

# **The efficiency of the public expenditure on the environment:**

## **A dynamic data envelopment analysis**

### **Summary**

The objective of this paper is to analyse the efficiency of public spending on the environment. Various categories of public expenditure are identified, namely: air and water, energy and biodiversity. Each category of expenditure has an outcome, that may be controlled through available indicators. Data are based on the European system of national and regional accounts allowing for homogeneous comparisons. A dynamic Data Envelopment Analysis (DEA) is applied by employing a panel of 21 decision-making units (i.e. the Italian regions) for the time span 2004 - 2011. In times of economic turmoil, the overall performance of the public intervention in Italy has increased with respect to the pre-crisis period, particularly on the energy sector that has detected an outstanding positive variation in the total factor productivity, mostly driven by a frontier shift experienced in many regions in the North of the country.

### **Extended Abstract**

In times of economic turmoil, and outstanding social changes, new paradigms and new measures of wealth come to the forth, and many start questioning the efficiency of the public intervention on the economy. Increasing research shows that a well-established measure of wealth, that is the Gross Domestic Product (GDP), is not anymore sufficient to assess the wealth and the human development of a country. In contrast, there is more and more evidence that new metrics must be identified to evaluate peoples' wealth (Costanza et al., 2014).

Kubiszewski, et al. (2013), comparing the GDP and the Gross Progress Index for 17 countries, find that these two measures were highly correlated from 1950 up to 1978, about the same time that global Ecological Footprint exceeded global Biocapacity. Afterwards, these two indicators started to move consistently apart, highlighting the divergence between pure economic transactions, that is the GPD, that showed an upwards trend until 2000, and the actual measure of progress remarkably offset by environmental and social costs. In this circumstance, the market's equilibrium is not efficient from

the standpoint of the society as a whole, and the Adam Smith's invisible hand fails to allocate resources efficiently.

When a market failure of this kind occurs, public institutions play an important role, on the one hand, in internalising negative externalities and, on the other hand, in subsidising goods and services that exert positive externalities. Hence, the rationale for the public sector intervention in the economy lies on the existence of a market failure along with an improvement delivered by the intervention, whose benefits should be greater than costs.

In these circumstances, central and local governments may implement several interventions to mitigate these negative impacts. In this respect, public intervention, directed to protect the environment as a scarce resource, is fundamental to foster intra and infra generations' equity, quality of life and human development. These public actions are linked to the concept of sustainable development that can be defined as an economical and social development without an exploitation of natural resources and the environment, that is the basis for life.

This concept is becoming a central issue for national and international development policies. So far, a number of international agreements have been issued to promote growth while protecting the environment. In the case of the European Union, the Treaty of Rome, that established the European Community, as amended by the Single European Act in 1986, explicitly indicated the development and implementation of a Community policy on the environment. It was then made operative with the Maastricht Treaty in 1992 and since then the member states have adopted various policies and regulations aiming at, for example, reducing CO<sup>2</sup> emissions, waste (Eurostat, 2007). Between 2002 and 2012, the environmental protection expenditure by the public sector in the EU-28 grew by 39.2% in current price value terms (Eurostat, 2014).

Yet, in times of economic recession, many governments face budget constraints (Balaguer-Coll et al., 2013) and often tend to prioritise unsustainable economic growth levers, hence limiting ways to mitigate against negative externalities on the environment. In the literature, there is an increasing number of studies that investigate the interaction between public agent, the environment and

individuals' welfare. Ong and Quah (2014), conducted pair comparison surveys on the preferences for public expenditure on education, environment and transportation in Singapore. The findings show that interviewees perceive larger improvements in their well-being from increasing public expenditure on environment compared to an equivalent increase in public expenditure on the other sectors.

A further issue relates to the level of economic inequality and corruption in a country. Harring (2014) analyses cross European differences in perceptions regarding the effectiveness of economic pro-environmental policy instruments (EIs) and find that people are less likely to perceive EIs to be effective pro-environmental policy instruments in relatively corrupt countries. In these circumstances, a public expenditure evaluation, that monitors in what measure public resources are used in an efficient manner, is essential, especially in those countries that are allegedly prone to be less compliance with public policies.

In this respect, Italy makes an interesting case study. As emerged by Harring's (2014) study, despite this country, among the members of the European Union, presents one of the lowest percentage of the population – just above 20% - that perceives EIs as one of the most effective policy instruments yet, according to the Yale Center for Environmental Law & Policy, Italy presents the best performance in terms of environmental health, together with Cyprus, Finland, Luxembourg and Sweden. Thus, it is remarkable that Italy ranks first for five main environmental indicators (i.e. child mortality, indoor air pollution, particulate matter, access to drinking water, and access to sanitation) that can be reasonably assumed to be driven by the public action.

Looking at the figures, Italian regional administrations totalled 4,094 million euro in environmental expenditure, with an impact on GDP of 0.26% in 2011 (ISTAT, 2014). This study focuses on the efficiency of public intervention on the environment within a regional setting. As a matter of fact, productive efficiency reflects the ability of a public sector to maximize output for a given set of inputs (Adam et al., 2011). Besides, a regional setting allows taking into account the intrinsic heterogeneity within a country and therefore differences in the idiosyncratic features and

resources of the territory. In addition, as a matter of facts, the regional governments have as to translate environmental policy direction into actions also following European Community directions as established by the Constitution of the Italian Republic, article 117 amended by the Constitutional Amendment Law no. 3 of 18 October 2001.

The analysis is run on three different categories, namely: air and water, energy and biodiversity. A dynamic Data Envelopment Analysis (DEA) is applied on a panel of 21 decision making units (from now on DMU, in this case the Italian regions) for the time span 2004 - 2011. All data are retrieved from the Italian Institute of Statistics (ISTAT) and inputs are based on the European system of national and regional accounts (ESA95). They are classified according to the accrual accounting system that has the advantage to give back a broad and multidimensional picture on the financial condition of regional governments. In fact, data on value of the cost-revenue structure deliver important information about provision of public services. DEA allows one to measure relative efficiency of this set of DMU linked to an “unknown” production frontier. To this end, a set of inputs and outputs are considered for each category of public expenditure that are reduced to a virtual uni-input–output structure.