

Economic Analysis of the Internalization the Externalities in Environmental Goods

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Abstract: The environment is characterized as a public good. Public goods are goods that provide benefits for society as a whole or part of it, usually regardless of whether the individual people are willing to pay to have these benefits. This proposed project is not viable in profitable terms to private enterprise, so it applied a modified version of the CVM (Contingent Valuation Method) to realize this project. The purpose of the paper is to present a modified model of an internalizing external costs caused by the operation of a manufacturing unit in conjunction with the new reality created. Using the CBA (Cost-Benefit Analysis), all critical parameters problem attributed to a single base assessment, which facilitates decision making process. The basis of evaluation is to compare benefits and costs. It is used the CVM in case study and the results show that there is less sensitivity for restoration of the cultural heritage monuments in comparison with the sensitivity for restoration of the natural and urban environment in general.

Key words: Experimental economics, WTP (Willingness To Participate), information, questionnaire.

1. Introduction

The purpose of this work is to present a modified model of internalization the external costs caused by the operation of a manufacturing unit in conjunction with the new reality created. The environment is characterized as a public good. Public goods are goods that provide benefits for society as a whole or part of it, usually regardless of whether the individual people are willing to pay to have these benefits. All entities, whether individuals or businesses or public agencies, have some financial resources with which they seek to achieve specific objectives (e.g. profit maximization) [1, 2]. To achieve a specific objective, usually there are many alternatives and possibilities. To be effective, i.e. to utilize the existing resources in the best manner possible, should be selected that the solution maximizes the desired outcome or minimizes the required sacrifices [3].

The procedure for the selection process is called optimization or maximization. In the business world, almost all the decisions may be considered as

optimization problems. The optimization can be applied to maximize the profit and minimize the cost of production [4].

2. The Problem Formulation

The optimization without constraints means that a business seeks to maximize the benefits or minimize costs without putting constraints on resources that will be used. The optimization effort can be not only one but several things simultaneously, so the problem becomes more complicated. There is a problem with optimization constraints when seeking to maximize utility or minimize the cost of an activity with the restriction that is certain pore size to be placed. The individual seeks to maximize his own benefit, cares only for his private benefits and costs and is utterly indifferent to the consequences of acts of other members of society. The relationship between risk and expected return is the key to whether or not to an investment [5].

Often, projects or activities have external effects, which involve social costs or benefits, in addition to the private external influences, because they are internalized in market prices and create tension

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between market prices and social benefits or costs. The economic analysis or CBA (Cost-Benefit Analysis) identifies and quantifies the benefits and costs of an activity or policy, and considers whether it is appropriate and beneficial implementation of the whole economy and society.

To properly place a CBA should make all sizes reflect the image of society. The various inputs and outputs that occur on a project from markets can function effectively or not. When markets function efficiently, the use of the purchase price is good approximation of the social cost. When you come from markets which are not operated effectively, the price does not reflect the true social costs on them [6].

3. Methodology

Using the CBA, all critical parameters problem attributed to a single base assessment, which facilitates decision making process. The basis of evaluation is to compare benefits and costs. If the benefits are larger, then the project (or activity) is socially desirable. "Weak" Treaty Pareto is that a project or a policy measure is socially acceptable when improving the welfare of every member of society. "Strong" condition Pareto is that a project or a policy measure is socially acceptable when ensure improved welfare even one person without reducing the welfare of another. The Pareto principle is based on individual conception of welfare, whereby the people regarded as the best exponents of their own prosperity through their options. It has limited use, since there is almost no action to improve [7, 8].

The search for suitable instruments or for the best possible combination of the use of command and control and of economic instruments nowadays constitutes one of the most complex points of discussion on environmental economics. The environmental reassessment of economic procedures and the change in production and consumption of non-conservation friendly models, which constitute the fixed position of the EU (European Union) and the

OECD (Organisation for Economic Co-operation and Development), could be achieved by using suitable economic instruments. Authors are focalising the present study on environmental taxes, the most well-known and widespread category of economic instruments, by studying the advantages and disadvantages of their enforcement. Next, authors will present the experience at an international level, focusing on their use as well as the consequences on international competitiveness.

According to the first theorem of economic prosperity, under certain conditions, a competitive economy guarantees a Pareto-optimal economic outcome. In other words, a competitive market leads to allocations of resources to the property that any position cannot improve or worsen the position of another. This allocation is done automatically through the price mechanism, e.g. where there is a demand, the price goes up and when there is a bid price, it falls. The adjustment of prices solves the problem of distribution of goods. The second fundamental theorem states that through the competition of firms that have objective, the maximization of profits and consumers who view they maximize the benefits can be excellent distribution of resources regardless of the initial distribution. Therefore, it is necessary to have a central designer to decide who gets what in the economy. In fact, the free market can lead to great disparities that can be removed by state intervention (e.g. taxation).

4. Problem Solution

The externalities or the external economies occur when a person acts or a business affects other people or companies when a company imposes a cost on others but does not compensate, or end, or when a company brings benefits in other businesses but does not receive remuneration for providing this benefit. It is distinguished two types of externalities, public e.g. air pollution, the water that affects the welfare of many people and private e.g. a person casts trash in

the yard of neighbour (This movement affects the welfare of the neighbour and any other). The cases where the activity of an individual or business imposes costs on others refer to as negative externalities or external costs. When positive externality is induced in the production of a commodity, the social costs production is less than the private cost. The optimal quantity of good 'Q' optimum is greater than the equilibrium quantity 'Q' market. Notice that in both cases, it is used for either external charges, or external economies; the price mechanism does not give enough information to the recipient of decisions. In one case, the values do not represent the actual cost and the other does not represent a real benefit. It is said market failure. According to Classic Economic Theory, taxation is an effective tool for addressing the external charge. Unlike the modern economics is as a way of supporting externalities awarding property rights over natural resources. It is argued that if the contaminant obtains a right of victims of pollution, then pollution will pay the first to stop or reduce the polluting activity. Unlike the pollutants to be able to benefit from the natural resource should compensate the victims, which have acquired the right to operate.

When there is a clearly defined system of property rights, the market mechanism will lead to an efficient allocation of resources. In environmental policy, the polluter (whether company or individual, or the State) pays applicable in several countries in the world. This is automatically an incentive to reduce pollution at least at the level where the marginal cost of reducing pollution equals the marginal cost of damage causing this pollution. Also, many countries apply the system of subsidies for the pollution control. This suggests that property rights are particularly important in the formation of environmental policy.

Economic theory emphasizes the importance of ownership of natural resources and negotiations between those resources which pollute and those who suffer from pollution. In particular, the passage of

regulatory approach to environmental protection, which was based mainly on the use tools of direct intervention on the strategic and integrated approach, requires an overall strategy for sustainable development.

Environmental redefinition of economic processes and changing unsustainable patterns of production and consumption cannot be achieved with tools to intervene directly, but rather the use of economic tools. The same should be accepted and to solve the environmental problems of the second generation, such as climate change, biodiversity loss and soil erosion, as taking effective measures in this direction requires the use of other tools except those of direct intervention. The key feature of economic instruments is that the type of conduct which guides the operators of production processes associated with a particular economic advantage. The logic function consists in particular to internalize partially or completely, of externalities i.e. the impact on the environment, which is secondary effect of production processes and consumption and which is not calculated as a cost to those who cause it. This is also an established position in economic theory. It should also be noted that all financial instruments do not show the same degree of compatibility with the market mechanisms.

These tools provide economic incentives for environmental change behaviour either through direct changes in the levels of prices and costs through fees products, duties on carbon or on raw materials, or through indirect changes in prices or the costs through financial and fiscal instruments such as direct subsidies, loans or ending through creating new markets for environmental goods, such as tradable licenses, etc.. The production and consumption of goods and services have created adverse impacts on the environment. Starting thus with the principle "I live, so be foul" and realizing that one cannot speak for the elimination of pollution, the problem lies in "how much pollution". In other words, what will be the "optimum" level of environmental pollution or

environmental protection from pollution, based on various economic, technological, social, psychological and other parameters that apply to a society in a given period?

The environmental degradation may be defined in economic terms, as external costs. The internalization of these costs occurs when polluters pay a tax or a fee. A tax or fee is defined as the payment for each unit of pollution deposited degradation. The main economic reason for using taxes in environmental policy is the integration of the costs of pollution and any other use of the environment on commodity prices and services produced by economic activities. Such costs are called 'externalities', because they are side effects of economic activity and not part of the prices paid by producers or consumers who are directly involved. The calculation of the economic value of externalities is not easy. For example, recent calculations show that the external environmental costs of road transport, such as increased costs resulting from air pollution, climate and disturbance from noise are quite large and growing.

These 40 externalities cost the EU an average of about 5.5% of GDP (Gross National Product). If you include the costs associated with accidents, costs are as high as 7.8% of GDP. An environmental tax tries to incorporate these external costs on prices ('internalising externalities') so that both social and private costs come closer. The better prices allow the markets to work more efficiently, leading to a reallocation of resources under 'fair and efficient' prices through the redistribution of costs. Environmental taxes also help in implementing the principle 'the polluter pays', after facing those who cause pollution to the full costs of polluting their activity. In practice, there is little or no agreed data on the economic costs of externalities or their distribution and therefore, the people making policies determine the price environmental taxes on those levels that they believe will achieve their goals of their policy.

The impact of environmental taxes on

competitiveness is an issue which is constantly on the agenda of discussions. The potential adverse effects on international competitiveness concern to designers of environmental policy when considering their application in energy and other products related to environmental problems. Some factors affecting the efficiency of environmental policy and effects on international trade are the size of its economy and its influence on pricing internationally.

The solution of environmental problems was used in system direct control (strategy command and control). The inability of the system for control and imposition of rules by the State in conjunction with the economic inefficiency characterizing the system cost of pollution control, led to the shift environmental policy, adopting economic tools to solve them. According to experience so far, financial tools can act as flexible, efficient and effective mechanisms under certain circumstances to achieve environmental objectives.

5. Case Study

The size of the external economy is estimated approximately by the method of the CVM (Contingent Valuation Method). The CVM is a survey-based technique, frequently used in experimental economics, especially useful for the valuation of non-market resources/goods/services and cultural heritage objects (of aesthetic, historic, scientific or social value), such as conservation of monumental remains and preservation of the physical and anthropogenic environment. The basic dependent variables used in CVM are (i) WTP (Willingness To Pay), which is the maximum monetary amount that an individual would pay to obtain/preserve a good; and (ii) WTA (Willingness To Accept) compensation, which is the minimum monetary amount required to relinquish the good. Therefore, WTP provides a purchase price, relevant for valuing the proposed gain of the good while WTA provides a selling price, relevant for valuing the proposed loss of the good. According to

classic economic theory, a significant difference between WTP and WTA should not occur, on condition that there is (i) no transaction cost; (ii) perfect information about goods/services and corresponding prices; (iii) no income effect; (iv) a market that engenders truthful revelation of preferences. Although these conditions were generally met in several economic experiments that used inexpensive market goods with readily available substitutes, the ratios WTA/WTP obtained were significantly greater than unity. This result was attributed to the fact that participants in these experiments lacked market experience.

In case that the CVM is applied for monumental remains, certain specific problems arise, because (i) the 'good' under examination has a subjective value, dependent on the cultural level of each reviewee; (ii) the intangibles associated with this 'good' are related to the present political behavior of each individual as regards his/her attitude to the local authorities or the central government; (iii) as a result, the answers may be biased, a matter that becomes evident only after final statistical processing, thus calling for supplementary information, possibly by means of an additional post-questionnaire; and (iv) the adopted/developed (for elicitation of people's WTP) technique itself should be revised (possibly by means of a meta-questionnaire) by the same group of experts who processed the answers in order to improve the questionnaire and store it into a dedicated KB (Knowledge Base) for future usage, since each monument is unique and the results coming from examining quasi-similar cases are of limited value.

6. Results

The sample N-valid is 100 responses regarding the WTP and N-missing is null. The descriptive statistics provide helpful information on the percent frequency of the WTP-value: 36% of the sample suggested WTP = 0 €, 16% agreed with WTP = 1-10 €, 10% accepted WTP = 11-50 €, 20% mentioned WTP = 51-100 €,

while 18% was willing to pay > 100 €.

One of the principle descriptors investigated in the main study concerns X_5 , i.e., the preference of the interviewees about the options (i) leave the situation as it is; (ii) perform only the necessary remediation; or (iii) proceed with radical restoration. Option (i) has been selected only by 12.5% of those that stated WTP = 1-10 €, which gives a 2% of the total sample. Option (ii) is agreed by 51% of the total sample, i.e., 61.1% of those with WTP = 0, 37.5% of those with WTP = 1-10, 40% of those with WTP = 11-50, 70% of those with WTP = 51-100 and 27.8% of those with WTP > 100. Option (iii) has been proposed by 47% of the interviewees, i.e., 38.9% of those with WTP = 0, 50% of those with WTP = 1-10, 60% of those with WTP = 11-50, 30% of those with WTP = 51-100 and 72.2% of those with WTP > 100.

It is worthwhile noting the relation between WTP and preference on restoration options. The interviewees that are willing to pay significant amounts tend to prefer a mild intervention, while those that agree with minimal to null amounts demand radical intervention. The latter group also considers any contribution of theirs to restoration as unfair judging that this expenditure should be covered exclusively by the State. From a socio-psychological point of view, this attitude may reflect extreme personalities with a tendency to holistic and pure solution (i.e., no mixed strategy involving people and the State is acceptable by interviewees who considered themselves as having no further obligations after regular tax-paying); as a result, they think that the State is exclusively responsible to resolve the situation.

In the case of restoration of the natural environment at three lakes in northern Greece, the WTP method is used to compute approximate external economies. The preservation/restoration of natural environment is frequently entailing excessive cost (paid by people through taxation), while it is a source of additional income for both, the State and the people, due to tourism. Since the evaluation of this good cannot be in

market terms, it is applied here in a modified version of the CVM, which is used in experimental economics in order to investigate the significance that people put on this good and how much they might be willing to pay for supporting activities concerning the preservation/restoration of Lake Kastoria. The WTP depends on (i) external diseconomies; (ii) the expectations for property values' rise as a result of the restoration; (iii) the proximity of interviewees' residence to the lake; (iv) the opinion of the interviewees; and (v) the time and money the interviewees spent for visiting the lake.

The survey sample consisted of 51.25% women and 48.56% men, the majority between 26 and 35 years old, since young people were more willing to participate in the survey; 27.5% of the respondents hold a university degree, whereas 37.50% had high school education. The majority of the interviewees belonged to the intermediate income class and enjoyed full-time employment. About 50% of the respondents live or work in close proximity of the lake; however, average WTP does not differ significantly with proximity or distance. Given that extensive media coverage during the recent years, most people were well aware about the problems of the lake. When respondents were asked to assign a level of importance to the protection of the lake on a 3-point scale (very, enough and slightly), 93.75% placed it at the highest scale, 11.25% at the medium scale and only 5% at the lowest.

The survey examined, among other factors, the attitude of citizens towards the general environmental problems of the area and the benefits that would derive from restoring the lake's ecosystem. The majority of the interviewees allocate the responsibility of environmental degradation to the failure or limited capacity of the State and local authorities, whereas they support all of the restoration activities proposed, with 69.03% giving high priority to biological agriculture for decreasing the input of chemical contaminants.

Economic valuation is a two-part process in which the first part (demonstration) displays and measures the economic value of environmental assets, while the second part (appropriation) finds ways to capture the value. The present survey has managed to demonstrate the economic value of preserving Lake Kastoria; the appropriation of this value requires policies, rules and regulations on the part of concerned agencies and institutions.

The WTP, a so-called 'restoration fee', which is actually a 'user's fee', indicates the possibility of fund raising from the community, especially when lake restoration is linked to tourist economy. On the other hand, non-use values for the lake, which this study shows to be substantial, can be captured through appropriate policy instruments. Designing appropriate policy instruments is one big task in itself and there are possible options to be considered like voluntary contribution or council taxation. Since education is a determinant that increases WTP in the medium/long-run, future surveys should target schools, colleges, and universities in the area, so as to increase potential 'capturable' non-use values and acquire relevant information useful for sensitizing young people.

In conclusion, in this analysis, it is demonstrated that social science research can provide useful information for complex environmental policy problems such as the restoration of a lake system. Policy analysis for such cases is especially difficult because these systems provide multiple, interdependent services that vary by type of lake, location, ecohydrological management and other factors. The work presented herein has been proven a useful comprehensive tool for determining the realistic cognitive burden for stakeholders and third parties.

In the case of restoration of the natural environment in industrial areas on the outskirts of Athens, the method is used to calculate WTP external economies as well. So during the last three decades, there has been growing interest in developing methods for assessing the preferences (of experts, stake holders,

community/organization members and independent individuals) for environmental quality.

This framework described above has been implemented in three cases at sites close to Athens (Lat. 37°58'42.22" N, Long. 23°43'01.12" E), referring to (i) the towns/ports Agioi Theodoroi (50.94 km south of Athens, Lat. 37°55'44.55" N, Long. 23°08'25.96" E) and Khalkis (54.87 km north of Athens, Lat. 38°27'47.06" N, Long. 23°35'29.78" E), where the source of pollution is an oil refinery and a cement production unit, respectively; and (ii) the small industrial city/port (actually a suburb 18.04 km to the south of Athens) of Eleusina (Lat. 38°0.2'36.09" N, Long. 23°32'31.63" E), where there are several sources of pollution.

In the town of Agioi Theodoroi, a quarter of the interviewees behave in an absolutely passive mode, while the rest exhibit a consistent attitude willing to pay or accept a rather small amount of money; nevertheless, 35% of them are in favor of relocation, possibly because they have interests with real estate or business associated with tourism. In the town of Khalkis, although 37% of the interviewees are not willing to pay, the corresponding percentage for WTA is negligible while the rest WTA-percentages are considerably high and in good agreement with the results for WTR (Willingness To Relocate).

In the small city of Eleusina, the absolutely passive percentage is quite high for both, WTP and WTA (46% and 67%, respectively), but 47% of the interviewees are in favor of relocation; this can be attributed to the high price of land in this suburb of Athens; the interviewees think they can take advantage from changing the use of land from industrial to urban, while they believe that the industrial units, where most of the inhabitants work, will relocate to a nearby place, quite accessible without entailing excessive transportation cost.

7. Discussion and Concluding Remarks

In this paper, it is considered that the natural

environment as a public good and environmental pollution as an external economy fails the price mechanism to internalize. In all three cases, the approach of foreign trade was with the CVM and calculated the external costs generated by the degradation of the environment from the responses of respondents in monetary units. Respondents answered without knowing it was the environment to its original condition and did not expect it to return to its original form. In the case of archaeological monuments, residents have built their buildings. In case of lakes, respondents have developed an urban way of life around the lakes. In the case of industrial units, residents have supported throughout the local economy on them. The initial state of the environment is unknown and undefined. Human works and buildings create new values in the region and therefore, the external costs can be measured only with the expected quality of the environment and this is not lost. Allowances, taxation and value of land use are calculated solely on the expected image of the landscape.

Therefore, the Pareto optimal socioeconomic lines status is defined according to the new form of environment created after the regeneration of areas and not according to the initial state of the environment. In any case, the society wants to reach the minimum point of the charge received from the pollution and what can be achieved by the 'invisible hand', but the regulation and government intervention. History has shown that the charge received by the society, because of pollution varies with the socioeconomic status of citizens. The more low-income residents are, more elastic the loss of the natural environment is.

References

- [1] Bedate, A., Herrero, L. C., and Sanz, J. A. 2004. "Economic Valuation of the Cultural Heritage: Application to Four Case Studies in Spain." *Journal of Cultural Heritage* 5 (1): 101-11.
- [2] Hanemann, W. M. 1991. "Willingness to Pay and Willingness to Accept: How Much Can They Differ?"

- The American Economic Review* 81 (3): 635-47.
- [3] Bateman, I., Munro, A., Rhodes, B., Starmer, C., and Sugden, R. 1997. "A Test of the Theory of Reference-dependent Preferences." *The Quarterly Journal of Economics* 112 (2): 479-505.
- [4] Horowitz, J. K., and McConnell, K. E. 2003. "Willingness to Accept, Willingness to Pay and the Income Effect." *Journal of Economic Behavior and Organization* 51 (4): 537-45.
- [5] Brown, T. C. 2005. "Loss Aversion without the Endowment Effect, and Other Explanations for the WTA-WTP Disparity." *J. Econ. Behav. Org.* 57 (3): 367-79.
- [6] Liao, T. F. 1994. *Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models*. LA: Sage Publications Inc..
- [7] Menard, S. 2001. *Applied Logistic Regression Analysis* (2nd ed.). LA: Sage Publications Inc..
- [8] Kopsidas, O., and Batzias, F. 2011. "Improvement of Urban Environment and Preservation of Cultural Heritage through Experimental Economics by a Modified Contingent Valuation Method (CVM)." *Recent Researches in Energy, Environment, Devices, Systems, Communications and Computers*: 157-62.