Environmental Impact Assessment Review 54 (2015) 61–71

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

journal homepage: www.elsevier.com/locate/eiar

Assessment of external costs for transport project evaluation: Guidelines in some European countries

Umberto Petruccelli

University of Basilicata, School of Engineering, Potenza, Italy

ARTICLE INFO

Article history:
Received 23 January 2015
Received in revised form 19 May 2015
Accepted 20 May 2015
Available online xxxx

Keywords:
Transport externalities
External costs assessment
Projects evaluation

ABSTRACT

Many studies about the external costs generated by the transport system have been developed in the last twenty years. To standardize methodologies and assessment procedures to be used in the evaluation of the projects, some European countries recently have adopted specific guidelines that differ from each other in some aspects even sensibly.

This paper presents a critical analysis of the British, Italian and German guidelines and is aimed at cataloguing the external cost types regarded and the assessment methods indicated as well as to highlight the differences of the results, in terms of applicability and reliability. The goal is to contribute to a European standardization process that would lead to the drafting of guidelines suited for all EU countries.

1. Topic

An externality occurs when someone's behavior affects the welfare of others directly and not through changes in market prices.

Externalities are effects arising from a production (production externalities) or consumption (consumption externalities) that fall on persons other than the producer and the consumer. Specifically, the negative externalities consist of costs, often non-monetary, that fall on subjects outside of the production–consumption relationship and have, as a result, a social cost and a market distortion due to production costs not paid by the producer or the consumer.

In fact, because the external costs are not taken into account in the cost structure of production thus not affecting the market prices, they are not paid by either the producer or the consumer and fall on third parties. This consequence distorts the decisions of the market and thus hinders the process of the social optimum pursuit.

Sometimes we distinguish the social costs from the external costs. In this case, social costs represent all costs, both internal and external, for all activities undertaken by the society as a whole and paid in any way by the society, not just in money. This classification leads to a distinction between the costs generated by the entire society's activities from those produced by specific groups of people. However this approach is not useful in the present work because the problem being dealt with here is the estimation of the value of the damage caused to the society, or part of it, by the activities carried out by groups of people or by the society as a whole. These activities can target even the welfare of the society as a whole but at the same time damage groups of people or the society.

In more general terms, an external cost or negative externality occurs when the social or economic activities of a group of people have a negative impact on another group of people not directly involved in any way in the activities of the first group.

In the transport sector, three different types of effect are normally considered as external costs:

- short-range (noise, air pollution, aesthetic impact) and long-range pollution (emissions of greenhouse gases);
- accidents;
- congestion.

In truth, congestion is an anomalous externality because it hurts the same people that generate it and is therefore called “club externality”. Moreover, congestion is difficult to internalize through fuel taxes, because it is highly variable in time and space and because the scenario without congestion, needed to calculate the damages, is difficult to define. In fact, the reference scenario characterized by no congestion, which is the free-flow operation of the road (extremely low vehicle flow), represents a situation of inefficiency which already generates a social damage due to the reduced use of the infrastructure; this would be a poor return on investment in terms of social benefits. However, the congestion effects are also framed between externalities because the damaging subjects and damaged ones belong to the same group, but do not suffer the damage produced by each one. In fact, the damage produced by the umpteenth motorist who enters in the already present vehicle flow (H) consists of the greater travel time corresponding to the flow ($H + 1$) with respect to the time corresponding to the flow H. Conversely, the same motorist and all of those present receive damage in terms of slowdown, compared with the situation of free flow (desired

E-mail address: umberto.petruccelli@unibas.it.

http://dx.doi.org/10.1016/j.eiar.2015.05.004
0195-9255/

speed), equal to the overall slowdown produced by all vehicles that make up the flow ($H + 1$).

The research on external costs has been addressed to quantify the effects (impacts) and to assess the value of the damage. To this end, the studies have followed two approaches:

- top-down, namely starting from the total assessments in money terms for all of the sector or set of activities, and then decomposing them into all of the particular externality sub-activity; this approach usually leads to the assessment of average costs;
- bottom-up, which is specific to each site, and starts from the evaluation of a particular case in specific conditions of space and time; the estimation of the externalities of a wider set of transport activity after is carried out by aggregating the individual case and passing at higher levels of aggregation; this approach also allows the assessment of marginal costs.

Although the combined use of both methods is recommended, the existing literature on the efficient internalization refers mainly to the bottom-up approach and specially follows the impact pathway approach (IPA) developed by the ExternE project (Bickel et al., 1997, Friedrich and Bickel, 2001). This process observes the physical path of a specific pollutant from its emission until its harmful effects on the external environment (end effects). This allows the evaluation of different types of pollution and their risks (European Parliament, 2009).

In this paper, the term (negative) "impact" indicates only the damage caused to persons or property and not the monetary value of such damage resulting from market prices or shared values.

The IPA procedure presents both quantitative and qualitative stages, as schematized in the following:

- identification and delimitation of the activity that produces externalities,
- identification of impact factors and their impact pathways,
- reconstruction of the quantitative impact pathways,
- economic evaluation of the damage by the use of prices.

The term impact pathways indicates effect chains that start from the primary activity (e.g., driving the vehicle) and directly result in a first effect (e.g., the pollutant emissions produced by the vehicle, or the car crash risk). Such a first effect causes a number of following effects, interconnected in a cause–effect relationship, these lead to the final effect of the resulting damage to specific receptors, and the final effect is subject to economic evaluation. We should distinguish between a qualitative phase of impact pathways characterized by the identification of the main paths and a quantitative phase. This quantitative phase represented by a mathematical model able to quantify the damage, starts from the primary activity that produced it and then estimates its monetary value. The graph in Fig. 1 illustrates the impact pathway approach (IPA).

After having quantified the damage, we need to set the unit price of each type of damage to be able to assess the resulting cost. The damage unit price setting differs depending on whether the damaged or destroyed goods can be purchased on the market (or easy replicated). In the first case, which concerns the destruction or damage of material goods or intangible assets, the monetary value of the damage is equal to the repair or replacement cost of the damaged goods or the cost of measures to restore the goods to their previous situation. In the second case, involving damages to life, human health, the ecosystem and natural or historical–architectural heritage, we need to refer to an average subjective value recognized by individuals to the specific harm. This value can be indirectly assessed by detecting the willingness of people to pay (WTP) a sum of money to reduce the damage risk or the willingness to accept (WTA) a financial compensation for an increase of the same risk. We can detect the WTP or WTA by interviewing a sample of the affected population and detecting their preferences granted to actual changes (revealed preference method — RP) or purposely built changes (stated preference method — SP) of the scenario.

Financial evaluation of external costs involves the assignment of a value to important intangible assets such as quality of life and environment, green and biodiversity, health, human life and time. The methods to assess the value of the environment relate mainly to at least one of these three parameters (Danielis, 2001):

a) consumption of resources or loss of product resulting from environmental damage;
b) willingness to pay to avoid environmental damage; and
c) costs of abatement actions for prevention of damage to the source.

The assessment of the value in accidents needs to consider all of the variables listed below, namely:

a) direct damage to market goods such as vehicles involved, cargo and parts of the infrastructure;
b) lost productivity of people and goods involved, as a result of the absence from work, all of the injured and the loss of use of vehicles in the time of repair or replacement;
c) expenditure on relief, health and justice;
d) slowdown upstream of the site of the accident to vehicles not directly involved; and
e) non-monetary expenses resulting from the loss of human life or health status.

The cost of congestion is related to the value of time lost in delays; the time value is treated as the wage opportunity cost or the willingness to pay to save time.

The interest for the monetary estimate of the damage caused by the externality arises from the acknowledgment of the need for a public intervention to rebalance the market, because this last one fails as a regulatory tool, particularly in the environmental field. In fact those who produce pollution reduces their production or consumption costs, thereby gaining an advantage against the damage caused to the remainder of the society. Therefore government interventions must limit the most polluting productions (charging them environmental taxes by which to cover the damage to society — internalization actions) and/or support environmentally sustainable productions (by subsidies), and/or impose bans and environmental minimum standards with which to comply.

The EU environmental policy has evolved through some long-term plans (Environmental Action Programmes — EAPs) drawn up since 1972, that outlined objectives and principles subsequently incorporated into the Community legislation.

With the 1987 Single European Act (SEA), the environmental protection was adopted explicitly among the fundamental objectives of the Union.

The 1992 Treaty of Maastricht then redefined the objectives of the Community economic policy in terms of promoting sustainable and non-inflationary environment-ally friendly economic growth.

The 1999 Treaty of Amsterdam has strengthened the legal basis for greater environmental protection and the promotion of sustainable development across the EU.

Finally, the 2009 Treaty of Lisbon strengthened and clarified the scope of the European environmental policy aimed at ensuring sustainable development, and it recognized the unitary role that the EU must have to participate in international actions to fight climate change.

Regulated by Title VI (Articles 90 to 100) of the Treaty on the Functioning of the EU, the transport policy is one of the most strategic EU common policies. In the transport sector, the European Commission has produced several documents concerning externalities. In December 1995, it published a Green Paper (*Towards fair and efficient pricing in transport*) aimed at developing policy options for internalizing the