harvesting strategy by identifying the harvesting and non-harvesting regions. We show that setting up reserve area not only leads to a better ecological conservation but may also increase the economic benefit for fishing industry in the long run. We further enrich our studies with some numerical analysis, enabling us to get some insightful understanding on the size of the reserve area where no-take policy should be implemented.

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