An indicator for the economic loss in value of damaged cultural heritage properties

Abstract

Disaster risk management (DRM) initiatives recognize the importance of cultural heritage and emphasise the need to assess the impact of hazards on the built cultural heritage. These impacts are connected to one of the challenges for the DRM sector related to the need to integrate non-monetized losses (such as those related to cultural heritage) into loss estimation procedures to obtain a sound quantification of disaster impacts. Quantifying loss in value of a cultural heritage asset introduces a high level of subjectivity due to the difficulty in estimating losses across the multiple types of values it embodies as a result of a certain amount of physical damage to the asset. To address this issue, the paper presents an indicator to estimate economic losses that represent the loss in value of cultural heritage properties due to damage caused by hazardous events. The indicator estimates loss in value of cultural heritage properties as a function of the (physical) damage they suffered and of the estimated economic impact that cultural heritage has in a country. This indicator does not reflect the true value of economic losses but establishes a standardized measure of potential economic losses comparable across countries.

Keywords: cultural heritage, cultural heritage damage, cultural heritage loss, economic loss indicator.

1. Introduction

The most widely used measures of disaster impacts are (a) direct losses, meaning the hazard's immediate, physical damage to property, infrastructure, agriculture and human life and (b) insured losses. Direct as well as insured losses are largely reduced to monetary damage, fatalities and injuries. At present, the use of direct losses dominates all other loss measures due to the tangible nature of physical damage.

One of the challenges currently faced by the disaster risk management sector is to broaden loss assessments to include other types of losses. For example, the inclusion of indirect costs as well as non-monetized losses into loss estimation is of paramount importance for a sound understanding and quantification of the full impacts of disasters. This relates particularly to the damage of non-monetized resources such as cultural heritage assets and the relationship between them and society (e.g. the economic losses of some sectors such as tourism as a result of damaged cultural heritage). Although disasters adversely affect the cultural sector, those effects are usually not captured in loss estimates and subsequently in loss and damage databases. The lack of this information produces incomplete and skewed risk assessments that are biased toward direct economic and human losses and severely underestimates the effects of hazards.

In light of this, there is a significant potential to advance loss estimation techniques and probabilistic forecasts by including impacts on cultural heritage and by attempting to value (monetize) those impacts. As long as cultural heritage resources are not valued, shocks to these elements will not be reflected in risk assessments and disaster risk management. Based on this discussion, a methodology is outlined in the following for defining an indicator that provides an estimate of economic losses representing the loss in value of cultural heritage properties due to damage caused by hazardous events.

2. An indicator for the economic loss in value of damaged cultural heritage properties

The topic of economic valuation of cultural heritage has been the subject of several studies over the past years and several methodologies have been developed to elicit monetary expressions of cultural values. The most commonly found methodologies are Cost Based Methods (the Replacement Cost Method, the Restoration Cost Method, the Substitute Cost Method or the Preventive Expenditure Method), Revealed Preference Methods (the Hedonic Pricing Method, the Market Price Method or Travel Cost Method), Stated Preference Methods (the Contingent Valuation Method or Multi-Attribute Valuation Methods) and Impact Studies, e.g. see (Herath and Kennedy, 2004; Vecvagars, 2006; Choi et al., 2010; Carson, 2011; Holden and Baltà, 2013) among others. Since

most of these methods were developed for other areas, they exhibit strengths and weaknesses when applied to cultural heritage assets. Most of these approaches require significant amounts of data and many of them also require surveys to be carried out among the population. Furthermore, results obtained from these methods are sensitive to the valuation method that is used and are always specific to a certain cultural heritage asset with little chance of being extrapolated to other (even similar) properties. Therefore, there is currently no single and entirely reliable approach to estimate the economic value of cultural heritage properties. It should also be referred that most of these methods were not developed to estimate the loss in value of damaged cultural heritage properties. The quantification of the loss in value introduces an additional level of subjectivity due to the difficulty in estimating losses across the multiple types of values that are embodied in a cultural heritage property as a result of a certain amount of physical damage in the property.

The proposed methodology builds on the valuation method based on Impact Studies and establishes an indicator that estimates the loss in value of cultural heritage properties as a function of the (physical) damage they suffered and of the positive estimated economic impact that cultural heritage has in a given country. It is noted that this indicator is not meant to reflect the true value of economic losses. Instead, it reflects a standardized measure of potential economic losses that is comparable across countries.

2.1. The pre-disaster value of cultural heritage

To define the proposed loss in value indicator, a baseline pre-disaster value of each cultural heritage property in a given country must be first established. Given the referred difficulties in valuing cultural heritage, this baseline value BV is defined using qualitative descriptors. As such, to establish the BV of a certain cultural heritage property, the following four types of value are considered, based on (EH, 2008):

- **Evidential value**: Derives from the potential of a place to yield evidence about past human activity (physical remains, written records, archaeological deposits, etc.).

- **Historical value**: Derives from the ways in which past people, events and aspects of life can be connected through a place to the present (divided into (a) illustrative value: the extent to which it illustrates something unique or rare; (b) associative value: the extent to which it is associated with a notable family, person, event or movement).

- **Aesthetic value**: Derives from the ways in which people draw sensory and intellectual stimulation from a place (either as a result of conscious design or the seemingly fortuitous outcome of the way in which a place has evolved and has been used over time).

- **Communal value**: Derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory (these can include (a) commemorative and symbolic values: the meanings of a place for those who draw part of their identity from it, or have emotional links to it; (b) social value: places that people perceive as a source of identity, distinctiveness, social interaction and coherence; and (c) spiritual value: emanate from the beliefs and teachings of an organised religion, or reflect past or present-day perceptions of the spirit of place).

It is noted that the unique and rare character of a certain cultural heritage property can be associated with any of the referred types of value. Each type of value then needs to be graded according to the following qualitative ranks V which are based on the National Trust of Australia "Conservation Plan" (Kerr, 2004):

- **Exceptional value**: Features of exceptional/international significance or which contain elements with a significance beyond national boundaries (a score of 20 is assigned to this rank).

- **Considerable value**: Features of considerable/national significance, possibly reflected in statutory designations such listed buildings or equivalent nationally graded sites (a score of 15 is assigned to this rank).

- **Some value**: Features of some significance, important at regional level either individually or for group value (a score of 10 is assigned to this rank).

- **Limited value**: Features of limited/local significance (a score of 5 is assigned to this rank).

- **Unknown value**: Features of unknown significance resulting from a lack of sufficient information on which to base sound analysis of its value (a score of 1 is assigned to this rank).

- **No value**: Features of no significance (a score of 0 is assigned to this rank).

Therefore, for each cultural heritage property, a matrix similar to the one presented in Table 1 is then established to define the value of the property.

Table 1: Example of a matrix with the ranked values of a given cultural heritage property

	Exceptional value (20)	Considerable value (15)	Some value (10)	Limited value (5)	Unknown value (1)	No value (0)
Evidential value		x				
Historical value	x					
Aesthetic value			x			
Communal value		x				

The baseline pre-disaster value of a certain cultural heritage property will then correspond to the sum of the scores established for each type of value given by:

$$BV = \sum_{i=1}^{4} V_i \tag{1}$$

After this first step, the next step of the methodology involves defining the cultural heritage capital at the country level. This cultural heritage capital, termed CHC, is defined by:

$$CHC = \sum_{i=1}^{NCHP} BV_i \tag{2}$$

where NCHP corresponds to the number of cultural heritage properties a certain country considers relevant for its CHC. The value of CHC is thus the total pre-disaster qualitative value of the cultural heritage properties in a certain country and needs to be established in a pre-disaster stage.

2.2. *The post-disaster damage data*

The next step of the methodology involves post-disaster data defined in terms of qualitative damage levels collected for each cultural heritage property affected by the disaster and that are part of the CHC. Based on the damaged state of the cultural heritage property, a qualitative loss or damage level must be assigned to each type of value according to the following four classes of loss/damage D:

- **Undamaged or unaffected** (a score of 0 is assigned to this class).
- **Damaged or partially lost**, but it can be repaired/restored to its initial state (a score of 0.3 is assigned to this class).
- **Damaged or partially lost**, but it can't be repaired/restored to its initial state (a score of 0.7 is assigned to this class).
- **Destroyed or lost** (a score of 1 is assigned to this class).

For each damaged cultural heritage property, a matrix similar to the one presented in Table 2 is then established to define the damage scores for each type of value of the property.

Table 2: Example of a matrix of damage scores for each type of value of a given damaged cultural heritage property.

	Undamaged or unaffected (0)	Damaged or partially lost, but it can be repaired/restored to its initial state (0.3)	Damaged or partially lost, but it can't be repaired/restored to its initial state (0.7)	Destroyed or lost (1)
Evidential value		x		
Historical value	x			
Aesthetic value			x	
Communal value		x		

A qualitative post-disaster loss in value indicator LV for a certain damaged cultural heritage property can then be defined as the sum of the damage scores established for each type of value given by:

$$LV = \sum_{i=1}^{4} V_i \times D_i \qquad (3)$$

By analysing the value of LV for all the cultural heritage properties the country considers relevant for its CHC and that were damaged by the disaster, the total relative post-disaster loss in value of damaged cultural heritage properties in the country TRLV can be obtained. This parameter is the sum of the LVs obtained for each cultural heritage property divided by the country's CHC:

$$TRLV = \frac{\sum_{i=1}^{NDCHP} LV_i}{CHC} \qquad (4)$$

where NDCHP corresponds to the number of cultural heritage properties the country considers relevant for its CHC and that were damaged by the disaster (i.e. meaning that all the NDCHP properties must be part of the group of NCHP properties previously defined). Finally, the indicator representing a standardized equivalent economic loss for the damaged cultural heritage properties, ILV, can be defined by:

$$I_{LV} = \frac{TRLV \times GVA + RR}{GDP} \qquad (2)$$

where GVA is the country's gross value added associated to the cultural heritage sector resulting from all types of cultural heritage related activities, RR are post-disaster cultural heritage repair and recovery costs, and GDP is the country's gross domestic product. For a given year where a disaster occurs in a country, the considered GDP and GVA values will have to be those of the previous year or estimates of that year's GDP and GVA based on available trends.

The underlying reasoning for the quantification of ILV according to this methodology is the assumption that the CHC of a given country is able to create a certain amount of revenue in the pre-disaster condition which can be reflected by the country's GVA associated to the cultural heritage sector. The GVA is also assumed to be able to capture a wide spectrum of the economic influence of cultural heritage, namely the influence of both use and non-use values of cultural heritage. Furthermore, if a disaster occurs, the methodology assumes, in a simplified manner, there will be an average loss in the country's GVA that is proportional to the global loss in value of the cultural heritage properties damaged by the disaster. Nevertheless, the proposed methodology might not be able to account for the case where cultural heritage tourism is not overly affected by the damages suffered by cultural heritage (i.e. in the short term, if the safety of people is not an issue, people might still want to see the same cultural heritage properties even though they were damaged).

Finally, it is noted that in order to be able to apply the proposed methodology in a given country, a national inventory of the existing cultural heritage must be available, otherwise the value of CHC will be difficult to define. In such cases, an economic valuation of the losses associated to the cultural heritage sector would need to

be based on indirect indicators. A possible approach could be one based on the assumption that a certain percentage of a country's GVA is a result cultural heritage tourism and that part of that percentage is lost, based on the amount of cultural heritage that is damaged.

3. Final remarks

International frameworks and programs for DRR are clear in their objectives of reducing hazard exposure and vulnerability to disasters. Furthermore, the importance of cultural heritage and its irreplaceable value for society is also clearly acknowledged in these objectives. However, how can disaster loss reduction be measured in cultural heritage if there is no reliable loss data on the impacts that disasters have on this sector? Currently, it is clear that existing disaster loss accounting systems underestimate the true cost of disasters as a result of several factors. One of the factors is the inability to account for the disaster impacts on cultural heritage.

Disaster loss databases are important tools to analyse patterns and trends of disaster losses and disaster risk based on past events (De Groeve et al., 2014). By understanding these patterns and trends, future losses can be mitigated by the implementation of efficient targeted measures. Furthermore, disaster loss data can also be used to determine if disaster risk management is actually being efficient in reducing risks as a result of DRR policies and investments. In this context, one of the key challenges in cultural heritage disaster loss recording is the quantification of economic losses associated to the damage suffered by cultural heritage properties and to other correlated consequences. Although the economic valuation of cultural heritage has been the subject of several studies over the years, no specific approach is believed to be simple and general enough to be applicable in the context of disaster loss assessment. To address this issue the proposed paper outlined a methodology defining an indicator that provides an estimate of economic losses representing the loss in value of cultural heritage properties due to disaster damage. The proposed indicator is not meant to reflect the true value of economic losses. Instead, it reflects a standardized measure of potential economic losses that is comparable across countries.

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