



Evaluating climate change in Greece through the insurance compensations of the rural production damages

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ABSTRACT

Climate change is a global problem and one of the major environmental concerns of today. It is also related to economic losses in many ways. It is evident that the worldwide research focuses on measuring the economic consequences of climate change. The present paper introduces a reverse point of view. Specifically, it attempts to estimate the environmental change in Greece through the economic losses caused by the rural production damages and the resulting insurance compensations. For this purpose, the data available by the Greek Agricultural Insurance Organization (GAIO) has been used, considering that if we assume that the climate has begun to change, these changes surely will affect the functioning of GAIO, which is the main institution for the insurance of the rural production in the country. For the statistical analysis, fit-for-use non-parametric tests were used and the main conclusion is that there was an increasing shift in the frequency of appearance of extreme phenomena that is related with atmospheric precipitation and more precisely with the rain and the hail, as well as an increase of the recorded windstorms in most regions.

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1. Introduction and problem identification

The threat of climate change has held the spotlight in recent years. Efforts to forge a long term policy framework for tackling climate change are continuing, but the 15th conference of the parties (COP15) to the United Nations Framework Convention on Climate Change demonstrated the difficulty of reaching agreement on “top-down” legally binding targets. Nonetheless, COP15 did make progress on some crucial issues. The Copenhagen Accord, while not formally adopted at COP15, reflected a large degree of consensus on a number of vital elements including the following: limiting the increase in global temperature to less than 2 °C; achieving deep cuts in global greenhouse gas emissions by 2050; the role of technology in meeting these goals; and the need for an additional funding for developing countries. Many governments are already backing up their support for Accord’s principles through increased funding for low carbon energy research and development, new and more effective policies, and national emission reduction targets (OECD/IEA, 2010; UNFCCC, 2010).

However, climate change will give rise to different impacts in different countries since different countries have different levels of development (Anthoff et al., 2009). In other words, every country has the identical current climate as well as climate change, while

countries differ from one another because of economic, demographic and geographic reasons (Mendelsohn et al., 2006). Moreover, even if climate change is a global problem, decisions are made by national decision makers (Anthoff and Tol, 2010). In this decision-making, non-governmental organizations (NGOs) are among scholars and policy makers fuelling debate (Venmans, 2012). In fact, the role of NGOs seems to be, in certain cases, very important since it could be the powerful stakeholder in order to safeguard the provision of ecosystem services in countries where state governance structures generally tend to be weaker and less focused on the environment (Van der Horst and Vermeulen, 2011). Thus, it is not surprising that in a recent survey of stakeholder attitudes, NGOs considered the threat of climate change to be more serious (Johnsson et al., 2010). On the other hand, a crucial issue in post-2012 climate policy is the allocation of emission reductions across different regions and the associated regional costs (Hof et al., 2010). In fact, this is a global problem that consists of small pieces of the same problem, more or less like a puzzle. If we control the problem in a national level, the control of the global problem will be straightforward. Thus, it is crucial to know about the climate changes on a regional scale (Hertig and Jacobeit, 2008). This is why studies focusing on one single country or region are still of special interest.

Therefore, serious consideration is currently being given to a range of international and domestic policy actions to reduce carbon dioxide emissions and their potentially damaging effects on the climate (Newell et al., 2006; Van Aardenne et al., 2010), while a large number

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of studies attempt to investigate climate change damages associated with the airborne pollution (e.g. [Bozicevic Vrhovcak et al., 2005](#); [Dovi et al., 2009](#); [Kiwjaroun et al., 2009](#); [Tzimas et al., 2009](#); [Bloem et al., 2010](#)). Nevertheless, estimating these impacts carries certain limitations and uncertainties, among which the most important are issues of valuing socio-political priorities of future developments, socio-political acceptance of technological options, income distribution effects, discounting of the future damages to the present value, regional differences in valuing externalities, or the rate of technological change ([El-Kordy et al., 2002](#); [Rafaj and Kypreos, 2007](#)).

It is very interesting that damages caused by the emission of a tonne of carbon today are spread across time and space ([Anthoff et al., 2009](#)). This is critically important in the analysis of sustainability because the damages to the environment from actions taken today extend into the very distant future ([Guest, 2010](#)). Thus, in order to calculate the marginal damage of greenhouse gas emissions today all damages that are caused by those emissions need to be summed up ([Anthoff et al., 2009](#)). In addition, taking into account cost estimates of potential changes in the frequency and severity of intense weather events due to climate change in the assessments of strategies for the reduction of greenhouse gas (GHG) emissions is necessary ([Botzen et al., 2010](#)). Therefore, the effects of the anthropogenic emissions on the magnitude and the frequency of extreme events yield of particular interest ([Tolika et al., 2008](#)). All these highlight the importance of considering in the climate change study both the issues of damages frequency and damages severity, together with their progress across time and space. Consequently, this is a principal concern in the present work as well.

Furthermore, in order to appraise the environmental impacts of various production and consumption activities, systems and technologies, one of the most widely accepted approach today relies on external costs i.e. monetary value of damages caused by them. External costs are imposed on society (e.g. human health) and the environment (e.g. built environment, crops, forests and ecosystems) and are not accounted for by the producers or the consumers of products and services ([Montanari, 2004](#); [Georgakellos, 2010](#); [Peltola et al., 2010](#)). Additionally, assigning values to certain goods works well, as long as, they have prices attached to them: cars, household items, buildings and so forth are relatively straightforward. Of course, here we have to note that the loss of non-economic 'goods', such as community sentiments and culture is very difficult to be covered ([Sturm and Oh, 2010](#)).

From the abovementioned discussion, it is clear, that countries which are mainly agricultural may serve as illustrative examples for measuring the impact of climate change. In Greece, specifically, even if at the present time economic activities like manufacturing and construction, wholesale and retail trade, tourism and services, etc. are very strong, the rural production is still one of the major sectors of the Greek economy. According to a 2007 survey on the structure of the agricultural and livestock holdings, the utilized agricultural area in Greece is 40,762.3 km² of 131,957 km² total area of Greece (31% of the total area of Greece is irrigated). The economically active population in agriculture in the country is about 13% (2001 census), while almost one out of four (24.9%) of the population lives in rural areas. In 2008, the gross value added of agriculture in Greece was about 7 billion €, when the Gross Domestic Product (GDP) for the same period was about 210 billion € (excluding taxes and subsidies on products). It should be noted, as well, that the gross value added of the food products and beverages manufacturing branch (which principally uses agricultural products as inputs) was another 3.2 billion € approximately (2006 data) ([ELSTAT, 2010](#)). On the other hand, agriculture is one of Greece's major export sectors, accounting for around 13% of goods exports, while food and beverage industry adds another 12%. Greek food products generally benefit from high quality and specific characteristics ([European Commission, 2011](#)). Therefore, it is reasonable to expect that in Greece the impact of climate change is depicted on the damages in the agricultural production and vice versa.

Thus, the concern for future climatic changes, because of the downgrading of the environment from the human activities, is evident, since the forecasts worldwide are very ominous, reporting an increase in the temperature of the planet as well as more frequent occurrences of extreme weather events ([European Environment Agency, 2005](#); [Russ et al., 2009](#)). But has the expected in the future climate change began already to take place in Greece? Do we have signs that this climate change is already here? In order to answer these questions, particular interest and importance were given to the study of meteorological elements of recent past aiming at the export of conclusions on changes that have made their appearance ([YPEHODE, 2006](#); [Loukas et al., 2007](#); [Giannakopoulos et al., 2011](#)). Additionally, some effort has been done in order to estimate the money loss due to that possible change ([Ciscar, 2009](#)).

Both issues could be approached considering that if we assume that the climate has begun to change, these changes surely will affect the functioning of Greek Agricultural Insurance Organization (GAIO), which is the main institution for the insurance of the rural production in the country. Indeed, climate change is likely to impact terrestrial and aquatic ecosystems via numerous physical and biological mechanisms especially in the Mediterranean basin, which is particularly vulnerable to present and future climate variability and climate change ([Goubanova and Li, 2007](#); [Giorgi and Lionello, 2008](#)). Thus, Greece, as a part of the southern Mediterranean countries, is expected to suffer from various changes in the currently cultivated crops. In general, changes in yields are expected in the future (2070–2099) due to shorter growing season, extreme events during developing stages, higher risk of heat stress during flowering period, higher risk of raining days during sowing dates, higher rainfall intensity, longer dry spells ([YPEKA, 2010](#); [Taner et al., 2011](#)). Obviously, this is in line with what was mentioned previously, e.g. in Greece the impact of climate change is depicted on the damages in the agricultural production.

The GAIO is an 'Organization of Common Utility, Legal Person of Private Right' while it constitutes the basic pillar of the state for assuring the rural production. GAIO is activated in the framework of a wider unified national protection system that is called "system of protection and insurance of rural activity". The organization and the operation of this unified system are under the control of the "Ministry of Rural Development and Food", while the services that derive from its function are coordinated, monitored and controlled by the "Management of Crises and Risks Office". The structure of the GAIO consists of (1) the central coordinative service, which is situated in Athens, (2) 13 regional offices distributed in the largest cities of country (in order to efficiently cover the total area of the country), and finally, (3) the Center of Meteorological Applications, which is situated in Thessalonica.

This structure aims at sufficiently covering the need for estimating the number and the value of damages coming from possible environmental extreme events that may appear all-over Greece. The estimation of damages' value is done by GAIO's specialized scientific personnel, while the basic objective of GAIO in regard to the quality of the provided services is to compensate in time and fairly. The reserve (money capital) that is needed each year for covering the damages coming from possible environmental extreme events is covered by (1) the actuarial contributions of farmers, and (2) the financial participation of the state (which is limited to 20% of the total annual capital). The way that the compensations are distributed is completely determined by the organization's regulations for insuring plant and animal production. From all the above, it is clear that GAIO, in order to provide its services, needs to continuously record the damages that Greek farmers experience from meteorological events.

In light of the aforementioned discussion in this paper, a study is presented aiming on estimating the environmental change in Greece through the economic losses using the data available by GAIO. This is maybe the first time that such an approach is used in order to depict the climate change in one single country. Thus, in [Section 2](#) a concise literature review concerning the assessment of the impacts from

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