



## Research article

## The contingent valuation study of Heiðmörk, Iceland – Willingness to pay for its preservation

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## ABSTRACT

The decision-making and policy formation context in Iceland has been largely devoid of total economic valuations in cost-benefit assessments. Using an internet survey and applying the double bounded dichotomous choice methodology, this contingent valuation study sets out an estimate of the total economic value pertaining to Heiðmörk, a popular recreational area of urban open space located on the fringes of Reykjavík, Garðabær and Kópavogur. In so doing, this case study advances the practice of using non-market valuation techniques in the country. The welfare estimates provide evidence that Icelanders consider Heiðmörk to possess considerable total economic value, with taxpayers willing to pay a mean lump-sum tax in the range 17,039 to 24,790 ISK per payment to secure its preservation, equating to an estimated total economic value of between 5.87 and 35.47 billion ISK. In the light of possible competitive land management demands among Heiðmörk's three owners and many recreational users in the future, the establishment of these values and their potential use in cost-benefit assessments informs the debate concerning whether the area should be preserved or further developed to satisfy economic objectives. Additionally, a body of experimental evidence is formed suggesting that the increased duration of a fixed payment vehicle is associated with much higher total economic valuations compared to a one-year payment period.

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## 1. Introduction

Economic valuations of environmental goods are a pre-requisite of socially optimal environmental policy (Mitchell and Carson, 1989; Hanley and Splash, 1993; Haab et al., 2013; Cook et al., 2016). The approval of development projects with significant environmental impacts implies that the economic costs of the affected environmental resources are less than the financial gains, but such decisions are frequently made without ever attempting to estimate monetarily the actual costs of the marginal losses. In Iceland, cost-benefit assessments have been undertaken without conducting total economic valuations to guide decision-making, meaning that the monetary value of socially desirable goods, such as recreational pursuits in preserved natural areas, has been

ignored (Cook et al., 2016, 2017). This is despite heated debate in recent years concerning the trade-off between environmental goods and industrial development, as well as consistent calls by the OECD advising Iceland to begin accounting for the environment in the economic assessment of development projects (OECD, 1993; OECD, 2001; OECD, 2014). In the absence of total valuation accounting, decision-makers are potentially approving projects that may undermine social welfare.

The contingent valuation method (CVM) is a state-of-the-art survey-based technique that is consistent with economic welfare theory (Boyle, 2003) and has been applied across a variety of contexts to elicit monetary valuations of environmental resources (Stenger and Willinger, 1998; Broberg and Brännlund, 2008; Loomis and Keske, 2009; Brander and Koetse, 2011; Damigos et al., 2017). The approach has been used extensively as a basis for policy decisions, including but not limited to projects related to recreational value and the protection of open access resources, the health impacts of exposure to toxins, transport safety, groundwater usage, hunting and fishing permits in national parks, and biodiversity protection (Carson, 2012; Hanley et al., 2013). Particularly for

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resources such as urban open spaces, where multiple ecosystem services are often delivered simultaneously across several system components, the CVM's capacity to appropriate use (Bateman and Willis, 2001), option (Weisbrod, 1964; Hanemann, 1989a) and non-use (Krutilla, 1967; Carson et al., 1995; Hanley et al., 2013) value ensures that it has considerable merit as a stand-alone estimate of marginal changes total economic value (Cook et al., 2017). Furthermore, the public goods characteristics of urban open spaces exacerbate the importance of estimating their total economic value, enabling decision-makers to be more fully informed about their preservation merits (McConnell and Walls, 2005; Brander and Koetse, 2011; Dickinson and Hobbs, 2017). This need is especially acute when urban sprawl diminishes the availability of accessible open space on the fringe of conurbations (Maxwell, 1994; Faushold and Lilieholm, 1999).

Over the years, the literature on the CVM has included criticisms of the potential for its monetary valuations to be influenced by bias, including but not limited to information and eliciting effects, hypothetical, starting-point and strategic biases (Duffield and Patterson, 1991; Diamond and Hausman, 1994; Hausman, 2012). In addition, the literature has often explored the sensitivity of WTP to the scope of the project (Loomis, 1990; Carson, 1997, 2000; Nielsen and Kjær, 2011). A variety of explanations have been put forward for observations of the lack of sensitivity of WTP to the scope of projects, including flaws in the survey design leading to amenity misspecification bias (Carson and Mitchell, 1993), diminishing marginal values from successive units of protected areas (Rollins and Lyke, 1998), and income effects (Veisten et al., 2004). However, many of the perceived weaknesses of the CVM can be overcome provided the survey design is carefully conceived, especially with respect to the sampling procedures, realism of the scenario and a clearly defined scope, inclusion of appropriate validity checks, and the incentive compatibility and consequentiality of the chosen payment vehicle (Carson et al., 2001; Kling et al., 2012; Haab et al., 2013; Johnston et al., 2017).

One scope-related issue that has been largely overlooked in the literature concerns the sensitivity of willingness to pay (WTP) to the duration of a payment vehicle. Assuming no forms of bias influence the results, the estimated total economic value of a well-defined environmental good should not differ in response to payment vehicles of varying duration. Instead it has been reported that the total economic value of public goods can be considerably larger when the commitment involves multiple rather than one-off payments (Rowe et al., 1986; Carson et al., 1992; Kahneman and Knetsch, 1992). Thus, rather than one total economic valuation for the same good being formed, a wide range may be established, even when unconventionally high discount factors are applied (Kahneman and Knetsch, 1992). Based on the outcomes from the Rowe et al. (1986) study, Kahneman and Knetsch (1992) contend that such outcomes are caused by a temporal embedding of payments, whereby participants are entirely unable to discriminate between payments that vary in temporal inclusiveness. The study by Rowe et al. (1986) was based on willingness to pay (WTP) for a toxic waste treatment facility in British Columbia through either a one-time or five-year set of payments. The mean WTP for the one and five year responses were only \$6 dollars apart, resulting in considerably higher total economic value associated with the longer payment duration, even when unconventionally high discount factors were applied. In contrast, Carson et al. (1992) found that WTP for scrubbing technology in an Ohio power plant was sensitive to some degree to a payment vehicle duration of either one or twenty years. However, the difference in total economic valuations was still consistent with discounting at very high rates of much more than 10% (Carson et al. (1992)). The bank of evidence concerning the temporal embedding of payments in contingent

valuation studies is currently very limited due to the small number of studies.

The three main aims of this paper concerning the case study of Heiðmörk – a popular but unprotected recreational area of urban open space on the edge of Reykjavík's capital area – are (1) to document in detail a methodologically robust application of the CVM in Iceland by eliciting a WTP estimate for Heiðmörk's preservation; (2) communicate results from an experiment concerning WTP responses to a payment vehicle of varying duration; and (3) enhance the growing literature concerning marginal changes to the total economic value of urban open spaces, in this case also an area with complicated management arrangements involving a number of stakeholders.

Section 2 of this paper begins by summarising the physical components of Heiðmörk, before providing a detailed review of this paper's methodology, including the survey design and mode of statistical analysis. Section 3 sets out the results from the study including the statistically significant predictor variables influencing WTP. Section 4 discusses the results and the possible explanations behind the range of welfare assessments formed by the three payment vehicle durations, implications of the outcomes with regards to cost-benefit assessments, and the likely wider relevance of the CVM in terms of future decision-making in Iceland.

## 2. Study site and survey methodology

### 2.1. Physical components of Heiðmörk

Heiðmörk is an urban open space of over 3000 hectares located to the south-east of Reykjavík, Iceland's capital city, and its neighbouring municipalities of Garðabær and Kópavogur. First given to the Reykjavík Forest Association in 1946, Heiðmörk was subsequently enlarged in 1957 to include land belonging to the Vífilstaðir sanatorium and adjoining land from the Garðabær municipality (Marteinsson, 1975). Today, the Reykjavík Forest Association retains a daily supervisory role concerning its management. Land ownership is divided between the municipalities of Reykjavík and Garðabær, with Reykjavík Energy, a public company, in sole charge of its reservoirs. A map of Heiðmörk, which was provided to participants of the online contingent valuation survey, is in Fig. 1 below.

Replete with forests, lava fields, two lakes (Elliðavatn and Vífilstaðavatn), open areas, cycle paths, footpaths, rest areas, and camping facilities, Heiðmörk is the largest area of urban open space in the vicinity of Reykjavík and currently provides recreational benefits to over 500,000 visitors a year (Bell et al., 2009; Davíðsdóttir, 2010), a sizeable number compared to the current national population of a little over 328,000 individuals. The area provides diverse ecosystem services including drinking water, electricity from a small hydropower plant, recreational benefits, carbon sequestration, educational and cultural benefits, and habitat services for various fish and bird species (Davíðsdóttir, 2010). Approximately 89% of its area is classified as vegetated land, and the remaining areas are mainly lakes (8%) and gravel surfaces (3%) (Egilsson and Guðjónsson, 2006). Heiðmörk is located on the Trölladyngja volcanic system and it is surrounded by numerous lava beds and caves (Guðmundsson, 2001). Fissures and faulting of the volcanic system run through the area from north-east to south-west and visibly put their mark on the landscape, providing an ideal environment for the groundwater streams originating in the nearby mountains. Located in the northern part of Heiðmörk are remnants of pseudocraters, geological features that, as far as is known, can only be found in Iceland and on the planet Mars (Thordarson and Hoskuldsson, 2002).

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