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Safeguarding Cultural Heritage, Fostering Sustainable Development: The threats of Climate Change and Acid Rain

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Abstract

Sustainable development incorporates the sustainable pathway of each civilization. However, cultural heritage assets can be heavily impacted by pollution, such as acid rain and climate change. The present study evaluates cultural heritage assets via a meta-regression analysis function transfer, in which we examined 106 studies, mainly from different countries, in the period 1995 – 2022. This methodology enables the valuation of cultural heritage – tangible and intangible – goods and services, as well as cultural values (e.g. aesthetic, spiritual, symbolic, etc.).The utilization of willingness-to-pay (WTP) would enable us to compare the two models (i.e., European and non-European) on how much a citizen would value cultural heritage based on non-market valuation.The results would inform policymakers about the importance of cultural heritage assets inthe sustainable development agenda. The results present that the WTP for the two examined models for Europe and non-European is 37.6€, and 60.12€ respectively.Europeans are influenced mainly by intangible cultural assets, whereas non-Europeans are influenced by oral tradition. Overall, cultural heritage conservation necessitates for proper economic valuation through a holistic approach, in short – the valuation of intangible cultural heritage is imperative for sustainable development in an era of multi-crisis.

Keywords: *Willingnesstopay; Tangible cultural heritage;Intangible cultural heritage;Meta-regression analysis;Benefit transfer; Value transfer.*

JEL Codes: *Z1; Z18; C5; Q53 ;Q54*

1. Introduction

The current multi-crisis era has gravely affected *cultural heritage*, either for lowering tourism (e.g. inflation and COVID-19) or due to pollution (e.g. acid rain and climate change). Cultural heritage consists of all valued tangible and intangible aspects of culture and society, such as monuments, buildings, archaeological sites, as well as objects and cultural practices. It is important, since it can not only provide evidence of the past, but also shape the present – individual and communal– identity (Orr et al., 2021).Moreover, it can augmentthe sense of *place*(e.g. sense of belonging) and *aesthetic wellbeing*of local populations (Sesana et al., 2021) and can be consideredan irreplaceable and extremely valuable record of human activity (Harkin et al., 2020).

Cultural heritage can be a *driver* of the economy atthe local, regional, and national levels, contributing to tourism development and urban growth (Fatorić & Egberts, 2020; Tuan & Navrud, 2008). COVID-19 has negatively affected cultural heritage, either through the loss of revenues or the cultural deprivation of local communities due to closures of museums and archeological sites (Kasiola & Metaxas, 2023). Cultural heritage should be considered an important component of quality of life (Tweed & Sutherland, 2007).

Threats to cultural heritage, posed by climate change, might cause severe damage to historical inheritance, leading to the loss of important and irreplaceable –tangible and intangible–assets to communities(De Masi & Porrini, 2021; Hambrecht & Rockman, 2017; Stergiopoulou et al., 2021). Climate change-related events can have an impact on heritage sites through changes in environmental conditions that can change the conservation conditions for the sites' materials (Kaslegard, 2011; Sesana et al., 2020). It is advisable that climate-related threats to cultural heritage are generallyrecognised as a threat to society (Hambrecht & Rockman, 2017).

Cultural heritage can be severely impacted by water- or wind-related phenomena. It has been found that water is one of the main reasons behind material degradation, meaning that an increase in precipitation or humidity can enhance corrosion, degradation, or other decay mechanisms. At the same time, wind and atmospheric pollutants can lead to surface abrasion and damage, and warmer temperatures can intensify the weathering of materials (Sesana et al., 2021).

Four decades ago, *acid rain* was a profound challenge, with adverse effects on ecosystems and public health (Perino & Talavera, 2014).Halkos (1993, 1994, 1996, 2003) accentuated the matter of acid rain owing to its profound effects on the interlinkages between economic growth and environmental externalities. Nowadays, acid rain might have been a slightly forgotten issue, as there is an attentional shift to climate change, but it is still apparent. It is expected that acid pollutants and diesel soot willdiminish, but carbon emissions will further aggravate outdoor cultural heritage (Brimblecombe & Lefèvre, 2021). More specifically, outdoor cultural heritage assets can

be irreversiblyaffected by pollution, such as acid rain and particulate matter (PM), as sulfur oxides (SO_x), nitrogen oxides (NO_x), and carbon dioxide (CO_2) emissions when dissolved in water can react with calcareous materials and render some materials into gypsum (Sakka et al., 2020).

Environmental refuges can lose their cultural roots becauseofclimate change. Rising temperature risks could lead to facades' deterioration or biochemical deterioration, whereas risks related to sea levelrise could lead to coastal erosion and population migration (Sabbioni et al., 2008).The latter is a poignant effectof climate change that can lead to the loss of rituals and cultural memories, which are significant aspects of cultural heritage (Dastgerdi et al., 2019; Kim, 2011).

Cultural heritage is confronted with various barriers that hinder its conservation. Fatorić & Biesbroek (2020) found that in the case of the Netherlands, institutional and technical barriers pose significant challenges in adapting cultural heritage to climate change.Sesana et al. (2018) identified that barriers to the adaptation of cultural heritage to climate change can be classified into the following themes: (i) diversification, (ii) uncertainty, (iii) resignation, (iv) loss, (v) value preservation, and (vi) financial resources. Additionally, Sesana et al. (2019)found that some of the main barriers that constrain climate change mitigation when it comes to cultural heritage include lack of regulation, lack of knowledge, heritage values, inefficiencies in energy use, and incompatible solutions, among others. Phillips (2014) found that *heritage managers* require more case studies and guidance, as well as more predictions on the impacts of climate change at a local level, so that they are incorporated into their decision-making. The author also supports the need for collaboration between different sectors to combine the approaches and understanding existing between different fields.

Eventually, the management of cultural heritage can also have a positive effect on environmental change management; management planning developed for the protection of historic assets can lead to better protection of adjacent landscapes (Harkin et al., 2020). Heritage can be proven as a valuable source of information and knowledge, inspiring policies related to climate change, and heritage assets can also support climate change mitigation and decarbonization (Fatorić & Egberts, 2020).In essence, it is imperative that the repercussions of climate change on cultural heritage be mitigated through people's education and the promotion of effective policies and strategies(Cassar & Pender, 2005).

Owing to the frequency and intensity of extreme weather events in the world, the need to adapt cultural heritage to climate change effects has become more urgent (Bertolin, 2019).The 17 Sustainable Development Goals, introduced by the United Nations in 2015, refer briefly to cultural heritage in Target 11.4, as part of the bigger 11th Goal of making *"cities and human settlements inclusive, safe, resilient and sustainable"*(UN, 2015). This limited reference mentions cultural heritage along with natural heritage and focuses on protection and safeguarding, and not on

valorization or regeneration(Nocca, 2017).Henceforth, it might be advisable that the SDGs in the future distinguish cultural heritage from natural heritage and give prominence to their distinct values.

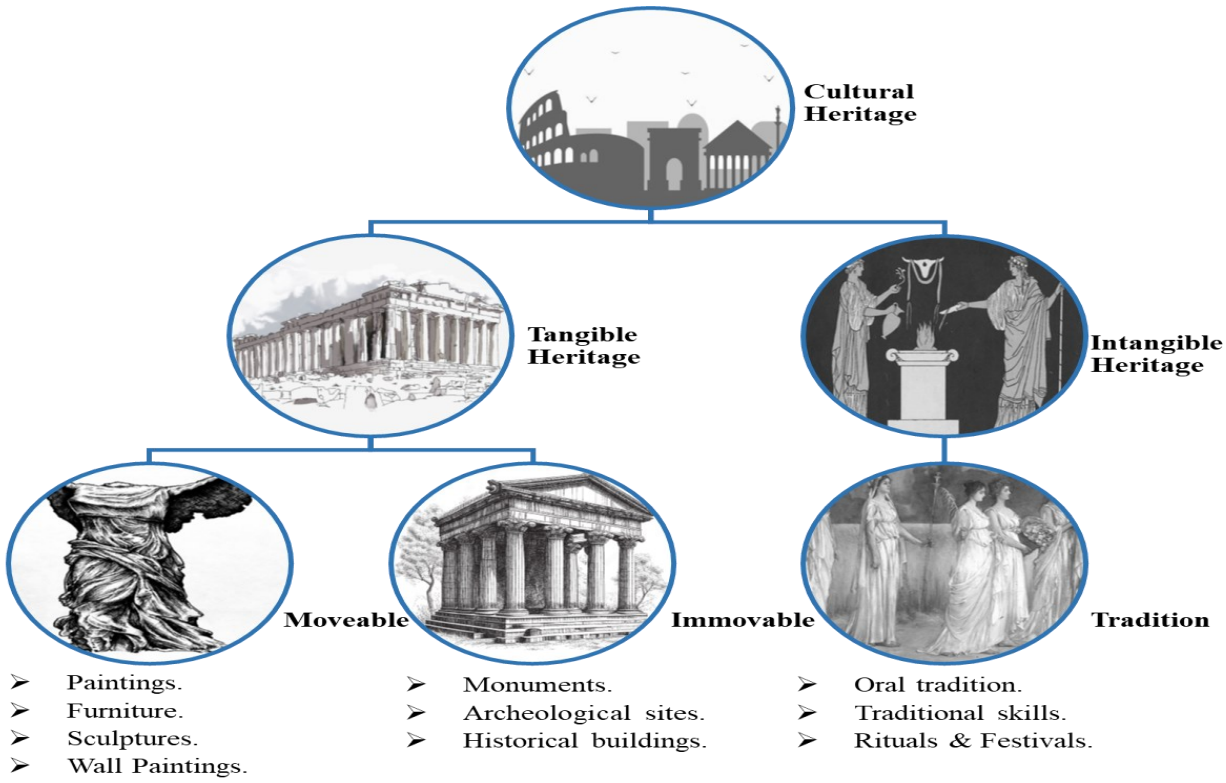
The present research aims to provide an economic valuation of cultural heritage goods and services by relying on meta-regression analysis function transfer. Through this methodology, it might be possible to compare three models that evaluate willingness to pay (WTP) in Europe, Asia, and both regions (i.e. global).The goal of this study is to answer the following research questions (RQ):the first research question (RQ1) is whether the European WTP is higher than the non-European WTP, and the second (RQ2) is to find the best policy implications for the protection of cultural heritage from pollution (e.g. climate change and acid rain).

2. Literature Review

The total capital of an economy comprises (i) natural capital, (ii) human capital, and (iii) man-made capital(Dasgupta, 2021; Halkos, 2023; Nijkamp, 2012), all of which are intertwined with the notion of human welfare. First, *natural capital*includes all stocks and flows of renewable and non-renewable resources derived from nature. Second, *human capital refers* to the stock of human knowledge, skills, abilities, and experiences, which are pivotal for the generation of constructive employment for society and the economy. Finally, the *man-made* capital stock covers the sum of the constructed environment (e.g. infrastructure, telecommunications, water, and energy).

Nevertheless, cultural heritage necessitates consideration ofsocial and cultural capital. Social*capital* refers to, among others, society's involvement, trust, and volunteerism in democratic societies, whereas*cultural capital* addresses issues such as the stock of an asset's cultural value, knowledge, history, language visions, myths, and people's view of the world and its function. Figure 1 illustrates UNESCO’s cultural heritage classifications.

Fig. 1 Cultural heritage goods and services classification.



Source: Authors' elaboration inspired by UNESCO (2003).

Obviously, cultural capital is more difficult to quantify, as many cultural goods are public or quasi-public goods, with changes in their provision being associated with possible externalities that have to be considered in any cost-benefit analysis (CBA). Any estimate of the value for public goods is significant. Moreover, in the case of cultural heritage, various assets are included, and sites often need maintenance, repair, or restoration. Apparently, such a case is different from any economic good, as it cannot be substituted if damaged or lost, as there are no markets, and they cannot be reproduced due to their uniqueness.

Cultural heritage comprises a variety of assets and sites that often require maintenance, repair, or refurbishment. Recently, there has been an increasing recognition of the necessityof identifying and assessing the value of cultural heritage assets to guide investments in maintenance and conservation programs (Bellandi et al., 2020; Riganti & Throsby, 2021).

In assessing the economic impact of cultural heritage on urban development, a notable methodological approach is the hedonic pricing model, which elucidates the influence of heritage attributes on real estate prices(Rudokas et al., 2019). This model has been instrumental in revealing that while the heritage status and the construction year of properties might not uniformly elevate real estate prices, factors such as location, heritage context, and architectural uniqueness significantly enhance property values(del Hoyo et al., 2019). For instance, properties situated in proximity to cultural events like the Fiesta of the Patios or within World Heritage sites often

command a price premium, underscoring the economic valorization of cultural heritage(Amar & Tyvimaa, 2022; Lazrak et al., 2014). These findings suggest that cultural heritage possesses intrinsic economic value that can manifest in higher property prices, thereby contributing to urban economic vitality and social cohesion.

In the cultural economics literature, the methodology of economic valuation ofcultural heritage goods aims to approximate cultural *capital*, hence an asset that gives rise to both economic and cultural value. There is a rich literature on the economics of cultural heritage, inter alia by Bedate et al. (2004), Poor & Smith (2004), Ulibarri & Ulibarri (2010), Báez-Montenegro et al. (2012), Báez & Herrero (2012), Tourkolias et al. (2015), Giannakopoulou et al. (2017), Kopsidas & Batzias (2019), Torres-Ortega et al. (2018), Suer & Sadik (2020), Merciu et al. (2021) to name a few publications with interesting results.

The total economic value (eq. 1) of cultural heritage goods can be decomposed into*use values* (*UV* – i.e. values associated with direct, indirect and future use) and *non-use values* (*NUV* – i.e. derived from existence, bequest, and altruistic). Therefore, the Total Economic Value (TEV) for cultural goods can be expressed as

$$TEV = UV + NUV \quad (1a)$$

$$TEV = (DUV + OV + QOV) + (EV + IV + BV + SV) \quad (1b)$$

Inadditionto the direct use value (*DUV*), option value (*OV*), and quasi-option value (*QOV*) of cultural heritage goods, we may also consider the non-use values as those derived from existence (EV), intrinsic (IV), bequest (BV),and synergistic (SV) values. It emerges that cultural capital concept is similar to that of natural capital, indeed as Riganti & Throsby (2021) declare «natural capital includes natural resources, both renewable and non-renewable, whilst cultural capital includes cultural resources, tangible or intangible too. Both forms of capital impose a duty of care on the present generation, and both have direct interrelationships with the real economy» (Riganti & Throsby, 2021, p.2). This means that methodologies applied to measure the economic benefits generated by natural capital can also be applied to measure the economic value of heritage goods and services.

On the other hand, cultural value, as Throsby (1999, 2000, 2012) reports, comprises *aesthetic, spiritual, social, historical, symbolic, authenticity, and scientific*. Some other values might be the For cultural heritage goods classification, this study refers to the Cultural Heritage Classification from UNESCO (2003). Figure 2 presents the economic and cultural values of cultural heritage.

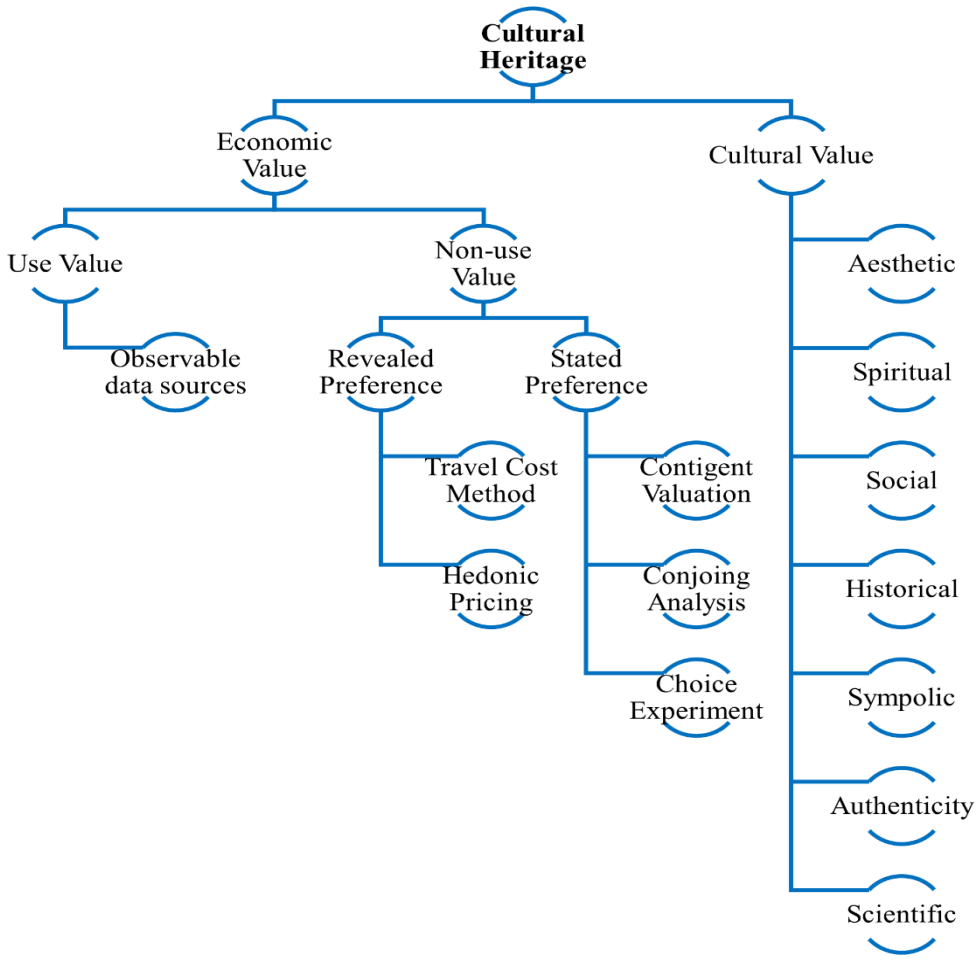
Accordingly, the use values generated by cultural capital can be assessed through observable data sources, whereas non-use values can be measured through revealed preference methods (e.g.

travel cost method, hedonic pricing method) or stated preference methods (e.g. contingent valuation, conjoint analysis, or discrete choice experiments)(Halkos, 2023).

The statistical analysis of previous research studies is called secondary analysis or *meta-analysis*, in essence Glass (1976) briefly described it as "the analysis of analyses" (p.3). The three main reasons for utilisingthe meta-analysis methodology are, as Smith & Pattanayak (2002) noted: *research synthesis*, *hypothesis testing*, and *benefit transfer*. However, the benefit transfer accuracy might be at stake due to three forms of error: (i) generalizationerror (i.e., the application of benefit transfer); (ii) measurement error (i.e., endogenous problems of primary researches); and (iii) selectionbias (i.e., choice of only statistically significant results and omission of other information) (Heckman, 1979; Rosenberger & Stanley, 2006).

Regarding the assessment of the cultural value of a heritage site, the usual approach refers to the Burra Charter developed by ICOMOS or (for items of universal importance) the criteria for nomination to the World Heritage List of UNESCO. The application of benefit transfer techniques is still limited, but as primary data studies grow, their use is expected to increase.

Fig. 2 Cultural Heritage: economic and cultural value and valuation methodologies.



Source: Authors' Elaboration.

3. Methodology

This study aims to prove an economic valuation of cultural heritage goods by relying on a meta-regression analysis function transfer. Primary literature related to cultural heritage valuation was selected. In total,106studies were identified andreported relevant information on actual cultural heritage WTP, which were therefore retained for the dataset creationbetween1995 – 2022 and providing estimation of cultural heritage goods at the global level. We expect to extend this information by relying on Dümcke & Gnedovsky (2013), which offers a review of several studies focused on the social and economic value of cultural heritage. The descriptive statistics of the socioeconomic and cultural variables are presented inTable 1, along with their descriptions and units of measurement.

Table 1 Descriptive Statistics of socio-economic variables, cultural goods and values.

Variables	Description	Units & Measurement	Mean (std. dev.)
Gender[a]	Indicates the percentage of male and female in the sample population.	Binary (0 and 1). [Female=1]	0.50 (0.04)
Income[b]	A continuous variable indicating the mean annual income of the sample population in euro.	Range (Euro, € | or expressed in Euro).	20,449.60 (17,868.46)
Age[c]	A continuous variable indicating the mean age of the sample population expressed in years.	Range (24– 53)	37.93 (5.95)
Education[d]	Indicates the percentage of the sample population that have a high education level.	Range (0.04 – 1.49) [university degree=1]	0.37 (0.29)
Economic Values	Dummy variables indicating the economic value of cultural capital.	Binary (0 and 1).	
Existence		[Existence=1, otherwise=0]	0.64 (0.48)
Bequest		[Bequest=1, otherwise=0]	0.36 (0.48)
Cultural Values	Dummy variables indicating the cultural value generated by cultural capital.	Binary (0 and 1)	
CV_aesthetic		[aesthetic=1, otherwise=0]	0.47 (0.50)
CV_spiritual		[spiritual=1, otherwise=0]	0.17 (0.38)
CV_social		[social =1, otherwise=0]	0.44

			(0.50)
CV_historical		[historical=1, otherwise=0]	0.44 (0.50)
CV_symbolic		[symbolic=1, otherwise=0]	0.48 (0.50)
CV_authenticity		[authenticity=1, otherwise=0]	0.48 (0.50)
Tangible Goods	Dummy variables indicating seven typologies of tangible cultural heritage goods.	Binary (0 and 1) [tangiblegood=1, otherwise=0]	
Tangible_paintings		[paintings=1, otherwise=0]	0.06 (0.23)
Tangible_sculptures		[sculptures=1, otherwise=0]	0.08 (0.28)
Tangible_furniture		[furniture=1, otherwise=0]	0.00 (0.00)
Tangible_wall		[wall=1, otherwise=0]	0.06 (0.23)
Tangible_historicalbuildings		[historical buildings=1, otherwise=0]	0.32 (0.47)
Tangible_monuments		[monuments=1, otherwise=0]	0.24 (0.43)
Tangible_archeogogicalsites		[archaeological sites=1, otherwise=0]	0.19 (0.39)
Intangible Goods	Dummy variables indicating three typologies of intangible cultural heritage goods.	Binary (0 and 1) [intangible goods = 1, otherwise=0]	
Intangible_oraltraditions		[oral traditions = 1, otherwise=0]	0.13 (0.34)
Intangible_social habits-festivals		[social habits-festivals = 1, otherwise=0]	0.34 (0.47)
Intangible_traditionalskills		[traditional skills = 1, otherwise=0]	0.26 (0.44)

a For studies in which gender data were not available for the population, we extracted that information from webpages providing official statistics, such as Statista (2023) and Statistics Times (2023).

b In the studies in which, monthly annual income was provided, the monthly amount has been multiplied per twelve months. For studies in which income data were not available, we extracted that information from webpages providing official statistics, such as Eurostat (2023), CEIC (2023), Trading Economics (2023), and USCB (2023). Eurostat database provides mean equivalized net income by year.

c For studies in which age data were not available, we extracted that information from Worldometer (2023).

d In case in which educational level data were not available, we extracted relevant information from webpages providing official statistics, such UNESCO (2023) as that adopt the International Standard Classification of Education (ISCED).

The dataset is composed of the following seven variables based on the recent Sustainable Development Solutions Network (SDSN) senior working group on the European Green Deal (Halkos et al., 2023) and EAERE 2023 byHalkos (2023): (i) *study name* which contains information about the authors, name, journal, and year of publication; and (ii) WTP, which is a continuous variable which expresses the annual mean WTP (in Euro, €) for cultural services, but in cases in which the value of the WTP was expressed in a currency other than euro, the exchange rate of the current year in which the study was developed was applied. In some studies, consumer surplus values are considered equal to the WTP. In the estimation, the WTP variable will be considered as the dependent variable; (iii) year of study development indicates the year of data collection; (iv) year of study publication; (v) location: a categorical variable reporting the geographical location in which the analysis has been developed; (vi) country: a categorical variable reporting the country in which the analysis has been developed; and (vii) valuation method: a categorical variable indicating the method used to develop the analysis. The analysed studies usedcontingent valuation or travel costmethods.

As the availability of primary data is limited or non-existent, we have summarised and synthesisedthe empirical findings of various studies in a meta-regression analysis function transfer with the meta-analysis model presented in Eq. 2:

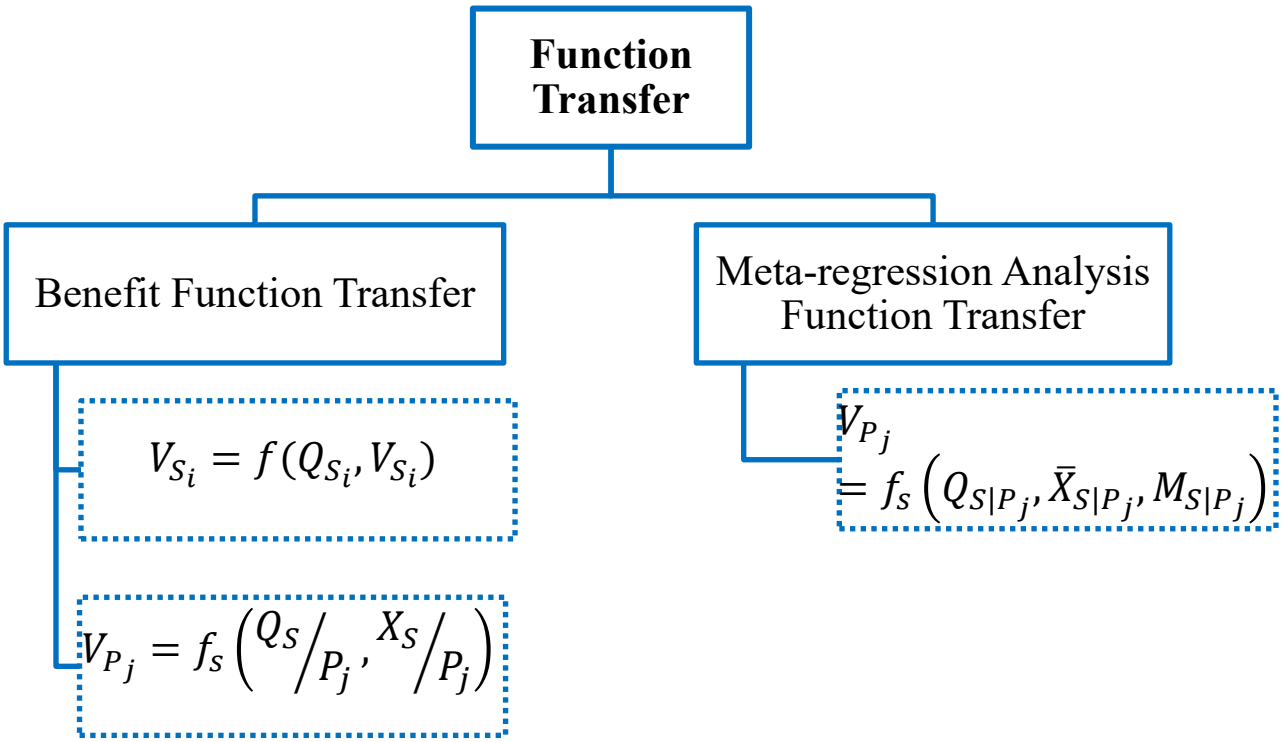
$$WTP_i = \alpha + \sum_{i=1}^{I} \beta_i Q_i + \sum_{i=1}^{I} \gamma_i X_i + \sum_{i=1}^{I} \delta_i M_i + \varepsilon_i \qquad (2)$$

where*i* corresponds to each observation gathered from studies considered, WTP is the dependent variable in our case (i.e., a continuous variable expressing annual mean WTPfor cultural services expressed in euros), $\alpha$is the intercept (if necessary);β,γ, *and* δ represent the parameters to be estimated as slopes of the specifications, quality-quantity variables (Q), socioeconomic variables and area characteristics (X), and methodological variables (M) are the matrices of the explanatory variables, and εerror term with the usual properties.

Benefit transferscan be classified as value and function transfers. In our case, attention is given to the latter. In Figure 3, function transfer consists of benefit function transfer and meta-regression analysis function transfer, where the benefit function transfer relies on the argument that the study area *i* considered is related to various characteristics of a study area context (V_{S_i} – e.g., location or climate) and a number of independent variables (X_S – e.g., socioeconomic and demographic variables). On the meta-regression analysis transfer function part, V_{P_j} is the value of policy area *j* as a function of the data considered from each study area *i.* The rest variables may be

quality-quantity variables (*Q*), socioeconomic variables and area characteristics (*X*), and methodological variables (*M*) (Halkos, 2023).

Fig. 3 Function transfer models.



Source: Halkos (2023).

4. Results

When dealing with robust value transfer, it is advisable that the examined studies depend on reliable data and properly specified qualitative methods. In addition, to have lower levels of heterogeneity, if possible, the study sites should have similar characteristics and populations. Moreover, assuming uniformity and the fulfilment of these assumptions may allow us to assess the relevant *shadow prices* for such goods. Non-use values often account for a large part of the TEV of cultural goods, with CVM being the method that is mainly applied. In essence,WTP is calculated as a function of explanatory variables.

Table 2 presents the correlation coefficients between socioeconomic variables, cultural goods, and values. All the correlation coefficients were less than 0.7, implying that potential multicollinearity among the explanatory variables was not expected. It is important to mention that education is slightly correlated with authenticity and symbolic values, as well as tangible historic buildings, but negatively correlated with intangible goods. Another interesting result from Table 2

is the positive correlation of intangible goods with intangible social skills and oral traditions but a negative correlation with tangible archaeological sites and historic buildings.

The WTP approximations, as presented in Table 3, reached 37.6€ and 60.12€ for European and non-European case studies, respectively. Our final model specifications rely on the statistical significance of the variables included. For the socioeconomic variables, education was statistically significant in Europe, whereas income was statistically significant in non-European cases. Moreover, referring to the cultural values aesthetic and spiritual in Europe, but in the rest of the world, relaxing the usual strict statistically significant levels to α=0.25, spiritual, symbolic, and sociocultural values can be deemed as important in the WTP estimation.

Next, cultural heritage goods and services are incorporated into the WTP calculation. In both models, intangible goods, social habits, and traditional skills are statistically significant. On the above cultural goods and services can be added the tangible archeological sites, historical buildings, and paintings referring to the European studies, whereas on the non-European countries important is the influence of intangible oral tradition. Briefly, European studies show that tangible cultural heritage (castles, ancient monuments, statues, mosaics, frescos, and paintings) might stimulate WTP, while the oral tradition (e.g. stories, legends, and myths) influences non-European countries more.

Thus, it is crucial toprovide appropriate diagnostic tests. Both European and non-European models have decent predictability, with 40.64% and 51.27%, respectively. Additionally, no ARCH effect can be spotted, and there is no heteroskedasticity based on the White test; however, there is heteroskedasticity based on the Glejser and Harvey tests.

Table 2 Correlation coefficients of socioeconomic and cultural variables.

	Gender	Income	Educ	Age	CV_ Aest	CV_ Auth	CV_ Spir	CV_ Symb	CV_ Soc	Int_ Goods	Int_ Soc	Int_ skill	Int_ oral	Tan_ arch	Tan_ hist	Tan_ paint
Gender	1															
Income	0.12	1														
Educ	0.08	0.25**	1													
Age	0.00	0.00	0.05	1												
CV_Aest	0.18	–0.16	0.04	–0.13	1											
CV_Auth	0.11	–0.10	0.20*	–0.07	0.23*	1										
CV_Spir	–0.10	–0.12	0.13	0.00	–0.12	0.17	1									
CV_Symb	–0.02	0.09	0.25**	0.03	0.09	0.45**	0.02	1								
CV_Soc	–0.04	0.12	0.00	0.02	0.09	0.18	–0.23*	0.23*	1							
Int_Goods	–0.05	0.00	–0.35**	–0.17	0.20*	–0.12	–0.23*	0.08	0.34**	1						
Int_Soc	0.00	–0.01	–0.12	0.02	0.01	–.28**	–0.16	–0.19*	0.14	0.66**	1					
Int_skill	–0.03	–0.13	–0.17	–0.05	0.29**	0.36**	0.02	0.34**	0.48**	0.55**	0.12	1				
Int_oral	0.07	0.04	–0.02	0.06	–0.03	–0.15	0.05	0.13	0.01	0.36**	0.25**	0.21*	1			
Tan_arch	.19*	0.11	0.11	0.06	–0.06	0.12	0.10	–0.03	–0.17	–0.36**	–0.19	–0.18	0.03	1		
Tan_hist	0.08	0.03	0.19*	0.31**	–0.08	–0.01	0.07	–0.01	–0.23*	–0.60**	–0.35**	–0.26**	–0.15	0.23*	1	
Tan_paint	0.00	–0.01	0.16	0.15	–0.15	0.17	0.00	0.09	0.11	–0.18	–0.09	–0.05	–0.09	–0.01	0.18	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 Results of the specifications with **WTP** for cultural heritageas dependent variable.

Variables	**European Countries (n=51)**	**Non-European countries (n=55)**
Gender	6.0392	
	[0.3536]	
Income	–1.0532	–0.2460
	[0.1177]	[0.0586]
Education	8.0032	–10.4789
	[0.0074]	[0.2434]
Age		1.4511
		[0.1288]
Cultural Value		
CV_Aesthetic	–63.5646	17.8077
	[0.0018]	[0.4664]
CV_Authenticity		32.9540
		[0.2798]
CV_Spiritual	–50.0845	–40.7892
	[0.0252]	[0.2342]
CV_Symbolic		32.3384
		[0.2036]
CV_Social		38.0880
		[0.2361]
Cultural Heritage Goods & Services		
Intangible Goods	114.3066	164.1822
	[0.0114]	[0.0238]
Intangible Social Habits	–50.5228	–177.9597
	[0.0582]	[0.0551]
Intangible Traditional	–57.2029	147.2847
Skills	[0.0512]	[0.0164]
Intangible Oral Tradition		–168.7514
		[0.0034]
Tangible Archaeological	–78.6118	
	[0.0017]	
Tangible Historical	73.5298	
Buildings	[0.0083]	
Tangible Paintings	–77.8216	
	[0.0077]	

Diagnostic Tests

R-square	0.4064	0.5127
ARCH effect test	0.0128	0.1259
	[0.9099]	[0.7226]
Heteroskedasticity	14.1405	21.54
Glejser	[0.2253]	[0.0430]
	14.8782	21.5420
HeteroskedasticityHarvey	[0.1881]	[0.0430]
Heteroskedasticity White	9.6655	14.878
	[0.5607]	[0.1881]
Total WTP (in EUR)	37.6	60.12

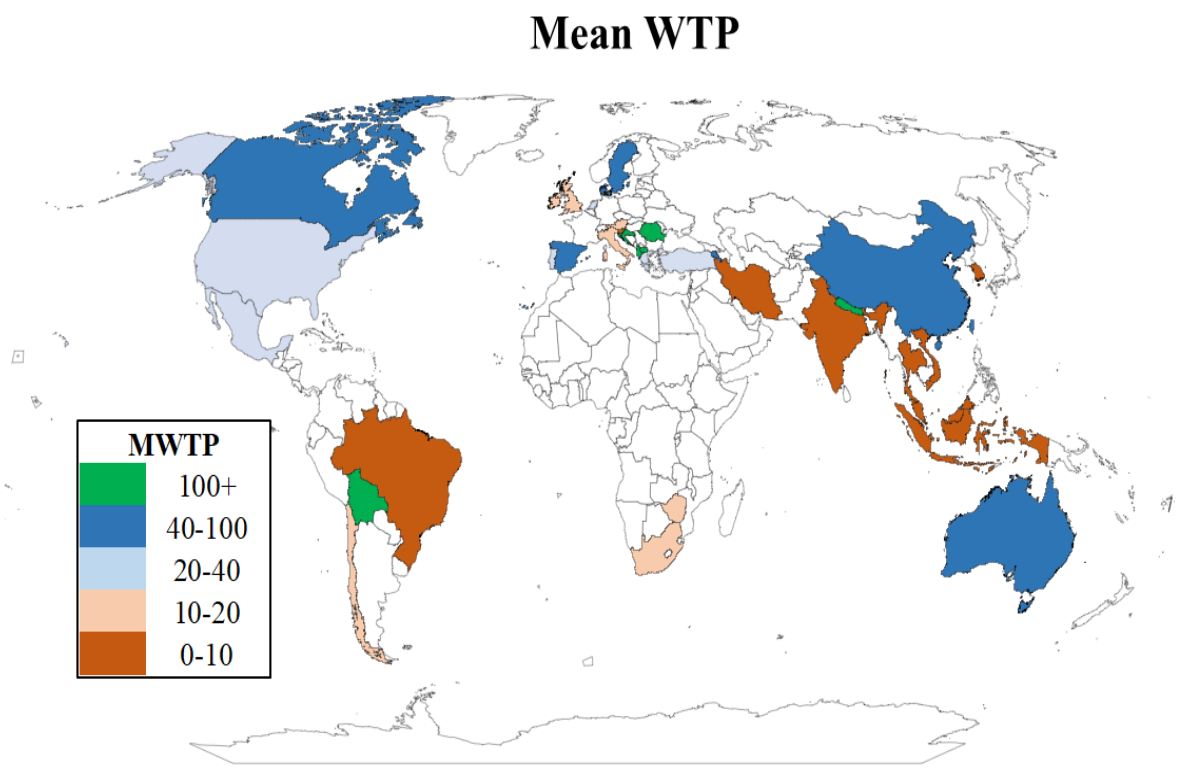
For the last specification, HAC standard errors and covariance (Bartlett kernel Newey-West fixes) were used. P-values in brackets.

In addition, the mean willingness to pay for the case studies is illustrated in Figure 4. It can be purported that while European total WTP has lower total WTP than the non-European as presented in Table 4, the MWTP shows a totally different pattern. It should be noted also that some countries have higher MWTP than others due to the averaging of the total WTP and due to the lack of data availability, to exemplify there is only one case in Bolivia, thus the total WTP is also the MWTP.

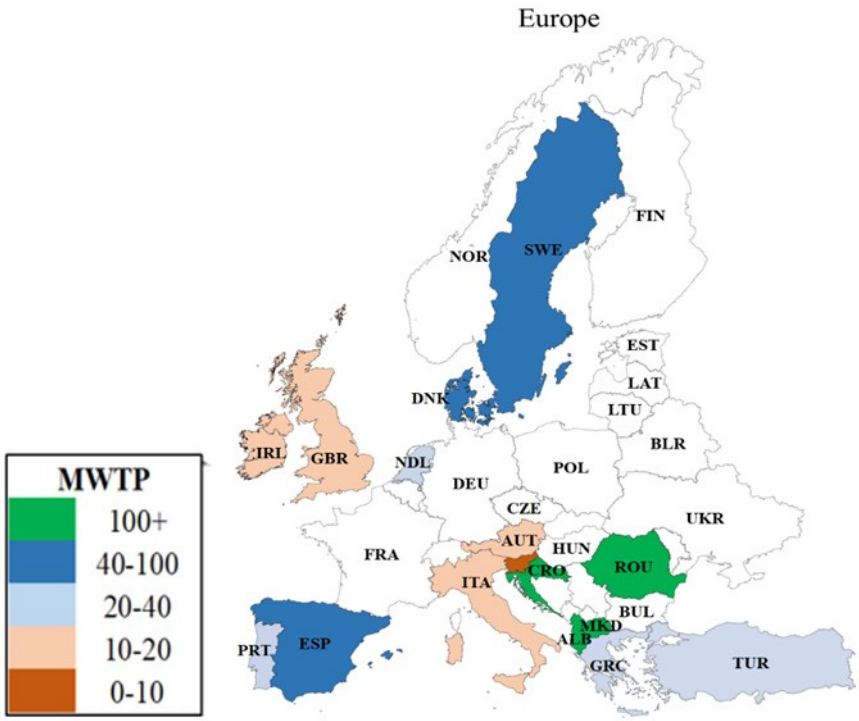
The MWTP, interestingly, unveils that Asia has the lowest MWTP values (i.e., brown colour), even though Asia hosts the oldest civilizations. The MTWP of the laggardsreach almost the 3€, as for example in India (0.68€), Indonesia (0.72€), and Iran (3.05€). On the contrary, the greatest Asian MTWP can be attributed to Taiwan (85€), China (88€), and Nepal (125€).

Europe has also rich cultural heritage. The highest MWTP values (i.e., green and deep blue colours) in Europe can be linked to North Macedonia (120€), Albania (127€), Croatia (134€), and Romania (343€). In the value range of €40-100 there is Spain, Denmark, and Sweden, furthermore, in the range of €20-40 there is Türkiye, Greece, Netherlands, and Portugal.The fourth value category (i.e., €10-20) is composed by Austria, Ireland, the UK, and Italy. Nevertheless, the lowest European MTWP belongs to Slovenia (1.62€). Overall, it is peculiar that countries with a relatively rich ancient history, i.e., Greece and Italy, do not express high cultural MWTP.

Fig. 4(a) Mean willingness to pay of the case studies and (b) the case of Europe.



(a)



(b)

Note: white colour indicates non availability of data.

The Americas, Africa, and Oceania are undoubtedly important for their cultural heritage, but there is not a large amount of research that can fit the scope of the present studyand this is the reason for their underrepresentation. The Americas show that the highest MWTP is in Bolivia (763€) followed by Canada (57€), the lowest MWTP can be found in the Brazil (2.87€). In Africa and Oceania there are only three four studies.Therefore, for Africathe total WTP is 10.46€ in South Africa and 15.64€ inZimbabwe (15.64€), whereas inOceania the MWTP is 40€, by which the total WTP of the two Australian studies are 6.47€ and 74.27€.

5. Discussion

Civilization is at risk due to several reasons, especially the outdoor cultural heritage sites are exposed to threatening phenomena such as climate change and acid rain. In parallel, other crises such as COVID-19, inflational pressures, and conflicts between countries might have averted people from scheduling travel and excursions to cultural heritage sites and monuments. Hence, it is pivotal that the economic and environmental assets of cultural heritage be specified, in order to safeguard civilization through the adoption of initiatives, projects, policies, and strategies.

In addition, some of the factors that can enable climate change mitigationinclude overcomingbarriers. The literature, inter aliaSesana et al.(2019), has focused on important barrierstolegislation and regulations, economic resources and incentives, sustainable refurbishment and transportation strategies, and changes in user behaviour.

It is also important to understand people's WTP in to protect World Heritage Sites and cultural heritage assets from the risks posed by climate change. For example, Laplante et al. (2005) examined the WTP of the Armenian diaspora in the US for the protection of Armenia's Lake Sevan, which constitutes a symbol of their cultural heritage. The findings suggest that each household of the Armenian Diaspora in the US would be willing to pay approximately $80 on average, as a one-time donation, in order to prevent Lake Sevan's further degradation, as well as approximately $280 in order to restore the lake's quality. Lo & Jim (2015) evaluated residents' WTP forr the preservation of stonewall trees that are of cultural significance in Hong Kong, with the results showing that 28% of respondents returned a zero WTP.

Furthermore, M.-H. Nguyen et al. (2021) have examined local residents' WTPfor the protection of a World Heritage Site in Vietnam from coastal erosion. A resident's WTP for a

coastal erosion management program is estimated at USD $1.7 per year, on average. Similarly, L. A. Nguyen et al. (2023) have focused on tourists' WTPfor the protection of the same site in Vietnam from coastal erosions. The authors found that each tourist is willing to pay USD $13.45 for an erosion protection program, an amount that is almost 7 times greater than what local residents are willing to pay for a similar program.

Overall, the economic valuation of cultural heritage has attracted the attention of both academics and policymakers. It is possible, via value transfer techniques, that cultural values and goods obtain a monetary value, even if they belong to non-market assets. This is extremely significant for policymakers to blueprint strategies for the safeguarding practically our civilization.

6. Conslusions and policy implications

The present analysis applied a meta-analysis methodology in order to approximate the WTP in two value transfer models; the European studies attained 37.6€, whereas the non-European studies presented 60.12€ WTP. Therefore, the answer to the first research question is that European WTP is lower than non-European WTP.

The two models present divergence among socioeconomic and cultural variables. It can be purported that the Europeans are more attracted by tangible cultural heritage (e.g., monuments or paintings); on the other hand, non-Europeans are influenced mainly by oral tradition. In tandem with these results, Europeans are more attached to beauty (i.e. aesthetic issues) and spirituality from the above tangible heritage assets, while non-Europeanshave symbolism and social values derived from the oral tradition. Another conclusion is that education determines WTP levels in Europe, but income guides WTP in non-European studies.

Some policy implications that could be proposed regarding the second research question are centred on environmental, economic, and cultural sustainability. In order to properly address the impact of climate change on cultural heritage, policy frameworks must incorporate heritage preservation into overall strategies for mitigating and adapting to climate change, promoting a comprehensive approach to sustainability.First, cooperation and information sharing on climate change and acid rain abatement are pivotal because these phenomena can severely and irreversibly impactcivilisation. We recommend the establishment of specialized funding mechanisms designed to support cultural heritage conservation projects, particularly those facing emerging threats from environmental changes.

Such mechanisms could range from targeted grants to tax incentives aimed at facilitating restoration and preventive measures.Second, promoting sustainable tourism practices through policy initiatives is crucial for protecting cultural heritage while fostering economic growth in local communities, thereby ensuring that tourism delivers positive conservation outcomes and harmonizes economic advantages with cultural preservation.Finally, oral tradition is as significant as tangible cultural heritage and should not be omitted from the policymaking process. Oraltraditions, as noted previously,are at risk due to environmental migration.The conservation of intangible cultural heritage requires equal attention in policy-making, recognizing the intrinsic value of traditions, languages, and practices is essential for sustaining the cultural identity and continuity of communities in the face of environmental changes.

To recapitulate, this study shows that the economic valuation of tangible and intangible cultural assets relies on diverse factors such as location, educational level, and income. Therefore, policymakers should incorporate such information into sustainable cultural management. The safeguarding of our civilization should be strengthened by the value transfer methodology, in the economic valuation literature strand, because it is now possible to offer monetary aspects to previously non-marketed assets. In a nutshell, the complexity of cultural asset approximation through economic valuation necessitates more holistic approaches, in short: the valuation of intangible cultural heritage is imperative for sustainable development in an era of multi-crisis.

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