

# Using the Travel Cost Method (TCM) with A Mix of Real and Hypotetic Markets

A Possible Adaptation in A Moment in Which Data Are Neither Sufficiently  
Available in Terms of Quantity, Nor Qualitatively Reliable

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**Abstract**—The problem of defining a reliable economic valuation in a period of lack of reliable and sufficient data is a relevant issue not only for Environmental Economics, and Real Estate Appraisal Sciences, which relies on traditional comparative approaches, developed on the availability of comparable market prices, costs and incomes. In the actual condition, using appraisal methods based on hypothetical markets becomes fundamental to solve the issue, not only for Environmental Goods and Cultural Heritage, but also for any other kind of asset. The paper proposal is eliciting the Willingness to Pay (WTP) through hypothetical markets even with the Travel Cost Method (TCM) to ensure consistent results with lesser errors, compared to values determined using traditional methods facing lack of data issues.

**Keywords**—Travel cost method; hypotetic market; total economic value; willingness to pay; Environmental Economics.

## I. LACK OF DATA AND INNOVATIVE APPROACHES

In a period in which data is lacking, or it is not representative of the ordinary investigation of human and social behavior, introducing more accurate and consistent procedures in the evolution from delivering meaning-making evidence to clarifying anthropological and social conduct is necessary to explain people economic choices and to generalize related theories [1]. This conjecture is fundamental for every development process related to social research and takes effect with the increase in the complexity of systems [2]. This situation leads to a general idea that research depends on cultural and operational tools, which have suddenly become obsolete in this turbulent situation [3], and any effort in redefining conventional standards of understanding and discernment must be connected to this statement [4].

In this extraordinary situation, research methods are made inadequate and contradictory because of the proliferation of micro-behaviors and the growth of unusual choices and conducts, that often propose ambiguous understandings of everyday human and social behaviors [2]. The differentiation of choices and conducts does not contribute in decreasing the capability of judging individual experiences [4], but in adding complexity in identifying core matters and defining clear outlines to key questions [3]. This uncertainty about contents makes investigation tools limited and inadequate in their attempt to determine valid correlations [2] between the way in

which a given fact occurs and the peculiar nature of the behavior of each part of the system [*ibidem*].

The divergence from the Italian tradition in the Project Appraisal Sciences [5] can, consequently, lead to the inclusion of new procedures and methods developed in other perspectives [4]. However, the resulting approach will rarely reject the value of experience completely [6], but it should increase the inclination to foster a critical and constructive dissertation on the effectiveness of some procedures [5] in specific instances, falsifying them to develop the option of addressing some topics with more interconnected and advanced tools, that are substantially dissimilar and predominant in terms of quantity and unparalleled in terms of quality [6]. This pledge to test new methods depends directly on the level of experience and the need for reliable results in extraordinary situations [2]. In terms of behavior, it is practically implemented in formulating ideas and proposals for a more appropriate solution to specific issues, rather than in theoretical terms [6]. The need of determining new conditions for more advanced research methods will, then, address objective complexities in promoting a detailed review of the disciplinary bases, on which new methods can be established [5].

In the Italian traditional Project Appraisal Sciences, the scientific process, which has historically been developed [1], is highly constructive and sufficiently comprehensive at different levels in the articulation of analytical and synthetical structures [6]. The conceptual reference framework is essentially made to explain any principal correlation between theoretical tools, techniques, and cognitive and interpretative procedures [2]. At times, a specific uncertainty in the connection between language and practice can be identified, when research is oriented to challenging topics for the discipline [2, 5]. The limitations do not result from a lack of development of a more organic description of problems and methodological functions: it is probable that some attempts to analyze existing instances will contradict the conditions admitted by theories [7].

This process is moved by the need to determine objective values for relevant assets, that are indivisible in every qualitative and quantitative feature [8], but for which no adequate datasets are available in the actual conditions, neither on their economic life, nor on that of similar goods. This is the principle on which the scientific pillars of Real Estate

Appraisal Sciences are outlined [1]. This principle makes the ordinary investigation of human and social behaviors problematic, challenging, and undistinguished [5]. The independence of Real Estate Appraisal Sciences in the Italian tradition is rooted in the uniqueness of its comparative method [1, 2] since it was invented in the XVI century [9]. In this way, the method can comprise variations or untypical instances [10], still meeting the final goal of producing accurate references for the collective control of the acceptability of any given economic action [2].

A supplementary evidence of the validity of this method is confirmed also when the assessment moves towards assets that do not have a reference market [10]. Essentially, its reasons and goals are unaffected also in such instances [2]. Every observation and measurement related to assets will still be aimed at determining a unifying function for those interpretive standards that reply to the collective longing for equity and sense of balance in the economic actions [5, 10]. In this sense, common sense entails to develop consistent analytical structures according to traditional methods. Issues that may rise will not be influenced by any inability of the Italian traditional Project Appraisal Sciences method to develop effective knowledge models [9]. It only implies a new demand for developing empirical evidence for the comparables set [11].

Historical selling prices and costs cannot be referred at for the same purpose [5, 6], as they represent monetary figures which reflect the rarely ordinary equilibrium conditions of the market [1, 2], at any given moment in time, between the distinct and subjective choices related only to specific assets. Consequently, any research should be addressed directly towards an idea of value, that overcomes the traditional methods and the established valuation standards [10]. This last prospect should be considered very carefully, still pondering this broadening to new methods as a way of widening the capability of traditional methods to answer to the actual issues [1]. These new concepts of value can be explored and properly integrated in the actual disciplinary framework [2], as the traditional method relies on general principles that will still represent the common foundations of any further contribution [1, 2]. All counting that the Italian traditional Project Appraisal Sciences (called 'Estimo') is defined by many authors as the discipline aimed at identifying a monetary value for those economic goods, to which markets are unable to assign a price [11], precisely or explicitly, as in the case of cultural and environmental assets [5, 6]. In this sense, the definition given in 1955 by an economist, Medici, is very significant: according to him, this discipline studies the method that allows to express a value judgment on an asset [*ibidem*].

This leads to the consideration that traditional methods meet a failure in determining the correct ordinary values for goods, when markets conditions are not average and normal [5]: other methods are to be introduced in such instances, dealing with a wider application of the Total Economic Value (TEV) theories. The measure of the TEV is based on the goal of obtaining an expression of individuals choices and preferences with respect to goods [6], which are not generally available on markets (as compared to all the relative possible values in the corresponding economic taxonomy), trying to

measure the relationship between wealth and utility, that the subject develops from them [1, 2]. The most effective method of measuring the economic value of an asset in terms of preferences of individuals involved in its market is related to the identification of the Willingness to Pay, or WTP, which stands for the highest price a buyer is ready to pay for a good/service, in opposition to the Willingness to Accept, or WTA, which represents the lower price a seller is ready to accept. Of course, several issues arise when economic values are to be calculated in terms of WTP/WTA [5, 6].

## II. MARKET FAILURES AND VALUE THEORIES

The roles played by subjects that interact in a market are generally divided between buyers and sellers (respectively, representing supply and demand, i.e., most market actors), complemented by mediators and intermediaries of different kinds, as well as the State and controlling national and international agencies [12]. The models of Neoclassical and Classical Economics establish their approach on production and markets, two notions which, though recently proved inadequate, represent the cornerstones of modern economic theories [13]. Those theories generally move from the consideration of the limitedness (or not) of available resources [14]. This last topic was a well-known theory since Adam Smith wrote his book 'An Inquiry into the Nature and Causes of the Wealth of Nations', one of the fundamental cornerstones of Classical Economics. Smith built his theories moving from the idea of developing a balance between production and demand (in which everyone can find his/her own wealth), based on the availability of resources to be transformed into economic assets [15].

David Ricardo also established his Microeconomics theories on three fundamental elements of production [*ibidem*]: land (which generally represents natural resources), work (which, in modern terms, describes technology and human resources) and capital. However, the scholar who most significantly explored the concept of the limitedness of resources is Thomas Robert Malthus, an English economist and demographer, that is famous for introducing the catastrophes theories [5, 6]. He has been the first intellectual to infer the problem of resource exhaustion: his conception of Economics is based on a dynamic view of systems, dealing with both the inevitable conflict between population growth and resource constraints and the considerable failure of technological progress in compensating productivity deficits related to resource depletion [15]. Malthus' pessimistic approach to resource decline and market failure to deal with it was overturned by John Stuart Mill, the forefather of scholars that, despite a long course of criticism, believe that the market can be able to cope with the dilemma of resource exhaustion [11]. Mill thought that the market could not fail, because its dynamics are based on the price growth mechanism [13, 14], that spontaneously triggers when exhaustion signals are discerned [12]. According to these intellectuals, markets work on the principle 'the rarer the good, the higher its price' [13], therefore, rarity will limit the access, the use and the consumption of resources [14].

Many scholars in the second half of the XIX century have recognized the inability of markets (and their failures) in efficiently managing non-marketable goods [16]: one of the

main related problems is exactly the inadequacy of markets self-regulating mechanisms. Markets are incapable to prevent resource depletion through the application of Mill's price growth rule [13, 17], and it has been abundantly demonstrated in many cases of resource complete exhaustion [15], or in the difficulty of safeguarding protected species threatened in different ways by economic systems [18]. Furthermore, environmental externalities cannot be fully internalized by markets, since wealth resulting from the production of economic goods creates advantages both for the producer (in terms of profit; see 14) and for the consumer, which obtains a benefit from the good acquisition [5, 6]. *Au contraire*, the pollution effects are distributed indistinctly among all the players in the market and the costs of reducing environmental liabilities and negative externalities (which increase as production grows, unless specific regulations are enacted; see 14 and 15) generally lies heavy on the whole community [13]. Negative externalities, therefore, are basically external costs, that originate in the market in which the production cycle, that generates them, is placed [19]. For this reason, the internalization of negative factors, such as pollution, which can only be achieved by attributing the costs of such actions to those operating in the market (typically producers), can never be considered complete [20], since the costs of reducing pollution were caused by those who produce its results, and they would represent only a partial compensation for the damage caused [15].

#### A. The problem of externalities assessment

An external cost or benefit related to specific activities performed by an economic entity is referred to as 'externality' (negative or positive, or respectively, economies and diseconomies). They stem from the fact that the social or economic functions of a group of people necessarily lead to the generation of impacts (negative or positive) on other sets of actors [19] potentially involved in these actions (be they people or elements that make up the environment). In other words, externalities are the effects, whether boastful or not, linked to an individual production/consumption activity, which affect the production/consumption action of another individual [13, 15]. The concept of 'external' costs and benefits arises from the fact that they do not come from specific economic entity activities, which they lie heavy on [20], and, generally, they do not affect the prices paid or the sums received to provide a good or a service. In this sense, externalities represent the effects of economic entities actions on the wealth of other subjects, that are not directly involved in their activities [18]. It must also be accepted that the social benefit is always somehow influenced by externalities, and this impact cannot be limited just considering the utility [13] that actors involved in market exchanges (buyers and sellers, i.e., supply and demand) will collect, since they are logically inclined to ignore the external effects caused by their choices [19].

This manifestation has led many authors to postulate the inability or failure of the market to maximize social wealth and surplus [10, 19]. Normal and ordinary market equilibrium instances [11, 14] are differently established, as their efficient configuration results in the maximization of the difference between value for consumers and cost to producers [13]. This is determined by the fact that the social cost curve, linked to a

given action, may be higher (negative externalities) or lower (positive externalities) than the corresponding private cost curve [15]. The distance between these two curves will determine the rate of social cost/wealth of a given economic action. Consequently, to maximize the social wealth of these economic actions by obtaining a total positive surplus from the market, it is necessary to identify the point at which the demand curve intersects the social cost curve [13, 14]. As far as negative externalities are concerned, the most typical examples relate to the field of the Environmental Economy and Transportation Sciences [19] and are represented by effects, such as atmospheric and acoustic pollution, climate change [15], accidents and traffic, while, as far as external benefits are concerned, the most interesting case study is are industrial districts [13], or organic farming practices [21].

The only methods that seem reliable and fully comprehensive in this sense [5, 6] are, then, those measuring the WTP/WTA of the same actors on the market (buyers and sellers), including the effects of externalities on local communities and environments [22, 23, 24]. This will lead to a more comprehensive way of measuring the TEV, or some of its components, that can lead to accurate value judgements, not only for those assets that do not have a market [13, 14], but also for goods that are available on markets in ordinary conditions, but that meet significant issues during extraordinary instances [5, 6], as many markets in this last year of pandemic restrictions.

#### III. A NEW APPROACH TO EXISTING METHODS

After analyzing the situation in which market data about values cannot be made available because of market failures in determining exchange prices, or costs, related to assets/services, the paper explores potential alternatives to the Travel Cost Method that can be applied in informative deficiency situations, assessing them in order to understand when and how they could be used to replace the TCM.

According to a useful scheme formulated in a Multicriteria study [25], evaluation techniques can be primarily divided between *ex-ante* or *ex-post* procedures, which in turn can be partitioned, secondarily, into monetary methodologies or not, which may be implicit or explicit [13, 14]. From the point of view of *ex-ante* evaluation, most analytical tools are generally used as investigative apparatus to highlight, before determining any result, the structure of strategic choices regarding any development and as negotiating tools to support the related debate. In *ex-ante* or intermediate evaluations [19, 25], this kind of approach is used to evaluate the propensity of different activities to pursue given goals, before or during the implementation of the related actions, especially through the opinions of decision-makers and beneficiaries regarding the effectiveness of those activities. For *ex-post* evaluations, instead, this kind of approach is used to contribute to the assessment of performed activities or actions, by evaluating their impacts and outcomes. The use of this approach as analytical method for complex goals can be useful after development phases were completed, to understand the level of fulfillment of stakeholders' strategies and interests.

Another significant fact, then, in the consideration of evaluation methods concerns their classification according to the measure unit used in the evaluation and the procedure used

to estimate it [11, 14], therefore, it is possible to divide these methods between:

- monetary and non-monetary techniques [15, 20],
- procedures considering real markets (in a conventional and estimative approach; see 13, 14),
- systems based on consumers income [11, 6].

Non-Monetary Techniques mainly include procedures based on the assessment of technical parameters [15, 20], such as Environmental Impact Assessment or Strategic Environmental Assessment. Non-Monetary Techniques are aimed at evaluating each cultural or environmental asset [13] based on the most appropriate technical parameter to express its status; this category also includes techniques, such as multicriteria analysis [19, 20], or the recently developed methods for the assessment of Ecosystem Services [26]. Among Non-Monetary tools we can mention Environmental Impact Methods, Environmental Accountability techniques and Multigoal schemes. System Dynamics models can also be included in this kind of evaluation systems because they simulate a system according to a project or policy, providing guidance for achieving their specific goals [19, 20].

These techniques still have a significant capability of proposing accurate results, even in a situation of lack of reliable and sufficient economic datasets, for the fact that they are based on non-monetary measures helps introducing qualitative judgements, that can overcome the actual extraordinary instances. This can be a possible alternative solution to finding reliable assessment methods in a period of lack of reliable and sufficient data, but it does not cover all the possible needs that assessment activities could be called to reply at, mainly, when monetary values are required.

#### A. Monetary Valuation Methods

Amongst Monetary Valuation Methods [19, 20], we can identify three main categories, ranging in a wide set of methods, and depending on whether they refer to:

- conventional procedures,
- traditional estimation techniques,
- modern assessment methods.

Conventional procedures [13, 14] use technical corrective coefficients to be applied at market prices or the corresponding costs [11]: these techniques are widely applied in the legal field for estimating the value of ornamental trees and gardens and for damages to public greenery [13]. These techniques, based on the theories of traditional Project Appraisal Sciences on value estimations, are used in legal procedures for the evaluation of mainly negative externalities produced by the use of mixed goods and in the context of cost-benefit analysis procedures [5, 14]. The value of the public reference good is identified by associating it with an economic component [11, 13], which can be used to estimate only limited portions of the TEV of goods, influencing social benefits [5, 6], since they are only able to estimate components which have a relationship with existing and ordinary markets [26].

The main traditional methods related to market values include the International Valuation Standards approaches (market comparison, income, and cost approach) and the traditional secondary methods of the Italian Project Appraisal Sciences, such as the complementary value (in Italian, 'valore

complementare'), the replacement/surrogation value (in Italian, 'valore di surrogazione'), and the transformation value (in Italian, 'valore di trasformazione'). Amongst traditional monetary techniques, the DTLR manual [28] mentions financial analysis (that assesses the impacts of an alternative on financial costs and revenues, with respect to the organization of decisions; see 29, 30), cost-effectiveness analysis (a technique that evaluates only the financial costs of project alternatives with similar performance; see 31, 32) and the Cost-Benefit Analysis (CBA), that is a microeconomic method invented by an engineer, Dupuit, in the context of Classical Economics. Most of these techniques are inapplicable in a situation of lack of reliable and sufficient market prices, for the fact that they are strictly based on real monetary values.

The CBA is an assessment technique used in the Economic Evaluation field with the aim of calculating the social surplus of projects and developments, such as major infrastructural works. The main use of this method is in *ex-ante* assessments for selecting the most appropriate solution between a set of possible alternatives (at least, 2 scenarios are needed). The CBA assumptions are simple: it is aimed at defining and estimating social costs and benefits of different alternatives, to select the one ensuring the highest net social surplus [13, 19]. The measure of this surplus is carried out through the monetization of all the cost and benefit components involved by the project, both in terms of figures to which a direct and actual monetary value corresponds, and of indirect ones (such as pollution, time, etc.). In tangible terms, there are several critical factors, such as the use of shadow prices and the claim of measuring all parameters by using monetary units, reducing the variety and diversity of facts involved in the evaluation to a single figure [28, 19]. Though this approach is increasingly criticized, CBA is still often used by the most important Institutions, thanks to the consistency of its core paradigm, that made it become one of the main and shared tools for project evaluation in the XX century, mainly in the 1970s [11]. Although the calculation of financial convenience parameters is a kind of CBA, it does not provide a suitable measure of the net return on economic factors [14], as much as market prices can not reflect the real economic value of inputs and outputs in terms of scarcity (or opportunity costs), or of economic policy objectives. This kind of analysis is facing many issues related both to the calculation of direct costs and benefits, and mainly for the monetization of indirect ones, as the lack of reliable and sufficient market data is highly affecting the accuracy of final decision parameters, like net returns.

Procedures that make use of the theories of modern Project Appraisal Sciences for the value estimation [19] take advantage of monetary measure units, dimensioning the value of public goods in terms of perceived utility, using the corresponding use parameters (built in terms of surplus or consumer income). These last procedures require an assessment of the demand function of assets, therefore, they differ, not only in this fact, from methods aimed at eliciting that same values. Monetary techniques include different categories of techniques, such as the Conventional Values method [13], the Market Values approaches [27] of traditional Project Appraisal Sciences [11, 13, 14], techniques aimed at

identifying the Consumer Surplus [19, 20], and the Cost-Revenue Analysis [11, 18]. In fact, the first principle of classification of evaluation techniques [33] should be their economic nature. Some interesting innovative economic techniques are Goal Programming Models, Multicriteria Analysis (MCA) and Impact or Added Value Analysis, which is a macroeconomic method. Methods that identify the Consumer Surplus can be divided between direct techniques (such as the Travel Costs and the Hedonic Prices methods) and indirect (such as the Contingent Valuation Method, or CVM).

In this last group, MCA is the most interesting one. It is part of the so-called Multidimensional Analytical Techniques and consists of multiple methods of analysis and numerous specific models based on the object for which they were conceived [25]. This set of evaluation methods focuses on concepts and methods established by different disciplines (from operational research to social decision-making theory through the theory of organizations) and was developed from linear programming experiences in the second half of the 20th century [33]. MCA was developed mainly thanks to the European and French Schools (through scholars such as Roy, Guigou, and Jacquet-Lagrèze) using some famous models (such as Electre) and in parallel with the CBA, until it exceeded its potential, becoming the most widely used technique since the beginning of the 1980s [25]. The main purpose of this set of tools is the synthesis of a group of alternatives to select the best possible solutions within an evaluation process [20]. This technique is, in fact, used to compare different design options or heterogeneous measures [13, 19], as it was designed to help decision-makers (whose participation in the process is a fundamental element) to integrate different choices, referring to the opinions of the actors involved, in a summary perspective or retrospective framework, the results of which are generally aimed at providing operational suggestions or recommendations for future activities [28]. A multi-policy evaluation can, in fact, be organized around a vision that produces a single synthetic conclusion or more results, that adapt to the preferences and priorities of involved actors. In this sense, MCA is like some techniques used in the field of Development Management or Information Systems [25] and to CBA [28], although it does not reduce the complexity of instances to a single monetary measure unit [19]. As evaluation method, it is an aid that allows a systematic analysis of alternatives and guides decision-makers towards a decision. In terms of actual applicability, this technique still has a substantial capability of proposing accurate results, being able to replace monetary measures with qualitative judgements to bypass the actual lack of reliable market data.

### B. Innovative Monetary Valuation Methods

Substantially, innovative methods calculate monetary values that can be attributed to goods, which are not exchanged on ordinary markets and for which individual preferences for the supply of public goods can be estimated (including environmental goods). These are the methods that, apparently, can face the actual lack of data in the most efficient way, by eliciting the WTP/WTA of potential buyers and sellers. According to the most competent and specialist

literature [1, 13], these methods can be, then, classified into [5, 6]:

- direct methods based on existing markets, including techniques as the Referendum, or Simulated Markets in Economic Experiments;
- direct methods based on hypothetical markets, which refer to Contingent Valuations, Choice Modelling (or conjoint analysis), Delphi technique, Focus Groups, Budget Games, micro-based estimation of Demand Functions, and so on;
- indirect methods based on existing markets, such as Hedonic Prices Methods, Family Production Functions, Travel Cost Methods, Market Choices, Voting Choices, Compensation Costs, and 'Incremental Consumer Surplus' techniques;
- indirect methods based on hypothetical markets, as the Contingent Ranking, the Priority Evaluation technique, and the Indifference Curve Mapping.

Direct evaluation methods are based on stated or expressed preferences and rely on the chance of determining an asset value by directly involving potential consumers [5, 6], who will be called upon to express their opinion on an existing or a hypothetical market. In other words, they will be asked to express their preference based on the definition of a market, that can have a relation to actual prices or not, in which the individual can directly communicate his/her WTP for a certain asset/service, to benefit of it. The direct methods, therefore, are aimed at estimating the value of a good/service by comparing it to its reference market [22], thanks to the use of *ad hoc* interviews, in which respondents are called to articulate the relative WTP for the good/service, or the WTA for any compensation to renounce to it, both in terms of existence and/or use. The demand function is deduced using consumer preferences about the market [5, 6], to estimate the TEV components (not all the techniques can identify all its factors). The main direct approaches are related to the Contingent Valuation Method (CVM), together with other techniques linked to the concept of Micro-Based Assessments Of Demand Functions [5, 6].

Indirect evaluation methods are based on stated or expressed preferences and rely on the chance of determining an asset value by comparing it with the value of a second asset, directly comparable and linked to the first, for which a certain, transparent, and incontrovertible market assessment is available [22]. These methods count on the relationships between public and privately owned goods in consumer activities. Indirect methods are essentially based on the behavior of individuals and are aimed at assessing a good/service using prices and values that people assume for being able to take advantage of that same good/service in different ways [5, 6]. The most common indirect procedures in literature include techniques based on TCM (probably the most widely used) and the Hedonic Prices (HPM). Some other examples are the Protection Costs Method (PCM), the Compensation or Replacement Costs calculation, and the Market Values Method (MVM). According to the theories that support these methods, it is possible to refer to some goods/services, whose prices can be calculated by analyzing the market and its dynamics, to infer other goods/services value, when they are complementary [*ibidem*]: the price of

this last ones can be, then, easily deduced by comparing them to the first ones. Consequently, by building the relative demand curve for known goods and services involved in the use of unknown goods and services, it is possible to deduce the demand function of these last ones [22]. Indirect methods, therefore, do not allow to determine the non-use values of goods/services, since they are aimed at estimating their actual use [5]: they cannot be applied when there is no connection between consumption/value of reference and comparable goods/services, or if the analysis goal is determining values not associated to their actual use. In these instances, direct methods are generally used [6].

The Protection Costs Method (PCM, in Italian, 'metodo dei costi di tutela') is widely applied in the field of Transport Economics to assess the impact of their negative externalities, meant as the final effects of an impacts chain and as protective interventions to be implemented to prevent a certain result of a harmful event [34]. The PCM is established on a sort of range of protection options: the extreme condition is represented by restorations. The foundations of this technique are based on the chance of identifying costs of protection alternatives, so as to be able to use them to determine the benefits of the set of mitigating/restoration actions aimed at reducing/removing the damage. The basic assumptions of this method, however, lead, in general, to a significant underestimation of negative externalities [*ibidem*], since the impossibility of completely restoring the initial situation of a given asset is not included in the assumed values [35], not considering its value of integrity, as far as the environmental heritage is concerned [36], and of authenticity of cultural and artistic assets [37]. This family of techniques is therefore not suitable to represent the full economic value of any damage, since the concepts of damage and restoration are perfectly distinct, both from an economic, technical, and physical point of view, since this method hypothesizes that the damage is a reversible action and that, therefore, it is technically possible to recreate the exact original situation [35]. As already mentioned, this method includes a wide range of techniques, divided by the kind of costs that they are aimed at calculating, which can be [34]:

- restoration costs, which are evaluated as the costs needed to implement any remediate to the qualitative and quantitative attributes of damaged goods;
- remediation costs, which are very close to the previous ones, identified as the costs required to remediate the actual situation, and to remove the environmental liabilities found in a given place, in the awareness of the fact that it is impossible to recreate the exact original situation of the damaged assets [35];
- prevention costs, estimated as costs needed to reduce the causes of any damage, so as to prevent such damage from occurring;
- mitigation costs, assessed as the costs of reducing the causes of a given damage, so as to reduce any damage, without, however, being able to avoid it;
- adaptation costs, which are calculated as the costs required for implementing solutions which, although not being able to identify the causes, can occur in the post-impact phases, in order to reduce the final harmful effects of any dangerous action.

As some of the previous techniques, this method becomes inapplicable when reliable and sufficient market values related to costs are not available, as it is strictly connected to monetary measures. Plus, the fact that negative externalities are highly underestimated, as well as some of the main components of the TEV (as the integrity/authenticity value), makes it a procedure that can only be applied in limited instances and times.

Another method based on real behavior is the observation and economic evaluation of alternative choices [22]. According to this method, aimed at assessing compensation or replacement costs, individuals reveal their preferences through the purchase of alternative goods to assets that are no longer available on the market [34]. When an asset or service is no longer accessible, people may decide to buy different alternative goods, whose price can be used to approximate the subjective value given to goods, which are no longer available [19]. As per the previous approach, the only constrain to the application of the method is that alternative assets/services are available and that reliable and sufficient market data on their prices can be accessed, making this technique inapplicable in many situations of lack of consistent and appropriate market data.

The Market Values Method (MVM) is based on the assessment of damage components which have an impact on the relevant market and on the corresponding prices [34], such as the damage caused by atmospheric pollution, which is often assessed considering both the costs of health services needed to treat diseases generated by environmental liabilities, and the reduction of the productivity of damaged ecosystems [7, 26]. The MVM is based on the evaluation of real markets, which can take a more complete view of environmental effects [8]. A possible example is the TEV of a health symptom [26]: its effects do not end in the cost of medications and treatments needed to solve its results. Similarly, the TEV of forests does not end in the value of timber volumes produced from it. The damage assessment carried out through the MVM is simple to apply, as it is based on generally available and verifiable data related to real markets, but it cannot be considered a suitable methodology to assess the value of assets for most types of negative (but also positive) externalities [34]. It is more suitable only to calculate the amount of damage suffered by some components of privately owned economic goods and subject of market trade. In fact, the MVM fails in including option and existence values, leading to a flattening of the TEV to what the market is able to rate independently [19]. Being a method based on market values, this technique cannot determine accurate results in a situation of lack of reliable and sufficient economic values, for the fact that it is only based on monetary measures coming from market transactions.

The Hedonic Prices Method (HPM) is aimed at estimating the value of a given effect suffered by an asset/service based on prices established by a market that is significantly affected by this effect (both positively and negatively), as every asset/service consists of several attributes of which consumers can benefit. If two goods are the same in all but one feature, that is their price, that difference is defined as the hedonic price of the non-market attribute. The HPM refers to a type of market which is referred to as 'surrogate', as it must replace the reference markets of the reference asset/service [5, 6]. This

method develops the value of different attributes related to assets/services from the market or the use price of a given set of comparison assets/services, needing a sufficiently transparent reference market [34]. According to other authors, the so-called hedonimetric method is usually based on market prices of buildings, therefore, differences in the level of renting fees of similar real estate units, situated in locations with different environmental features (such as noise pollution, air quality, green areas, and services, etc.) should lead to estimating their values [13]. As for the MVM, the HPM has the advantage of being able to originate its values from the analysis of actual choices of potential consumers, despite having a significant limit in the complexity of considering even the main non-environmental factors, which can influence the prices of the surrogate market [34]. The main limitations of this technique come from the type of market to which it refers, that should be transparent and not affected by information asymmetry (which, of course, affects the real estate market). Moreover, the estimated values will have a restricted validity, as most of the initial conditions defining that market persist; ultimately, this method requires a considerable amount of data and a significant ability to manage its analysis with statistical technical specifications. Being a method strongly rooted in real market prices, also the HPM will fail in special conditions, meaning without reliable and sufficient data, its results would be of questionable quality. A possible solution to this issue is building a specific hypothetical market to elicit revealed preferences, based on a conjectural environment, and a supposed economic reference system.

According to the most recent developments [26], there are three main methods of assessing benefits coming from visiting goods/services, i.e., techniques based on the concept of HPM, TCM and the Contingent Valuation Method [5, 6], to which the technique of benefit transfer should be added. This last one is method whose first goal is to address the problem of spatializing with high resolution the recreational tourist value [34], to carry out resource assessments that are different in type or location from the reference ones. Its most advanced applications are based on meta-analysis approaches to incorporate geographical variables into the model [26]. However, the need to consider socio-economic variables, generally available on a minimum spatial scale of census units (the municipality) has limited spatial disaggregation of values [34]. This method works well only for environmental goods, although it appears to be ineffective in the case of cultural goods, as it would presuppose the existence of goods with perfectly and fully comparable characteristics. Plus, being another method based on real market prices, it still suffers for the lack of reliable and sufficient data, that researchers are facing in this period.

#### IV. USING TCM WITH AN HYPOTETIC MARKET

The Travel Cost Method (TCM) can assess the fruition and recreational components of goods/services by assessing the travel costs related to visiting or using them [5, 6]. This method is mainly applied for estimating the value of environmental goods and their components, as it can determine the value of goods/services by aggregating the WTP of individuals for using properties, but not only for

recreational purposes. The basic foundations of this method are the assessments of costs that individuals will pay to visit a certain place [34]: these costs (direct, or indirect) become the indicator of the value of the site. The TCM is, then, based on the assumption that benefits given by goods/services must at least cover the travel costs incurred to visit the related site [38].

The TCM is, then, based on the assumption that the number of visits made to a given recreational site by an individual decreases as the travel costs increase [34], in turn, it consists both of actual expenditures incurred in accessing that site (consisting, respectively, of transport costs and other spending components related to leisure activities) and of an estimate of the economic value of the time required to travel, since if the costs were to exceed the benefits, the consumer would refrain from benefiting from that recreational activity [13]. The main limitations of this method relate to the dependence on income in terms of time spent on recreational activities linked to a good/service [34], as well as the need to consider the presence of alternative sites and multiple destinations for the visit. Since 1982, there are extensive literature contributions on empirical applications of evaluation methods related to the estimation of travel costs in its real components, direct, or indirect.

The TCM can also use the purchase of complementary assets, considering that if individuals do not pay directly for using goods/services, they must, however, pay indirect costs to enjoy them [13]. Environmental economists use the TCM to measure the value of goods/services, assuming that rational consumers/visitors expect to receive a benefit at least equal to the cost incurred for the visit, or any related activity [34]. The value of assets/services is therefore the sum of the benefits enjoyed by users, calculated using its demand curve. In other words, the individual economic assessment is associated with travel costs incurred, then, counting the number of visits made by a sample of users. By means of interviews, information is collected on the distance between residence and the visited location and on the incurred traveling expenses [5, 6]: the demand for any good/service is, then, a function of distance, cost, and time.

A possible example of this method is related to damages suffered by a natural park because of the construction of a polluting industry in its surrounding area. It should be noted that, to visit the natural park, it is necessary to pay for the entrance ticket, or, anyway, to go on site, to have any meals outside, and so on. The evaluation consists in the analysis of the decrease in the number of potential visitors and the related changes in the distribution of the corresponding travel costs before and after the industrial plant is developed, to appraise the decrease in the demand for visiting the natural park and the consequent reduction in its use value.

There are many challenges related to this technique. First, it is difficult to isolate the benefits arising from goods/services, given the wide variety of motivations behind the decision to travel to a certain site [34]. Second, it is not clear how individuals assess the time spent traveling - whatever the opportunity cost of their leisure time - and which components are considered a cost, as it is possible that the journey itself is a pleasant experience [5, 6]. Third, it should be noted that this method cannot measure preservation values

[34]. Fourth, in a period in which market data are not reliable and sufficient, researchers need to find a different way of building the economic environment in which the evaluation is conducted. Therefore, a hypothetic market should be built to elicit the WTP of visitors and calculate reliable and appropriate economic evaluations based on that.

Considering that, the TCM can be also efficiently rooted on hypothetical markets, as we recently experimented in a course at the Politecnico di Milano: students prepared a TCM questionnaire proposing to respondents their alternative developments for a natural park in Italy. Based on that, students asked to respondents (that have been interviewed using only web-based tools) if they were ready to pay for visiting the park after the refurbishment and how much (given that a similar natural park ticket could cost a certain sum) and if they would like to visit every and each single option they proposed. The hypothetical market was created not only on the fact that the questionnaire measured only potential visits, but also on the assumption of different development alternatives, that are not yet available, for the reference area. Another hypothetic element is that Italian natural parks are mostly freely accessible, and no ticket is due for visiting them. The results also included the WTP for complementary activities, which involved trekking, rock climbing, and other possible secondary services. Surprisingly, the mix of hypothetical and real market references led to determining the value of both the refurbishment projects and the complementary services in a very accurate way, comparing the TCM with other existing databases related to touristic activities and visitors.

This approach will be further investigated in the future courses and in some research activities, that will be developed in the incoming year, such as a series of theses that are ongoing now and that should be completed by the end of 2021. In this way, further evidence will be produced supporting this new approach to TCM and similar methods, involving hypothetical environments in their practical application.

## V. CONCLUSIONS

In conclusion, different methods exist according to how individual economic preferences are elicited, meaning directly from the statements of interviewees (stated preferences), or indirectly deduced from their behavior (revealed preferences), and to how the economic system is settled, based on real and hypothetical markets, depending on the result of observable, or supposed behaviors. The real market methods have the advantage of relying on the measurement of real behaviors, but provide assessment results that are limited to the use value, showing many constraints in this period of lack of reliable and sufficient data.

Hypothetical contexts, instead, offer the advantage of being always valid and reliable, for researchers that try to assess how much individuals (or the community) would be willing to pay if a given asset/service is made available or offered to them [34]. A hypothetical environment concerns, therefore, the preference for a good not yet produced, whose supply is, then, uncertain, being subject to the behavior of others, and whose actual financing is postponed to a subsequent decision [13]. This second option gives

researchers and scholars the chance of determining a stable and reliable economic environment even in uncertain and indeterminable contexts, by building those market data that are not reliable or sufficient in the reference assessment period.

Using a mix of these two techniques, the positive effects of both real and hypothetical environments can be maximized, minimizing their negative sides. This needs an adaptation of the actual theoretical framework that ensures the reliability of some assessment methods, in order to be able to use the most useful approaches in all possible instances.

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