Editorial

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Biographical notes: George Halkos is a Professor in Economics of Natural Resources in the Department of Economics at University of Thessaly. He is the Director of the Operations Research Laboratory. His research interests are in the fields of applied statistics and econometrics, environmental economics, applied microeconomic with emphasis in welfare economics, air pollution, game theory, and mathematical models (non-linear programming). He has published articles in many journals, acts as referee in many reputable scientific journals, has worked as team leader and research fellow in various research and academic institutions and has participated and presented his scientific work in international conferences.

1 Risk management of environmental pollution

Pollution and environmental degradation caused by human economic activities have been the research interest in the last few decades. Serious environmental problems like acid rain, global warming, ozone depletion and contamination of air and water are complicated and difficult if not impossible to be managed by a single nation, implying the necessity for international cooperation (Halkos, 1993, 1994, 1996). Tol (2001) states that isolated individual efforts are doubtful to have an important effect on the environment.

The greater than ever global environmental problems such as climate change, damages in ecosystems, scarcity of natural resources and air and water pollution are signs that economic wealth in economies is at present undervaluing these environmental risks (Barbier, 2015). In these lines it is useful to elaborate worldwide principles and general policy and legal outlines to encourage and rationalise such schemes. Progressing such a policy strategy is expected to create a self-reinforcing profit to investors and society but also to firms and countries. Gains to society are expected if more firms are involved in environmental risk management, and are rewarded with higher financing by investors. This is justified by firms starting diminishing natural resource scarcity, pollution and other environmental problems like climate change. These gains may be even more important, as firms decrease more and more the incidences and effects of environmental degradation imposed by their actions, by investing in pollution abatement, decreasing water use, switching to energy alternatives instead of fossil fuels, reducing hazardous wastes, etc.

In these lines the first paper by Barbier and Burgess illustrates the relation between environmental risk management and investment decisions. Increased environmental risk management reduces firms' total cost of capital attracting more investors. It is shown that greater environmental risk may strengthen the after-tax cost of capital for a firm. On the other hand improved firms' environmental risk management demands a variety of matching policies. The empirical findings show that environmental risk may expand the cost and the amount of firms' debt. Another impact is the rise in the after-tax cost of equity capital. That is better environmental risk management is supposed to lower firms' total cost of capital making them more appealing to investors.

Moving on and in terms of natural disasters, enormous losses of people's life and infrastructures are created by landslides generated by various factors like rainfall, soil, land use and land covers, etc. The size of landslide damages may be decreased or minimised by applying innovative landslide risk analysis models. The next paper by Velmurugan and Venkatesan uses Bayesian classification methods to construct an innovative soft Bayesian prediction model (more adequate and precise than other data mining classifications) to categorise landslide occurrences. This is performed with spatial data analysis and the help of spatial knowledge databases and global information systems in prominence regions of India.

2 Sustainability, environmental degradation and economic growth

Conventional policies coping with environmental problems by using an ex-post management are likely to cause disturbing and permanent results to the environment (Zofio and Prieto, 2001). These circumstances started to alter from the Earth Summit in Rio in June 1992. Since then, a large number of countries have adapted sustainable development and sustainability principals (Callens and Tyteca, 1999).

Sustainability is multidimensional and encloses socio-economic, biological and ecological features. Eco-efficiency may be considered as an important tool of sustainable development. Kuosmanen and Kortelainen (2005) classify eco-efficiency as the skillfulness to create the maximum level of economic production with the least feasible environmental degradation. Obviously the concept of eco-efficiency includes both economic and ecological features and can be employed both at firm and country level.

Huppes and Ishikawa (2005) observe that eco-efficiency is a misunderstood notion expressing the four possible natures of eco-efficiency, namely environmental productivity, intensity, cost improvement and cost-effectiveness. For these ratios a rise in economic actions may be regarded as a negative environmental aspect, a rather static view of the reality (Porter and van der Linde, 1995) but this may be not the case in a dynamic viewpoint. For a firm or a country to attain dynamic competitiveness it is necessary to support sustainable development and researchers have to offer policy makers adequate measurements of eco-efficiency and sustainability. As a result, economic performance measures require adjustment to include environmental effects.

In these lines, an extensively used method is the creation of environmental indices using data envelopment analysis (DEA). DEA is a suitable technique for measuring efficiency when there is a necessity to combine multiple inputs and outputs measured in different units into a single index. Then DEA estimates efficiency of decision making units, employing inputs to produce outputs. DEA as a *non-parametric method* relies on mathematical programming to identify efficient frontiers and generate effective entities

that endow with benchmarks for measuring DMUs comparative efficiency. DEA allows for technical efficiency under constant and variable returns to scale and also the Malmquist index and its components (Halkos and Salamouris, 2004; Halkos and Papageorgiou, 2016; Bampatsou and Halkos, 2016, 2017). A consideration of each DMU's productivity is summarised in productivity gains due to improvements in efficiency and technological progress, improvements in efficiency but with productivity losses, technological progress but with productivity losses, productivity gains when efficiency change equals to technological change, and productivity loss when efficiency change equals to technological change.

The paper by Bampatsou et al. uses an input oriented DEA model with constant returns to scale, aggregating both productive and ecological factors into a comprehensive index of total factor productivity (Malmquist) to reveal the total factor productivity index for the EU15 countries with the use of panel data on energy consumption for the time span 1995 to 2011. Apart from calculating the total factor productivity change index its driving forces are also recorded demonstrating if productivity gains stem mainly from improved efficiency or as a consequence of technological progress. It is also shown if the overall development is more driven by input-saving or environmental-saving processes. The comprehensive breakdown facilitates decision makers with more insights into the driving forces of productivity gains or losses.

The empirical finding reveal that technical progress influencing the capacity to optimally combine inputs and outputs is the main feature for the instantaneous rise of desirable output and decline of undesirable by product for most decision making units for the sample time period. The highest values of productivity gains are attained when the annual average growth of efficiency change is higher than one and lower than the annual average growth of technical efficiency. Conversely, the lowest values of productivity gains can be attained when annual average growth of efficiency change is lower than one and lower than the annual average growth of technical efficiency.

Moving on the relationship of air pollution and economic growth may be explored testing the validity of the environmental Kuznets curve hypothesis (Halkos, 2003, 2013, 2015). In these lines the study by Rudenko considers the hypothesis of the inverted U-shaped interdependence between environmental damage from air pollutant emissions and economic growth expressed by the gross regional product per capita in the Arctic regions of Russia. With the use of a panel data for 2000–2014, fully modified ordinary least squares panel long-run estimates proposed by Pedroni is applied to explore the validity of this hypothesis. It is fount that all regions of the Russian Arctic are on the increasing part of the curve with economic growth having no beneficial environmental effect in the Arctic. The necessity of concentrated policies and incentives to reduce air pollutant emissions in the Russian Arctic is emerging.

3 Sustainable tourism and environmental management

Sustainable tourism is an important matter for local and global communities because of several harmful matters on tourist destinations. By realising the benefits from sustainable development, firms and societies can make attempts to incorporate these notions into their every day business practices. However achieving sustainability is not easy and the implementation of sustainable development sometimes may fail as it is a long-term

process demanding enormous financial and human resources, while its benefits become evident gradually and are likely only in a long-term point of view. Successful accomplishment of sustainable development demands adequate management systems and methods integrating them into the general strategy of the firm.

In these lines the paper by Giannoukou and Beneki aims to present the factors, procedures and frameworks for a firm to effectively create, retain, progress and manage sustainable tourism development. These are appropriate and related to firms in the tourism industry like tourism agents, tour operators, hotels and restaurants. The results stem from developing sustainable tourism performance criteria and indicators divided into four key perceptions, namely institutional, economic, socio-cultural and environmental. For integrating these perceptions the tourism sustainability balance scorecard as management tool and methodology of the traditional balanced scorecard is expanded further identifying the causal relation between factors of firms in establishing priorities and targets rationally. This is a first effort to create guidelines for the design and planning of sustainability strategies in tourism sector.

The study by Escalante et al. tries to reveal alternative methods to cope with difficulties of cave sustainability in system dynamics. System dynamics permit different approaches in analysing the whole tourist cave system and the various social, economic, and ecological factors ensuring that they are integrated for sustainability. For this reason two main policies for cave tourism sustainability are used to simulate long-run sustainability. To explore the dynamic effects of policies a case study is performed on an emerging cave destination in the Philippines finding that combining dynamic pricing and vegetation improvement is the best management policy to guarantee sustainable tourism in running the cave system. The empirical findings from this work establish general insights dependent with certain climatic conditions that require careful concern on differences among case specific values like carbon dioxide emission levels and calcium ion concentration.

On the other hand, appropriate and thoughtfully planned environmental management policies are important in protecting the environment. Suitable valuation of direct and indirect environmental values seems to be a priority of achieving sustainability. In these lines the study by Guta and Thiam discusses the disputes and opportunities related to the function of forestry in promoting water-energy and food security in Ethiopia. The historical and institutional context of forest management policy in the country are concisely highlighted first with an expressive framework taking into consideration interconnections emerging from simultaneous natural resources uses to follow. This proposed framework takes into account the competing activities between forest and other natural resources like water, energy and agricultural land use. The institutional situations and governance forms encouraging nexus management approaches are outlined. In this way necessary policy innovations to attain optimal economic and non-economic values of forest and other alternative natural resources practices are discussed. It is shown that current interactions detected between forestry management practices and water-energy-food security nexus create institutional coordination problems. These occur from heterogeneity between stakeholders in each associated sector (water, energy or food) requiring the promotion of a better organisation effort to permit all involved stakeholders to obtain a general platform to express their concerns and access considerable comprises.

Finally, the last study by Nayak et al. examines the concepts of poor households living in and near an Indian national park (the Bhitarkanika), looking at the concepts of

conservatism and *environmentalism* of the poor as a theoretical basis. Primary research is used for extracting values and motives hold to conserve this unspoiled beauty. Respondents, despite their low income levels, consider the non-use value important to conserve this mangrove wetland. Willingness to pay in terms of labour hours is almost 296 times higher than their WTP in terms of annual cash. Obviously different types of values related with conservation and non-use values form require full attention as important parts in such conservation, demanding recognition in policy decision making processes for sustainability.

4 Policy implications

Relying on the empirical findings of the studies presented a number of policy implications emerge. Specifically:

- Environmental risk may increase both the cost and the amount of firm's debt with a rise in the after-tax cost of equity capital. This implies that improved environmental risk management may reduce total cost of capital making firms more attractive to investors.
- In categorising landslide incidences, Bayesian classification methods may be used to construct more adequate and precise classifications like soft Bayesian prediction models.
- Technical progress affecting the ability to optimally merge inputs and outputs is the main feature for the simultaneous increase of desirable output and reduction of undesirable by products.
- In examining the income pollution relationship in the regions of the Russian Arctic the need of specifically focused policies and motives to cut down air pollution becomes apparent.
- Sustainable tourism performance criteria and indicators may be divided into four key insights: institutional, economic, socio-cultural and environmental.
- Specific climatic conditions require cautious consideration of the differences between case specific values like CO_2 emissions and pollutants' contents concentrations.
- Recent interactions between forestry management practices and water-energy-food security nexus generate institutional coordination difficulties with the heterogeneity between stakeholders in the sectors involved (water, energy or food) to require encouragement of better organisation effort allowing stakeholders to express their concerns.
- Apparently dissimilar kinds of values associated with conservation and non-use values require full attention in the nature's protection together with policies encouraging sustainability.

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