case: the culture and sport evidence programme

Understanding the value of engagement in culture and sport

Technical Report

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dcms department for culture, media and sport

ARTS COUNCIL ENGLAND

ENGLISH HERITAGE

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SPORT ENGLAND

The CASE programme The Culture and Sport Evidence (CASE) programme is a three-year joint programme of research led by the Department for Culture, Media and Sport (DCMS) in collaboration with the Arts Council England (ACE), English Heritage (EH), the Museums, Libraries and Archives Council (MLA) and Sport England (SE).

The work on this project was carried out by a consortium led by the EPPI centre with Matrix Knowledge Group

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http://www.culture.gov.uk/what_we_do/research_and_statistics/5698.aspx

1. Contents

2. Introduction

The Culture and Sport Evidence (CASE) programme was set up by the Department for Culture, Media and Sport (DCMS) in 2008, in collaboration with the sector-leading non-departmental public bodies (NDPBs) the Arts Council England (ACE), English Heritage (EH), Museums, Libraries and Archives Council (MLA) and Sport England (SE). The programme aims to generate strategic evidence for *maximising engagement* in culture and sport, and *maximising the value and impacts* people get from engaging in culture and sport. This strategic evidence will be used to inform the deployment of public funds to maximise engagement in sport and culture, and the value citizens in England receive from that engagement.

As part of the CASE programme, DCMS commissioned the EPPI-Centre (Institute of Education, University of London) and the Matrix Knowledge Group to undertake a research project to investigate 'The drivers and value of engagement with culture and sport'. The project used systematic review methods and modelling techniques to begin the process of summarizing existing research evidence on sporting and cultural engagement. This evidence will provide the basis for understanding why people engage in cultural and sporting activities, the value they derive from this engagement and the benefits for society as a whole. An overview of the approach, methods, and results of this project can be found in *'Understanding the drivers, impact and value of engagement in culture and sport: an over-arching summary of the research'* published alongside this report on the CASE website.

This report summarises one of four work streams undertaken as part of this project. The objective of this work stream is to answer the question: What is the economic value of engaging in sport and culture? The other three work streams are concerned with the following research questions:

- What do we mean by engagement?
- What are the drivers of engagement?
- What are the outcomes of engagement?

The answer to the question 'What is the economic value of engaging in culture and sport?' has important implications for policy makers as it will inform the level of investment that can be justified to promote engagement. This is particularly the case in an area such as culture and sport in which it is acknowledged that the market fails to ensure an efficient level of engagement (Baumol, 2003).

Governments throughout the world view culture and sport as a legitimate target for government expenditure but without having a clear understanding of the benefits that this expenditure has to society (Forrest and McHale, 2008). This not only makes it difficult to plan the efficient use of existing budgets, but also makes these budgets vulnerable at times of fiscal tightening.

Engagement in culture and sport can take many forms. Thus, before we can consider the value of engagement in culture and sport, a more precise definition of engagement is required. This project is concerned with engagement as attendance at culture events / sites and participating in sport. More precisely still, the following definitions are adopted:

- Heritage: attending a heritage site.
- Art: attending an arts event.
- Sport: participating in sport.
- Museums, libraries and archives: attending a museum, library or archive.

Engagement in culture and sport was defined as attendance at culture events / sites and participating in sport as these engagement types are the most common forms of engagement for the different culture and sport sectors. Throughout the remainder of this report, the above engagement types are generically referred to as “engagement in culture and sport”.

The early stages of this project involved a stakeholder engagement exercise to define engagement, and the outcomes of engagement. It is important to note that a number of forms of engagement in culture and sport identified during that exercise are not included in this report, such as: deciding, producing / participating in culture, studying, volunteering, and watching sport.

The report is structured into four sections. Section 3 provides a background and rationale for the study of the value of engagement in culture and sport. It is argued that the market cannot be relied upon to deliver the benefits of engagement in culture and sport, justifying government intervention to increase levels of engagement. However, government intervention is currently limited by a lack of understanding of the economic value of engagement. That is, in order to justify expenditure on government activities to increase engagement it is important to understand that the benefits of these activities exceed their costs.

For some types of engagement, such as attending the theatre, market prices are available that can be used to value engagement. However, market failures mean that these values do not reflect the true value of engagement to society. Furthermore, market prices are not available for all engagement types. Consequently, it is necessary to rely on non-market techniques for valuing engagement, such as contingent valuation techniques. A review of market and non-market studies of the value of engagement identified methodological challenges associated with these techniques and a paucity of data.

As conventional economic methods cannot be relied upon to provide values to inform policy in the short-term, alternative accounts of value are considered. An innovative method to measure the impact of policy outcomes on subjective well-being (SWB) is proposed as a possible source of monetary values for engagement in culture and sport.

Sections 4 and 5 present the results of analyses to estimate the value of engagement in culture and sport. The scope of the project meant that the estimating of the value of

engagement was restricted to analyses of secondary data. Section 4 summarises the results of an attempt to apply the SWB method to estimating the short-term private value of engagement. Section 5 summarises a decision model to estimate the long-term value of engagement. Limitations with the existing data meant that the scope of the decision modelling was limited to estimating the economic value generated by the long-term health gains associated with doing sport.

The final section summarises the report and concludes on the implications for research and policy making in the area of culture and sport. In particular this section considers the methodological lessons from the attempts undertaken to model the value of engagement in culture and sport.

3. Background: Our current understanding

This section summarises the current understanding of the value generated by policies to increase engagement in culture and sport. It addresses the following three questions:

1. What types of value does engaging in culture and sport generate? Section 3.1 summarises the result of a stakeholder engagement exercise to identify the potential benefits of engaging in culture and sport and identifies support for these effects in the literature.
2. What is the role for government in generating the value associated with engagement in culture and sport? Section 3.2 identifies some of the reasons why the market might fail to ensure the optimal provision of these benefits.
3. How should the value of engagement be measured? Section 3.3 considers whether economic valuation techniques, as recommended by H.M. Treasury, should be used to value engagement in culture and sport, or whether alternative valuation methods are preferable.

3.1 What types of value does engaging in sport and culture generate?

Economists look upon capital both as a store of value and as a long-lasting asset that produces a stream of services over time. Throsby (2006) defines an item of cultural capital as being an asset that embodies or yields cultural value[1]. Sporting and cultural assets and investments, such as museums or leisure facilities, represent a *stock* of sporting or cultural value. These assets then yield a *flow* of services each time they facilitate engagement in culture and sport.

A number of studies have indicated that economic benefits are generated by culture and sport through, for instance, their role in attracting tourists to the UK, and the regeneration effect of capital investments. For instance:

- The first five years of Arts Lottery capital spending created between 27,000 and 36,000 jobs in the UK (Arts Council England, 1997).
- The economic impact of the museums and galleries is in the range of £1.83 billion to £2.07 billion (NMDC, 2004).
- In 2004 consumer expenditure on sport in the UK was £23.6 billion (more than 3% of total expenditure) and the sports sector employed 569,000 people (Sheffield Hallam, 2010).
- Repairs to historic farm buildings and dry stone walls in the Yorkshire Dales National Park involved the injection of between £7.08 million and £9.12 million into the local economy, with every £1 spent on repair work resulting in a total output in the wider local area of £2.48 (Courtney et al, 2007).

[1] It is important to note that the term “cultural value” is used here in a different way to that of the originators of the term – Bourdieu and Passeron (2000). Bourdieu and Passeron see cultural capital as the stock of individual assets generated by engaging in culture which enable people to demonstrate their social status. The definition of cultural value employed by Throsby represents a broader notion of value – being any impact on utility generated by the services provided by cultural facilities.

- The annual turnover of Britain's major museums and galleries exceeds £900 million and the major museums and galleries spend over £650 million a year (NMDC, 2006).
- Visitors to the canals in Wales spend £34 million per year along the canal corridors, supporting the equivalent of more than 800 full-time jobs (Ecotec, 2007).

This paper is concerned with a different measure of the value generated by engagement in culture and sport. Specifically, the concern is for the value of a person participating in sport or attending/visiting a cultural asset. Given that it is the policy objective of the DCMS and associated NDPBs to increase levels of engagement (see introduction), it is important that the value of generating such improvement is understood. This will enable policy makers to ensure that resources are allocated efficiently to achieve such objectives.

It is difficult to identify the value of individual engagements in culture and sport from the economy-level analysis conducted by the studies identified above. That is, it is difficult to isolate the marginal value of an extra unit of engagement from estimates produced at such an aggregate level. Some of the value of engagement is likely to be reflected in the expenditure-type estimates reported above. When a person pays to participate in a sport or to access a cultural asset, the value that the person gains from participating/accessing is partially reflected in the amount he pays. There are, however, a number of reasons why this amount misrepresents the value of engagement. That is, the market prices fail to capture some types of value generated by engagement. Before this market failure can be understood (further discussion of market failure in the provision of culture and sport is provided in the next section), however, it is necessary to consider what types of value are generated by engagement in culture and sport.

Throsby (2001: 31) suggests that "progress towards operationalising the concept of cultural value" requires that value is deconstructed into its constituent parts. Adopting this approach, Table 1 summarises the benefits of engagement in culture and sport identified through a stakeholder engagement exercise undertaken as part of this project. Workshops and interviews were held with stakeholders to explore the benefits of engagement in culture and sport. Stakeholders included both national and local representatives of organisations responsible for policy, research and delivery in the fields of culture and sport.

Table 1: Benefits generated by engagement in culture and sport

Individual engager	Community	National
Achievement	Bequest value	Citizenship
Continuity with the past	Community cohesion	International reputation
Creativity	Community identity	National pride
Diversion	Creativity	
Enjoyment	Employment	
Escape	Existence value	
Expression	Innovation	
Health	Option to use	
Income	Productivity	
Inspiration	Reduced crime	
Knowledge of culture	Shared experience	
Self-esteem	Social capital	
Self-identity		
Skills/competency		
Solace/consolation		

Many of the benefits identified in Table 1 are also discussed extensively in the literature (see, for instance, Ruiz, 2004). A number of studies have emphasised the learning benefits of culture (for further discussion of the learning benefits of culture see the review undertaken by EPPI as part of this project '*Understanding the impact of engagement in culture and sport: a systematic review of the research on learning impacts for young people*') for example:

- The impact of arts education on education outcomes (Brice-Heath, 1998; Burton et al., 2000; Catterall et al, 1998, 1999).
- The impact of museums as a learning resource for those in education, as well as for society more broadly (Scott, 2003).

The literature also suggests that culture promotes community cohesion, for example:

- People believe that museums develop communities by building identity through reflecting shared collective values and common heritage, and contributing to social cohesion (Scott, 2003)
- Community archives can promote understanding, tolerance and respect between generations and between diverse communities; promote active citizenship; and create pride and interest in communities that have been marginalised (Siddons, 2007).
- Exhibitions of refugee oral history interviews generate a greater understanding of refugee communities and their positive contribution (Lowry and Mullen, 2007).

There is also some evidence that culture and sport generate positive health benefits, for example:

- Introducing arts and humanities into healthcare can reduce stress, depression, anxiety, the need for medication, blood pressure and pain (Arts Council England, 2004; Staricoff, 2004).

- The arts can generate positive mental health outcomes in the general population through enabling self-expression and communication (Arts Council England, 2004).
- Sport and recreation generate psychic benefits due to the sense of well-being derived from being physically fit and healthy, the mental stimulation and satisfaction obtained from active recreation, and the greater status achieved in peer groups (Gratton and Taylor, 2000; Gratton, 2004).
- Sports and recreation generate physical benefits due to reduced risk of Chronic Heart Disease (CHD), diabetes and colon cancer; reduced blood pressure; reduced risk of falls and accidents; and reduced back pain (Gratton and Taylor, 2000; Gratton, 2004).

Given that the stakeholder engagement and the existing literature suggests that these benefits are derived from culture and sport, assuming these benefits are realised, it is important to understand both whether there is a role for the government in ensuring these benefits are realised, and how these benefits should be valued. These are the topics of the following sections.

3.2 What is the role for government in generating the value associated with engagement in culture and sport?

The previous section identified the value generated by participating in sport and/or attending a cultural event or site. However, it is not enough to show that sport and culture generate these values to justify government intervention to promote engagement. Neoclassical economic theory tells us that a perfectly functioning free market will provide the most efficient allocation of resources. Therefore, when markets are functioning well, there is no role for the government to intervene. Government should intervene only when markets are not operating perfectly, i.e. to correct market failures. In such an instance, markets will wrongly value the benefit of engagement in culture and sport, resulting in either too few or too many people engaging.

The existing literature contains much discussion about the failure of the market to ensure an efficient level of engagement in culture and sport (see, for instance, Baumol, 2003). That is, economists have identified a number of reasons why the market will fail to ensure the appropriate level of engagement in culture and sport, including: external benefits, the public-good properties of culture and sport, information problems, and the merit-good argument. These arguments are then used to justify public funding of culture and sport. The remainder of this section elaborates on these arguments with a view to considering whether government intervention to increase engagement in culture and sport is justified.

An ***externality*** exists when a third party not involved in a decision to consume is nevertheless affected by it. An example of an externality often employed in economics textbooks is the pollution generated by the production of industrial goods. As the producer does not incur the cost of this pollution, the effect of the pollution on other

people is not considered when deciding how much of the good to produce, and too much of the good is consequently produced.

The consumption of culture and/or sport is subject to a number of externalities. For instance, as there is no market in, for instance, heritage-options, the value of having the option to visit a heritage site in the future would not be considered by a market tasked with providing heritage sites. More generally, as the preferences of future generations are not reflected in market prices, these values to future generations of engaging with a cultural asset will not be considered by market-based decisions to supply such assets, resulting in their under-supply.

The benefits derived from the consumption of culture and/or sport are also characterised by the presence of externalities (see Le Grande et al., 2008). For instance, doing sport is associated with improved health outcomes, which in turn bring about a number of externalities. For instance, healthy individuals will be more productive in the workplace, take fewer days off sick and require less support from the NHS. These benefits fall to family members, co-workers, firms, taxpayers and generally the whole of society. That is, they do not accrue to the healthy individuals themselves, causing those individuals to under-invest in their health from a societal point of view.

Educational outcomes are also associated with externalities. The previous section identified a number of educational outcomes associated with engagement in culture, including: a better knowledge of one's own and others' culture. Such outcomes provide a socialisation function, producing a common standard of citizenship and social cohesion. However, these benefits are experienced by society as a whole, rather than the individual deciding whether to engage in culture. Thus, from a societal point of view, too few people will decide to engage in culture.

Another source of market failure is ***information problems***. The existence of information problems means that even non-external effects might be ignored when making consumption decisions. An example of such an information problem is the benefits associated with education. When deciding how much education to accrue, individuals struggle to comprehend the full benefit they get from education. This is particularly the case given the age at which most make decisions around whether to invest in education. Although parents have more information on the benefits of education, the incentives of parent and child are not always perfectly aligned.

The decision to engage in culture and/or sport is also subject to information problems. For instance, if people do not fully appreciate the long-term health effects of engaging in sport, they will tend to engage less than they would have were they better informed. Gratton and Taylor (2000: 10) illustrate this source of market failure when they state that: "The rather complicated nature of the commodity that is sport makes rational decision-making difficult, since the consumer is unlikely to have sufficient knowledge about present and future benefits that will follow from taking part in sport." In this instance, there is a case for government intervention to educate people about the benefits and costs of engaging in culture and sport.

A third cause of market failure is the existence of ***public goods***. The nature of public goods means that it is not profitable for the market to provide them. Public goods are characterised by non-excludability and non-rivalry. That is, it is not possible to limit people from consuming the good and the consumption of a good by one person does not preclude the consumption of the good by others. Examples of public goods include environmental resources such as the seas and the atmosphere, and a number of goods provided by governments, including street lighting and defence.

A number of authors have noted the public nature of cultural goods. Johnson (2003: 316) states that there are "some public good aspects to much museum output. Research findings, for example, exhibit non-excludability and non-rivalry in consumption. The visitor experience displays non-rivalry (at least up to capacity limits), but is typically excludable". Cuccia (2003) notes that the public good nature of cultural heritage can lead to its overexploitation and irreversible damage.

The existence of ***merit goods*** is another reason proposed for government intervention to correct market failure. Merit goods are those that are judged valuable beyond people's ability or willingness to pay for them. Health is commonly cited as a merit good. For instance, the establishment of the UK NHS was partly justified by the intrinsic value of health.

The merit good nature of culture and sport is often cited as justification for government intervention to fund and supply culture and sport (Baumol, 2003). That is, if the market does not supply culture and sport, their superiority and inherent worthiness justify government funding and provision. Mirroring this economic argument, the literature on the value of sport and culture contains much debate on the role of intrinsic and instrumental values. The conference "Capturing the public value of heritage" (held in London in January 2006) was dominated by papers whose conceptual underpinning was based on this dichotomy. In her introductory presentation, Kate Clark identified "differences between the so-called 'intrinsic' values that we ascribe to a place or object, and the instrumental benefits that arise from funding or conserving it".

Other papers at the same conference made a similar distinction. The management consultants Accenture defined the intrinsic value of heritage as being "made up of 'soft' benefits inherent in people's experience of heritage, such as aesthetic quality and cultural significance" (2006: 19), and contrasted this with the more tangible use values. The think tank Demos defined intrinsic values "in terms of the individual's experience of heritage intellectually, emotionally and spiritually" (2006: 15), in contrast to instrumental values associated with heritage, which are "those ancillary effects of heritage where it is used to achieve a social or economic purpose" (2006: 15).

The idea that government funding and provision of culture can be justified as a result of it being a merit good with inherent or intrinsic value has, however, come in for some criticism. For instance, the idea that culture has intrinsic value, beyond any value derived from people's experience of it, drew the criticism of Christina Cameron's paper at the same conference. She argued:

> *The use of the word 'intrinsic' is perhaps not the best one, since historic properties do not inherently have values. Historic properties take on value because people ascribe values to them. What makes a site part of our heritage is not the site itself but the fact that groups and individuals have attributed values to it. One can argue that all values are extrinsic, including physical ones. Values are complicated, multifaceted and diverse. [...] as Hamlet remarked: 'There is nothing either good or bad but thinking makes it so.' (pg. 71-72)*

It is Accenture's and Demos's definitions of intrinsic value that Bakhshi et al (2009: 4) have in mind when they identify the "obstructive line-up which pits economists, cast as architects of instrumentalism and all things philistine, against arts leaders, cast as beleaguered defendants of intrinsic value and all things aesthetic". Bakhshi et al. reject this line of argument, and argue that those values that are considered intrinsic are qualitatively no different from those considered instrumental.

Baumol (2003: 22) is also sceptical of the merit good argument, arguing:

> *It seems generally to be felt among economists, even among those most personally supportive of the arts that, while these arguments have some validity, they do not by themselves constitute an overwhelming case for extensive support of the arts. The basis objection is that, while cultural activity does undoubtedly offer such benefits, so do other human activities, and that it is not clear that [...] they deserve to be singled out for special support.*

Despite scepticism about the merit good nature of culture and sport, the preceding discussion identified a number of reasons why the market might fail to ensure the appropriate level of engagement in culture and sport.

Key amongst these reasons is that people will underestimate the benefits of engagement either to themselves or to society as a whole. As a consequence, these benefits will not be reflected in market prices, reducing the incentives to the market to provide opportunities for engagement. Government intervention to respond to these market failures and to ensure that the benefits of engagement are produced will also suffer from a lack of information about the size of these benefits. Specifically, in order to determine how much to spend on interventions to promote engagement, governments needs to know the value of engagement. The next section considers how these benefits can be measured.

3.3 How should the value of engagement be measured?

As discussed in the previous section, the justification of government intervention to promote engagement in culture and/or sport is contingent on two conditions. First, the market fails to ensure an optimal level of engagement. Second, the benefit generated by government action exceeds its cost. The previous section outlined various reasons

why the market might fail to ensure an efficient level of engagement in culture and sport. This section considers how the value of engagement can be measured in order to assess the efficiency of government intervention.

The first half of this section considers the possibility of employing economic valuation techniques to measure the value of engagement in culture and sport. It focuses on the practical and methodological challenges associated with applying these approaches. It identifies a limited number of existing economic value studies in the culture and sport policy area, as well as a range of methodological challenges associated with these approaches. We argue that these limitations mean that an alternative method is required for the short-term valuation of engagement in culture and sport.

The second half of the section then considers the conceptual challenges associated with valuing engagement in culture and sport – is the value implicit in estimates generated by economic techniques such as 'willingness to pay' (WTP), capable of capturing the value of culture and sport? We argue that this narrow notion of value is insufficient to cover all the benefits of engagement. Measures of subjective well-being are identified as a possible alternative approach, one that not only captures a potentially wider range of benefits, but for which data currently exists to provide an approach to valuing engagement in the short term.

3.3.1 Does willingness-to-pay provide a means to value engagement in culture and sport?

H.M. Treasury's guidance on conducting economic evaluation (HMT, 2003) suggests that two sources of value should be considered. First, market values should be employed. Second, where market values are not available, revealed preference or stated preference techniques should be employed to value non-market goods (see footnote 2 for more on this). This section considers whether these latter techniques provide the possibility of an approach for valuing engagement in culture and sport in the short term.

Despite H.M. Treasury backing, as well as having at least a cautious seal of approval from a range of eminent economists (see, for instance Arrow et al, 1993), there are a number of methodological concerns about the usefulness and validity of value estimates derived from WTP techniques.

First, the methodological variation between the studies limits their comparability. Having reviewed studies on the social and economic impact of culture, the arts and sport, Ruiz (2004) noted that there is no common or systematic approach to evaluation of initiatives or programmes, rendering it impossible to compare and contrast findings.

Second, there are questions about the transferability of value estimates between assets, as cultural and heritage sites are thought to be unique. Studies have attempted to estimate the accuracy of value transfer – the valuation of a culture and heritage site using values derived for another site. Brouwer and Spaininks (1999) found that transfer

errors ranged from 1% to 475%, and Brown (2004) found that errors ranged from 3.65% to 110.8%.

Third, there are general concerns over the validity of the value estimates produced using WTP techniques. The validity of the estimates produced by revealed preference techniques depend on the ability to isolate the impact of the good in question on prices, and is based on the assumption that markets work well. The difficulty in fulfilling these requirements is thought to explain the large variation in estimates produced by revealed preference studies (Dolan et al., 2008).

Stated preference techniques also face a number of challenges. The main challenge is the assumption that individuals have a coherent set of preferences. A number of phenomena have been identified as evidence that such coherent preferences might not be observed in practice, including: substitution effects; endowment effects; hypothetical bias; the influence of irrelevant cues, where respondents are influenced by the elicitation procedure, such as start-point bias; anchoring effects; focusing effects; embedding effects; and range bias (Dolan and Metcalfe, 2008).

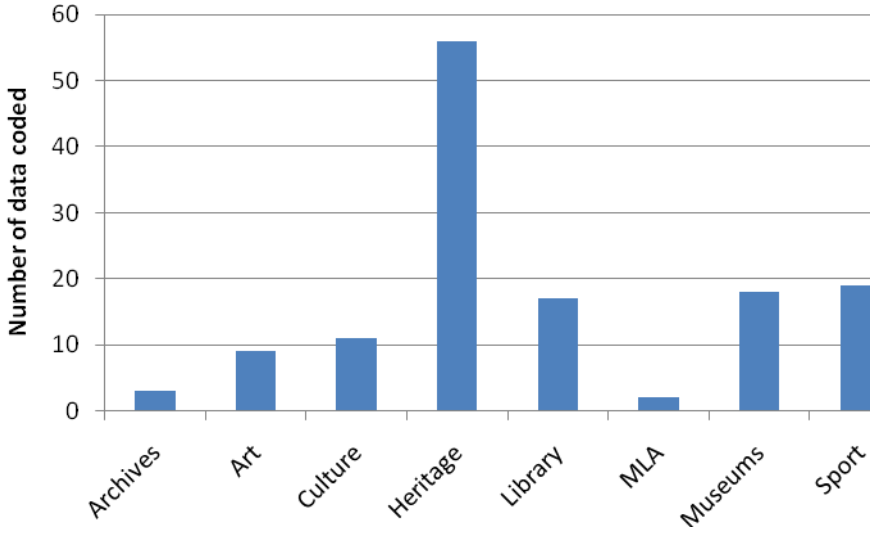
As well as the above methodological concerns, generating WTP estimates through revealed preference and stated preference studies is time-consuming and expensive[2], something that is beyond the scope of this study. In these circumstances, one approach would be to draw on valuation estimates from the extant literature. However, mapping the literature revealed that such studies do not exist in sufficient number to make such an approach feasible.

The mapping exercise was undertaken to identify measures of the economic value of culture and sport in the existing literature. The method employed to identify and map the literature is summarised in Appendix 2 to this report. The review identified 94 studies containing 135 pieces of data. Of these, 52 (39%) were from the UK. The distribution of data across types of sport and culture are summarised in Figure 1. It demonstrates that:

1. Heritage is by far the most researched field, with about 55 estimates of value being identified.
2. Between 15 and 20 estimates of value were identified for each of libraries, museums and sports.
3. About 10 estimates of value were identified for art and culture (where the latter includes goods such as TV channels, or the film industry).
4. Very few estimates were identified for archives.

[2] Revealed preference studies are data demanding, requiring econometric analysis of the factors that influence the price of market goods. Stated preferences are equally, if not more, resource intensive, requiring survey work to elicit people's willingness to pay for non-market goods.

Figure 1: Economic value data identified for sport and culture



'Culture' includes film and TV

The analysis disaggregated the data identified in Figure 1 into different types of value estimates. Appendix 3 provides a detailed analysis of the data identified and summarises the definitions of the value types identified in the analysis.

Figure 2 summarises the data identified in the review. It shows the number of WTP estimates identified for each engagement type, distinguishing data derived from market prices and data derived from non-market economic valuation techniques. Figure 2 demonstrates that the economic valuation literature only partially covers the engagement types relevant to this project. The engagement types of concern are: doing sport (community); visiting a heritage site, museum, library, or archives, and attending an art event. Of these engagement types, the value associated with the use of heritage is relatively well-evidenced, with more than five studies on each of the market and the non-market value of using heritage sites. There are some studies on the use of museums, libraries, and art. There are very few economic studies of the value of doing sport and using archives.

Another limitation with the existing literature is that only a small proportion of studies are UK-based. For instance, of the heritage studies identified, there were only six stated preference studies of people's willingness to pay to engage in or preserve heritage sites. The willingness to pay estimates identified in these studies include:

- £14 per person to renovate historic buildings in Newcastle upon Tyne (Garrod et al, 1996).
- £27 to £50 per person to clean Lincoln Cathedral (Pollicino and Maddison, 1999).
- £3 per person to visit Warkworth Castle, Northumberland (Powe and Willis, 1996).
- £3 per person per month to use Bolton museum (BMRC and MLA, 2005).

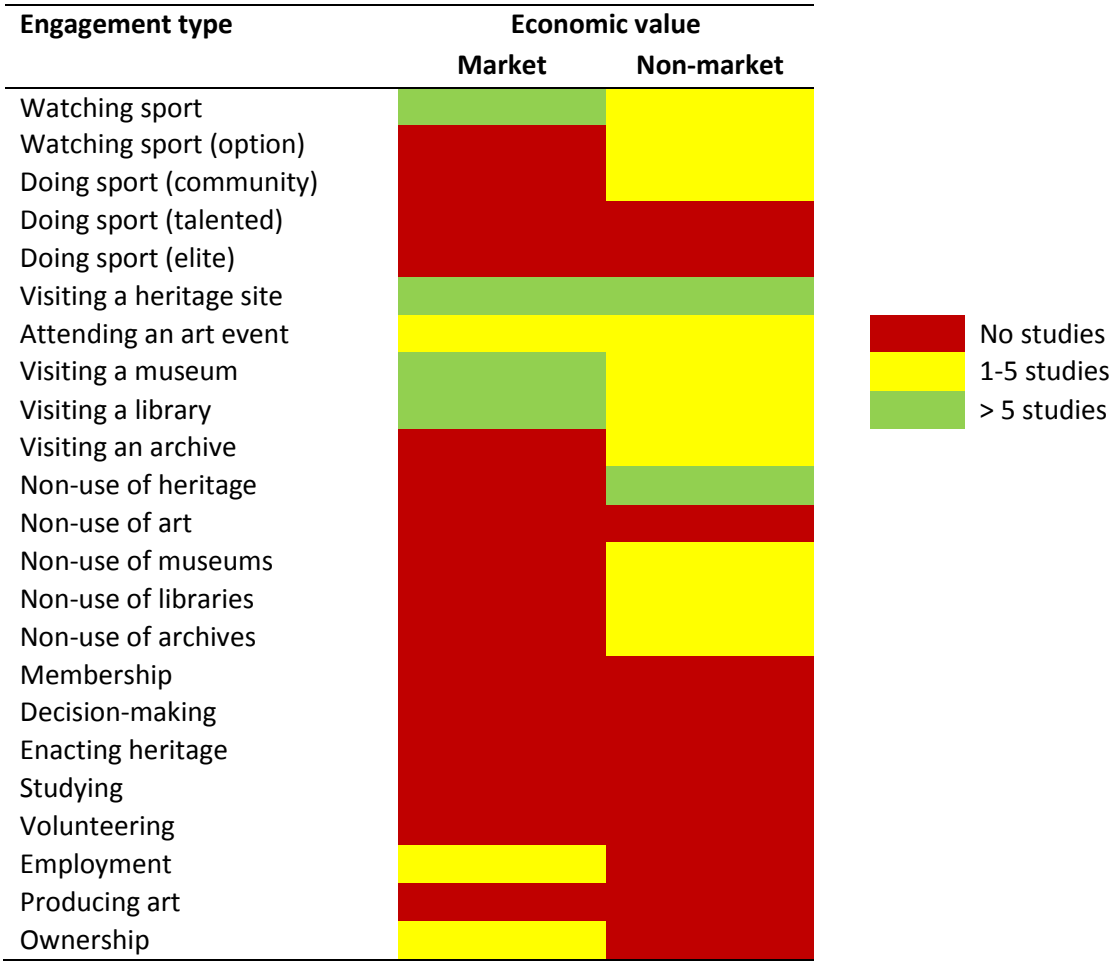
- £13 - £34 per person per annum to prevent the closure of Surrey History Centre (Ozdemiroglu and Mourato, 2001).
- £6 per person per annum to maintain the British Library (Pung et al, 2004)

Both the methodological challenges associated with revealed preference and stated preference techniques, as well as the paucity of data from extant studies adopting these approaches, mean that an alternative method is required if engagement in culture and sport is to be valued to inform policies in the short term. The next section considers the account of value underlying conventional economic valuation techniques, and whether any other accounts of value offer the short-term potential to generate values for engagement in culture and sport.

3.3.2 What types of value are generated by engagement in culture and sport?

Direct comparison of the costs and benefits of government intervention requires that both the inputs and outputs/outcomes of the government intervention be given monetary values. It is often argued, however, that the value generated by culture cannot be captured by the economic notion of utility associated with monetary valuation techniques (Throsby, 2001). In order to explore this matter further, this section considers what is meant by economic and non-economic notions of utility.

Figure 2: Summary of economic value studies of engagement



What is meant by economic utility? At the heart of standard welfare economic theory lies utilitarianism, a philosophy that requires that every choice must ultimately be judged by the consequent states of affairs. Within economics more generally, this consequentialist foundation has traditionally been applied in a narrow sense, whereby only the impact on an individual's utility associated with different possible outcomes is considered (Dolan et al., 2007). More narrowly still, economic value is often interpreted as the amount people are willing to pay to obtain an outcome.

Many economists would reject this narrow view of utility in favour of a broader notion of utility. For instance, health economists often employ the quality-adjusted life years (QALYs), a preference-based approach, in which respondents state their preferences over future states of health and illness (Dolan, 2000). For the purposes of this discussion, however, the term "economic value" will be taken as referring to the amount people are willing to pay for an outcome. This has a number of advantages. First, it corresponds to the way in which many critics of economics understand economic value. Second, it corresponds to H.M. Treasury's guidance on measuring economic value (see HMT 2003).

It is often argued that there are certain goods that cannot be captured in the economic notions of value as WTP, whether through the market or through monetary valuation techniques (for a discussion of the limitations of WTP in the context of culture, see Throsby, 2001). Consequently, there is an increasing recognition that economics needs to develop a wider concept of utility (Dolan et al., 2007). For instance, the focus on WTP does not consider any utility that might be generated from the manner in which outcomes are achieved.

The work of the Swiss economist Bruno Frey and his colleagues finds that people care not only about outcomes, but also about whether these outcomes have been achieved justly (HMT, 2009). They call this procedural utility and suggest that it is an important source of utility: it is not only what, but also how, that matters. It is still not clear whether procedures are valued because they promote better outcomes or whether they also provide an important reinforcement of self, and of due respect (Dolan et al., 2007; Frey and Stutzer, 2002).

The idea that procedural utility could be derived from the respect it confers on participants and that this utility is not amenable to monetary valuation is a specific example of a more general critique of valuation by WTP. A number of authors have identified an incommensurability of moral values and economic values (see Keat, 1997; Sagoff, 1988). Etzioni (1988) observed that actions undertaken with moral motivations (such as abstention from pre-marital sex, and Ramadan fasting) generate value that is qualitatively different from those achieved through consumption. That is, adhering to morals provides a sense of affirmation, of having done what is required, and re-establishing one's values. In contrast to the values promoted in the market, this often involves the denial of pleasure in the name of the principles invoked. The incommensurability of moral norms and market values is well-captured by Kenneth Arrow in his remark on trust: "If you have to buy it, you already have some doubts about what you've bought" (1974: 23).

It is likely that the value generated by culture and sport is a combination of economic and non-economic utility. Outcomes such as enjoyment and improved health are likely compatible with the values inherent in attempts to elicit people's WTP for goods. Outcomes such as improved self-respect and the reinforcement of self-identify, however, could be incompatible with notions of economic utility defined accordingly to people's WTP. If this is the case, estimates of WTP will fail to capture the value of engagement in culture and sport.

If WTP estimates don't capture the value of engagement in culture and sport, how should engagement be valued? Parfit (1984) identifies a number of alternatives to the preference satisfaction account, including: mental state; objective list; and flourishing accounts.

Objective list accounts do not provide a formal theory of well-being, rather a list of attributes and characteristics that are taken to constitute well-being. Examples of such lists include Rawls's (1971) index of primary goods, and Sen's (1987) capability approach. The latter includes attributes that people enjoy as citizens: freedoms such as democracy, free speech and tolerance. While some of these items might necessarily be measured from a subjective perspective, the key feature of objective list accounts is that the importance of the attributes to well-being is determined externally.

The flourishing account of well-being originates in Aristotle's perfectionist version of well-being in which the well-being of an individual is judged by considering how close he is to reaching the potential of humankind (*eudaimonia*). In this vein, Ryff and colleagues have developed a psychological well-being (PWB) model which is represented by six aspects of human potential – autonomy, personal growth, self-acceptance, life purpose, mastery and positive-relatedness – which can all be seen as essential components of what it is to be a flourishing human being (Ryff and Keyes, 1995). Such measures, however, require external expert judgment as to what constitutes "self-actualisation". As a consequence, as with objective list accounts, there is no widely agreed definition of eudaimonic well-being, which makes empirical analysis difficult (HMT, 2009).

Both the objective list and the flourishing accounts are limited by difference in expert opinion about what contributes to well-being, and a consequent lack of empirical data (Dolan and White, 2007). While these challenges are not necessarily insurmountable, they limit the current possibilities of these accounts for valuing engagement in culture and sport. It is also difficult to see how these approaches could provide the monetary valuation of well-being required by H.M. Treasury's recommendations on policy appraisal. However, a fourth account of well-being – mental state accounts – does offer the possibility of an empirical alternative to the preference account.

Mental state accounts draw on an individual's assessment of his life or subjective well-being (SWB). The use of measures of SWB to value policy outcomes accepts the welfarist principle that value judgments should be based on an individual's welfare, but rejects the welfarist principle that an individual's preferences are the best way to

assess welfare. Instead, the focus is on people's experiences and how these experiences are related to their evaluations of their lives or their hedonic (or pleasurable) experiences.

The SWB approach has a number of methodological advantages over the economic value methods (Dolan and Metcalfe, 2008). They do not require the assumption of equilibrium in markets and there is no need to construct a hypothetical market. Thus, measures of SWB can avoid many of the problems inherent in individual preferences, particularly those that are elicited in unfamiliar contexts, as well as avoiding the focusing effect (the tendency for respondents in contingent valuation studies to place more emphasis on the good being valued than they would do outside the context of the study).

Importantly, while the SWB approach is still very much in its infancy, it provides the practical possibility of generating monetary values for engagement in culture and sport within the timeframes of this research. The next section provides more discussion about the SWB approach and explores its usefulness by applying it to the valuation of engagement in culture and sport.

4. The value of engagement: Measuring short-term value with subjective well-being assessments

4.1 Introduction

This section presents the results of an analysis of subjective well-being (SWB) measures undertaken to measure the immediate, private benefit generated by engagement.

The use of SWB measures as a tool for valuing the outcomes of public policy is receiving increasing amounts of academic interest (Dolan et al., 2008). Layard (2005) states the case for using measures of SWB as expressing the benefits of policies in a manner that accords to what should be the primary goal of modern governments – reducing those things that make us unhappy and increasing those things that make us happy.

Furthermore, the possibilities of SWB measures are also being recognised by policy makers themselves. Perhaps most prominent among these initiatives was President Nicolas Sarkozy's commission into measuring progress, which was chaired by a number of eminent Nobel Prize-winning economists (Stiglitz et al, 2009).Also, a number of lower-profile developments suggest the growing importance of well-being measures in policy making. The OECD recently convened a conference of academics and policy makers to discuss the use of such measures in policy making[3], and the UK Government has recently included well-being in its sustainable development indicator set. Importantly, a recent H.M. Treasury position paper stated that SWB methods had the potential to support policy analysis and that the approach accorded with the strategic objectives of the Treasury (HMT, 2009).

The SWB approach involves measuring how people's self-assessment of their well-being varies as they experience outcomes targeted by policy. Well-being assessments are elicited, for instance, in responses to questions such as how satisfied people are with their life overall. Answers are generally recorded on scales ranging from, for instance, 1 for not satisfied at all to 7 for completely satisfied. There was initial scepticism about whether responses to such questions could be sensitive enough to capture the effect of policy outcomes. There is, however, a growing literature on the sensitivity and validity of responses to life satisfaction questions, including:

- Responses yield consistent and intuitively appealing associations between well-being and life experiences, such as health and employment (Peiró, 2006; Dolan et al., 2008).
- Responses have been shown to be associated with actual behaviour, e.g. suicide, and key physiological variables (Bell, 2005; Lyubomirsky et al. 2005; Dolan and White, 2007; HMT, 2009).

[3] http://www.oecd.org/document/12/0,3343,en_21571361_31938349_37720396_1_1_1_1,00.html

- Psychological studies showing how those with higher scores are more likely to be rated as happy by friends and less likely to show signs of mental disorder (Peiró, 2006)

To date, there has been little research on the impact of engagement in culture and sport on SWB. Galloway (2005) reviewed the literature on the impact of participation in culture and sport on quality of life (QoL) and sense of well-being (see Appendix 1 for more detail on the review). Despite the limitations with the literature, the review concluded that:

- There is some evidence of a positive association between participation in cultural activities and well-being. However, the effect tends to be small, and one study found no association between the frequency of engagement with cultural activities and levels of satisfaction.
- There is some evidence to suggest a positive association between participation in sport/exercise and well-being. This evidence is limited, however, in a number of ways, including: there is no evidence on the relationship between the level of participation and well-being; and it is not possible to conclude whether sport and exercise have different effects on well-being.

The Galloway review points to a number of methodological shortcomings in the extant literature, including:

- The use of different concepts and scales for measuring well-being limits comparability between studies.
- The samples used in the studies are either too small or not representative of the general population.
- Most studies do not control for confounders.

More recently two studies have been undertaken on the relationship between sport and happiness. Kavetsos and Szymanski (2008) demonstrate the impact of international sporting success and hosting major events on population happiness. Forrest and McHale (2008) analysed the Taking Part survey to estimate the relationship between participating in sport and SWB. They conclude that “women who choose to play sport [...] raise their level of well-being. [...] However, the result is not replicated for men” (1).

The Forrest and McHale study is subject to a number of limitations that the analysis in this report attempts to overcome. First, and perhaps most obviously, it does not cover engagement in culture. Second, the Taking Part survey is cross-sectional and thus is limited in its ability to isolate the causal relationship between doing sport and SWB. While the study uses instrumental variables in an attempt to control for endogeneity in the relationship between doing sport and happiness (doing sport may make people happiness, but happy people may be more likely to do sport), the analysis risks biasing from unobserved respondent heterogeneity. Third, income, a key variable for the use of SWB methods to value policy outcomes, is not well specified in the Taking Part data, being recorded in bands and capturing only respondent income, rather than household income. Lack of a good measure of income limits the possibility of using the results of the analysis to estimate income compensation, reducing the certainty around these estimates. Our analysis attempts to overcome these limitations.

As noted above, the use of the SWB method to inform policy making is still in its infancy. Thus, despite the increased interest in the method, and the developing body of evidence to support the validity of the approach, it is important that the experimental nature of the approach is understood and that the output from the method is treated with the corresponding level of caution. However, the challenges to applying conventional valuation techniques in policy areas such as culture and sport (see section 3) mean that there is value in exploring the possibility of applying the SWB method. The remainder of this section considers the usefulness of the SWB method by applying it to value engagement in culture and sport.

4.2 Method

The British Household Panel Survey (BHPS) is the main source of data for well-being studies in the UK. The BHPS is a survey of adult individuals and households. It is longitudinal, having been carried out annually since 1991, and has a nationally representative sample of more than 10,000 adult individuals since the year 2000.

The BHPS has a number of benefits compared with alternative data, such as Taking Part. The key benefit is that the panel nature of the BHPS allows the analysis to control for unobservable individual characteristics, such as personality. That is, the analysis identifies associations between an individual's pattern of engagement in culture and sport over time with their self-reported SWB. The next section describes the analytical approach adopted to assess this association. The following section describes in more detail the data employed in the analysis.

4.2.1 Empirical approach

The basic regression model used in the analysis of SWB data is of the following form:

$$SWB_{it} = \beta_0 + \beta_1 \ln(y_{it}) + \beta_2 E_{it} + \beta_3 X_{it} + \varepsilon_{it} \quad (1)$$

with i = 1..N and t = 1...T, and where:

- SWB_{it} is individual i's SWB at time t.
- $\ln(y_{it})$ is the natural logarithm of household income.
- E_{it} is engagement in culture or sport.
- X_{it} are personal and social characteristics.
- ε is the error term

The panel nature of the BHPS dataset means that the model summarised in equation (1) can be applied in a number of ways. First, should there be no unobserved individual variation impacting on SWB levels, the waves in the panel data could be pooled and analysed as if it was a cross sectional dataset. However, the Breusch-Pagan test identified such individual effects, suggesting that pooling the data was not appropriate.

Second, where unobserved individual variation is present, either fixed effects (FE) or random effects (RE) models can be run. The FE model treats the unobservable individual effects as correlated with other regressors and fixed for each individual. As a result, the model is carried out via a "within" regression, which compares an individual to themselves at different points in time. A disadvantage of this model is that variation "between" individuals is not exploited. That the analysis does not consider all the variation in the data is considered an inefficient use of the data. Also, the impact of time-invariant regressors (e.g. sex) cannot be identified.

The alternative is to use RE models, which treat the individual effect as a random variable. RE make use of variation not only within individuals but also between individuals. RE models assume that unobserved individual variation is not correlated with other regressors, but is instead randomly distributed across individuals.

The Hausman test suggested that the FE model was most appropriate. However, both FE and RE models were applied.

To control for the endogeneity of income, both FE and RE models were run with an instrumental variable (IV) for household income. Income endogeneity occurs when the dependent variable – in this case SWB – depends on income and income itself is a function of SWB. Income endogeneity can result in biased and inconsistent parameter estimates (Oswald and Powdthavee, 2007). A standard approach for dealing with this problem is to use IVs (Blanchflower and Oswald, 2004). The use of IVs is also a common approach to deal with measurement error. Measurement error is particularly relevant to income, given the difficulties in collecting accurate income data through household surveys. Thus, by instrumenting income we prevent measurement error bias in the income variable.

A valid IV for income is a variable that is highly correlated with income but not correlated with SWB. This IV is then entered into the regression equation in place of income. Here we draw upon an instrument previously tested in the BHPS by Oswald and Powdthavee (2007) – whether the interviewer saw the payslip of the respondent. The reasoning for using "interviewer saw payslip" as an IV for income is that where the payslip is shown to the interviewer, the information about income is likely to be more accurate. The payslip is usually issued by the respondent's employer, and typically contains information on gross income and all taxes and any other deductions such as retirement plan contributions, insurances, garnishments, or charitable contributions taken out of the gross amount to derive at the final net amount of pay (Powdthavee, 2009). There is no reason, however, to expect SWB to be affected by whether or not the interviewer sees the payslip.

Where a statistically significant association is identified between engagement and SWB, the SWB provides the possibility of estimating the monetary value of engagement using the income compensation (IC) approach. ICs represent the income that is required to hold SWB constant following a change in engagement in culture and sport. Using the coefficients for income and the engagement variables from equation (1), ICs were estimated using the following equation:

$$IC = \bar{y} - e\left(\ln(\bar{y}) - \frac{\hat{\beta}_2}{\hat{\beta}_1}\right) \qquad (2)$$

where $\bar{y}$ is the average income of the sample population, and the $\hat{\beta}$ terms represent the estimated coefficients from equation (1) for income and the policy outcome being valued.

The ICs are calculated based on household income, rather than individual income. This not only facilitates comparison with the existing literature (see for instance Delaney and Keaney, 2005), but also reflects the fact that income is distributed within a household (Dolan et al, 2006). Furthermore, the ICs are calculated for the average income in the sample population.

4.2.2 Data

Subjective well-being. The BHPS provides a number of measures of SWB that have been extensively used in previous well-being studies (Dolan et al, 2008). In this study we used life satisfaction (LS) as an indicator of SWB, as this is considered the most comprehensive of the available measures. Other measures, such as depression and the General Health Questionnaire, are more health focused. The LS variable reports the response to the question: "How dissatisfied or satisfied are you with your life overall?" Answers to this question range from 1 for not satisfied at all to 7 for completely satisfied. This question was included in the survey in the following years: 1996 to 2000, and 2002 to 2007. The variable was re-scaled to a 0-1 range to facilitate the interpretation of the coefficients.

The SWB question in the BHPS is ordinal in nature. This would have implications for the form of regression model employed. Ferrer-i-Carbonell and Frijters (2004), however, demonstrate that it makes little difference to the results of the analysis if the data is treated as cardinal.

Engagement in culture and sport. The BHPS only includes limited measures of engagement in culture and sport[4]. Specifically, the BHPS includes data on the

[4] The exact question wording is:
'We are interested in the things people do in their leisure time; I'm going to read out a list of some leisure activities. Please look at the card and tell me how frequently you do each one...

frequency that respondents do sport, go to theatres, concerts or other live performances (from herein referred to generically as 'concerts') and go to the cinema in waves 6 (1996), 8, 10, 12, 14 and 16 (2008). Although going to the cinema is not within the central CASE forms of cultural engagement as defined by Taking Part arts questions, it was included for comparison. The SWB analysis was therefore run for all these measures.

However, as these measures do not cover the range of sectors of concern in this project, a method was developed to also generate data on the probabilities of engaging in sport, the arts, museums, libraries and heritage, using definitions of engagement of interest to this research project. The method comprised two stages:

1. Estimating the probabilities of engaging in culture and sport. The probabilities of engaging in culture and sport were obtained by estimating regression models using Taking Part data. These models provided coefficients for the variables that are likely to determine the probability of engaging in culture and sport versus not engaging. Models were run for the following engagement variables:
    a. Heritage – visited a heritage site in the past 12 months.
    b. Art – attended an arts event in the past 12 months.
    c. Sport – whether a person has done three episodes of at least 30 minutes of moderate-intensity sporting activity in the past four weeks (as defined in the Sport England "1 million" indicator).
    d. Museums – whether a person has visited a museum in the past 12 months.
    e. Libraries – whether a person has visited a library in the past 12 months.

2. Predicting the probabilities of engaging in culture and sport. The probabilities of engaging in culture and sport were predicted by using the coefficients estimated in the previous stage and applying the following equation to individuals in the BHPS.

$$\widehat{P}_{it} = \phi(\widehat{\delta}_0 + \widehat{\delta}_1 X_{it} + \widehat{\delta}_2 \overline{Z}) \qquad (3)$$

where

- ϕ is the logistic function
- X_{it} are personal characteristics available in the BHPS
- $\overline{Z}$ are personal and local area variables that impact on the probabilities of engaging in culture and sport but are not available in the BHPS, and were thus replaced by their mean values in Taking Part data. The inclusion of these variables ensures that (i) the estimates of $\widehat{P}_{it}$ are as accurate as possible, and

Go to the cinema; Go to a concert, theatre or other live performance; Play sport or go walking or swimming'

that (ii) the right hand variables in equation (3) are different to those in equation (1), thus avoiding identification problems[5].

Table 2 presents summary statistics for the actual (Taking Part) and predicted (BHPS) probabilities of engaging in culture and sport. It demonstrates that the predicted probabilities have similar means to the actual probabilities, but have much less variation.

Table 2. Summary statistics of actual and predicted probabilities of engagement in culture and sport

		Mean	St. Dev.	Min.	Max.
Visiting a heritage site	Actual	0.69	0.46	0.00	1.00
	Predicted	0.79	0.09	0.14	0.95
Attending an art event	Actual	0.57	0.49	0.00	1.00
	Predicted	0.66	0.09	0.15	0.90
Doing sport	Actual	0.13	0.34	0.00	1.00
	Predicted	0.11	0.07	0.00	0.43
Visiting a museum	Actual	0.42	0.49	0.00	1.00
	Predicted	0.43	0.10	0.06	0.78
Visiting a library	Actual	0.45	0.49	0.00	1.00
	Predicted	0.42	0.11	0.12	0.85

Given the high predicted probability of visiting a heritage site (0.79), there was concern that the consequent lack of variation in the probability of visiting a heritage site would reduce the possibility of identifying the effect of such visits on SWB. Consequently, the analysis of heritage visits was re-run for a more specific definition of heritage engagement – attending a historic building (non-religious) which has an engagement rate of 35% according to Taking Part 2008/9.

Other variables. Other variables required to build the SWB regression equation include individual variables that can influence SWB. The usual individual level variables were drawn from the BHPS. These include sex, age, marital status, income, household size, number of children, employment status, health problems, visits to the doctor, being a full-time carer, educational attainment, contact with family and friends (Dolan et al., 2008).

Two measures of income in the BHPS were included in the regression analysis: absolute income and relative income. Absolute income is measured by the logarithm of household income adjusted for inflation. The logarithm of income was used to account for the fact that the SWB function is often believed to be concave in income (Ferrer-i-Carbonell, 2005). To control for the effect on needs of household size and composition,

[5] Further detail on the variables used in the model to predict the probability of engagement can be found in the technical report of the Drivers of Engagement available alongside this report on the CASE website (www.culture.gov.uk/case)

income was equivalised using the McClements scale before housing costs are deducted (Taylor, 2009).

The relative income effect was explored by incorporating the individual's reference income. The reference income of an individual was defined as the average income for individuals of the same sex, age group, region, and year. Relative income is thus defined as the logarithm of the average income of the reference group. The specific relative income variable include in the analysis is the different between the logarithm of income and the logarithm of the average income of the reference group. This variable is expected to have a negative impact on SWB, indicating that the lower the income for the reference group of an individual, the happier he or she will be.

Descriptive statistics of all variables are presented in Table 17 of Appendix 4.

An important concern with the regression modelling is that multicollinearity causes the estimates of the coefficients to become unstable and the standard errors for the coefficients can get inflated. The variance inflation factor (VIF) was calculated to check on the degree of multicollinearity. Table 24 of Appendix 4 presents VIF values. As a rule of thumb, a variable which VIF value is greater than 10 may introduce collinearity. The high VIF values in the age related variables are expected, given that one is a combination of the other. No evidence of collinearity between the independent variables was found, except for the dummy variables for marital status; one of which was thus dropped from the regression equation where appropriate. For every engagement variable, the second columns show how VIF values for marital status drop after one of the dummies is excluded.

4.3 Results

4.3.1 The relationship between actual engagement measures and SWB

As discussed in the previous section, the analysis of the relationship between engagement and SWB was undertaken in two phases. First an analysis of the relationship between measures of **actual engagement** from the BHPS and SWB.

Table 3 reports the results of the analysis of the association between actual engagement and SWB (full regression outputs are presented in Table 21 of Appendix 4 and the Hausman test in Table 22). This was performed for the three engagement types available in the BHPS: doing sport, attending the cinema, and attending a concert. The analysis was conducted separately for 4 levels of engagement: once a year or less; several times a year; at least once a month; and at least once a week.

As would be expected, Table 3 demonstrates that the effect on SWB obtained from engaging in culture and sport tends to increase with the frequency of engagement. For instance, based on the FE models, going to the cinema once a month has double the effect on SWB as going to the cinema only once a year or less (the associated SWB gain is 0.02 versus 0.01 on a scale of 0-1). The only instances where this relationship

does not hold is increasing attendance at performing arts events (cinema and concerts) from once a month to once a week.

The coefficients of other regressors included in the models tend to have the expected signs. For example:

- Being married or living as a couple has a positive impact on LS, compared with being single.
- The impact of experiencing health problems is generally negative and strongly significant.
- Being unemployed or inactive, compared with being employed, has a detrimental effect on LS, while those who are retired are better off.
- Being in contact with family and friends has a positive impact on LS, and the effect increases with the frequency of contact.

Understanding the scale of SWB gain associated with the actual engagement measures

Comparing the coefficients obtained from the analysis reported in Table 3, it is estimated that the SWB increase associated with actual engagement measures cover live arts ('concerts') and sport at least once a week is 0.25 to 0.60 times that lost due to being unemployed[6].

[6] The effects on SWB of culture, sport, unemployment, and health used to estimate the relative effect of these variables are drawn from the same multi-variate models. That is, the all these estimate have been generated using the same analysis and are, thus, comparable.

Table 3: Fixed effects and random effects estimation of the impact of actual engagement in culture and sport on life satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	LS	LS	LS	LS	LS	LS
Independent of interest	Do Sport		Go to the Cinema		Go to Concerts	
Baseline	Never/almost never					
Specification	FE	RE	FE	RE	FE	RE
Absolute income	0.053	0.029	0.052	0.028	0.052	0.028
	(3.00)***	(2.44)**	(2.92)***	(2.36)**	(2.89)***	(2.35)**
Once a year or less	0.005	0.009	0.01	0.01	0.01	0.01
	(1.13)	(2.36)**	(2.90)***	(2.63)***	(4.17)***	(6.95)***
Several times a year	0.015	0.025	0.013	0.012	0.02	0.03
	(4.41)***	(8.15)***	(4.69)***	(4.69)***	(7.66)***	(10.78)***
At least once a month	0.019	0.033	0.019	0.020	0.022	0.028
	(6.03)***	(11.77)***	(5.08)***	(6.33)***	(4.70)***	(7.03)***
At least once a week	0.025	0.042	0.019	0.017	0.019	0.023
	(9.83)***	(19.48)***	(2.42)**	(2.64)***	(1.78)*	(2.53)**
Constant	0.362	0.696	0.363	0.721	0.384	0.726
	(2.15)**	(6.56)***	(2.16)**	(6.77)***	(2.28)**	(6.82)***
Observations	67,028	67,028	67,007	67,007	67,014	67,014
Number of pid	22,484	22,484	22,484	22,484	22,481	22,481

Standard errors in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%

4.3.2 The relationship between predicted engagement measures and SWB

The second phase of the analysis was to estimate the relationship between **predicted engagement** and SWB. Tables 4 to 6 report the results of the relationship between engagement in culture and sport and SWB when engagement is defined as that predicted using the model generated based on the Taking Part survey (see s. 4.2.2).

Table 4 presents mean values of the predicted probability of engaging in culture and sport for the seven points of the life satisfaction (LS) scale. The results indicate that the probabilities of visiting a heritage site, attending an art event, doing sport and visiting museums tend to increase for increasing levels of LS. The exception to this rule is visiting libraries, for which the mean probability of visiting tends to decrease for higher levels of LS.

Table 4: Mean levels of predicted engagement in culture and sport by life satisfaction levels

	Life satisfaction						
	1	2	3	4	5	6	7
Heritage	0.7561	0.7804	0.7847	0.7858	0.8035	0.8131	0.7745
Historic building	0.3495	0.3793	0.3855	0.3879	0.4114	0.4236	0.3825
Art	0.6323	0.6523	0.6554	0.6591	0.6750	0.6869	0.6625
Sport	0.0772	0.0981	0.1055	0.1098	0.1225	0.1230	0.0882
Museums	0.4111	0.4330	0.4335	0.4325	0.4474	0.4534	0.4196
Libraries	0.4679	0.4547	0.4432	0.4286	0.4220	0.4263	0.4293

Table 5 presents correlation coefficients between LS and each of the predicted engagement variables. Correlation coefficients give an indication of the degree of linear association between two variables. As before, the results suggest that, except for visiting libraries, the association is positive. The coefficients range between 0.0072 for doing sport and 0.0564 for attending an art event. The absolute values of the coefficients tend to be low, suggesting that the unconditional association between these variables is relatively weak. However, there are a number of other variables that influence SWB that are not controlled for in this bivariate analysis.

Table 5: Correlation between life satisfaction and predicted engagement in culture and sport

	Life satisfaction
Visiting a heritage site	0.0408
Visiting a historic building	0.0545
Attending an art event	0.0564
Doing sport	0.0072
Visiting a museum	0.0153
Visiting a library	-0.0408

The results of the regression analysis of the impact of predicted engagement in culture and sport on LS are presented in Table 6. The analysis is based two model specifications, fixed effects (FE) and random effects (RE), for each independent variable of interest. Full regression outputs are presented in Table 25 of Appendix 4.[7] The results of the Hausman test are presented in Table 26 of Appendix 4. These suggest that RE estimates are inconsistent. However, as mentioned before, the validity of the test to decide which estimates are more appropriate is contested.

The coefficients of the predicted engagement variables in Table 6 indicate the following:

- The impact of visiting any heritage site on LS is statistically non-significant in the RE model, and is negative in the FE model.
- The impact on LS of visiting a more specific type of heritage – historic buildings – was found to be positive and statistically significant at the 10% level in the RE model.
- Attending an art event has a positive impact on LS. This result is valid for the RE model for which the coefficient of the variable is positive and significant at 1% level. Under the FE model, the impact of art on LS is not statistically significant.
- Doing sports has a positive impact on LS. Both the FE and RE models estimate positive and significant coefficients for this variable –at 5% and 1% level, respectively.
- Visiting a museum has a positive impact on LS. Both the FE and RE models estimate positive and significant coefficients at 1% level.
- The impact of visiting a library on LS is not statistically significant.

As expected, the coefficients of absolute income are positive across all models, and the coefficients of relative income are negative. However, the coefficients for absolute income tend to be small, and they are statistically significant only for some models (heritage, art and sport). In contrast, the impact of relative income on LS is statistically negative across all models. These results should not come as a surprise. There is good evidence that relative income effects are large and significant, and although the evidence cannot rule out an effect of absolute income, it does suggest that the impact of absolute income is smaller than that of an individual's relative income (Dolan et al., 2006).

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[7] The number of observations in each model varies as each engagement variable has been drawn from a different combination of regressors –i.e. the variables in equation (3) are different for each engagement variable and their availability in the BHPS across waves differs.

Table 6: Fixed effects and random effects estimation of the impact of predicted engagement in culture and sport on life satisfaction

	Heritage		Historic building		Art		Sport		Museums		Libraries	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log of real equivalent household income	0.029	0.027	0.017	0.017	0.043	0.035	0.039	0.036	0.026	0.019	0.040	0.013
	(1.83)*	(2.20)**	(0.94)	(1.11)	(2.60)***	(2.87)***	(3.51)***	(4.16)***	(1.26)	(1.18)	(0.82)	(0.48)
Relative individual income	-0.015	-0.023	-0.016	-0.021	-0.016	-0.025	-0.009	-0.025	-0.016	-0.021	-0.017	-0.020
	(3.45)***	(6.05)***	(3.14)***	(4.31)***	(3.77)***	(6.55)***	(2.52)**	(7.73)***	(3.12)***	(4.08)***	(3.03)***	(3.48)***
Engagement	-0.102	0.005	0.022	0.053	0.026	0.133	0.110	0.241	0.097	0.089	0.101	-0.003
	(2.23)**	(0.13)	(0.62)	(1.70)*	(0.75)	(4.53)***	(2.00)**	(5.25)***	(3.35)***	(3.69)***	(0.91)	(0.05)
Constant	0.813	0.623	0.696	0.730	0.438	0.546	0.455	0.543	0.611	0.693	0.463	0.747
	(0.00)	(6.27)***	(3.82)***	(5.23)***	(2.85)***	(5.21)***	(5.05)***	(8.60)***	(3.05)***	(4.80)***	(0.98)	(3.12)***
Observations	103,447	103,447	58,317	58,317	103,782	103,782	129,824	129,824	58,127	58,127	58,134	58,134
Number of individuals	18,635	18,635	9,520	9,520	18,670	18,670	24,621	24,621	9,500	9,500	9,501	9,501
R-square	0.0018	0.1313	0.0133	0.1204	0.0102	0.1307	0.0099	0.1240	0.0209	0.1197	0.0159	0.1198
Wald-test	1734.14	5177.75	1.43e+06	2632.76	2.43e+06	5479.93	2.92e+06	6881.71	1.42e+06	2629.15	1.42e+06	2572.08
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in brackets.
* Significant at 10%; ** significant at 5%; *** significant at 1%

Comparison of the coefficients in Table 6 can be used to assess the magnitude of the effect of engagement in culture and sport on SWB compared with other policy outcomes. For instance, for those effects that are statistically significant, the SWB generated by engaging in culture and sport is the equivalent to:

- 1.6-4.1 times that lost due to unemployment.
- 1.1-2.8 times that lost due to experiencing "many health problems".

These results suggest that the size of the SWB gain associated with the predicted engagement measures is too large to make theoretical sense. In addition, the pattern of findings – the contrast between heritage effects and museums (ostensibly similar activities on a range of factors) again suggest that the analysis is generating unexpected results. One reason for this could be the nature of the predicted engagement variables, including:

- Some of the factors that influence engagement may not be fully controlled for by the analysis used to predict engagement.
- The analysis does not distinguish between the effects of different frequencies of engagement. That is, the large effect of engagement on SWB could be explained by those people who are engagers doing so multiple times.

The large SWB gains associated with some of the predicted forms of engagement and the negative effects of visiting heritage sites obtained from the analysis of predicted engagement raises questions about the validity of the analysis. Instead, the best strategy for estimating SWB gains associated with engagement in these areas is to generate actual data measures of engagement.

4.3.2 Monetizing the subjective well-being gains associated with actual engagement measures

Where the coefficients on income and engagement are both statistically significant, the income compensations (IC) associated with actual engagement in culture and sport were calculated. These are reported in Table 7 based on the coefficients identified in the model of the association between actual engagement measures and SWB reported in Table 3. Due to the methodological challenges identified above ICs are not presented here for the predicted engagement data. However, this analysis was carried out and the results are available for inspection in Appendix 5.

In summary, Table 7 shows;

- Doing sport at least once a week has an IC of £11,000.
- Going to the cinema at least once a week has an IC of £9,000.
- Going to a concert at least once a week has an IC of £9,000.

As expected, lower frequency engagement generates lower ICs, including[8]:

- Going to the cinema once a year or less has an IC of £3,700.
- Going to a concert once a year or less has an IC of £4,700.

[8] The IC for doing sport is not included in this list, as the effect of doing sport once a year or less on SWB was not statistically significant.

Table 7: Income compensation estimates for actual engagement in culture and sport (£2008/9)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	LS	LS	LS	LS	LS	LS
Independent of interest	Sport		Cinema		Concert	
Baseline	Never/almost never					
Specification	FE	RE	FE	RE	FE	RE
Once a year or less	-	7,872	3,716	5,691	4,689	11,609
Several times a year	7,272	17,044	6,527	10,284	9,420	18,256
At least once a month	8,888	20,048	9,031	15,061	10,178	18,651
At least once a week	11,095	22,571	9,031	13,428	9,031	16,528

4.4 Discussion

This section presents the results of an analysis to establish the impact and monetary value of engagement in culture and sport on subjective well-being (SWB). The application of the SWB method to value policy outcomes is in its infancy. What does this analysis suggest for the efficacy of employing this approach? To answer this question, it is illustrative to consider the policy implications of the results of the analysis.

4.4.1 SWB gains associated with engagement in culture and sport

SWB measures can be used to inform policy making in a number of ways. First, SWB can be employed as a standard measure of policy outcomes, allowing the relative benefit of different policy outcomes to be compared. For instance, the analysis of varying frequencies of participating in sport, going to the cinema, and going to a concert can be used to inform the level of engagement government should promote. The analysis suggests that SWB levels increase with the frequency of sports participation. This trend, however, does not hold for attending arts events – cinema and concerts. SWB levels associated with attending arts events increases with frequency until the level of frequency reaches once a month.

Standard measures of SWB can also be used to inform the allocation of resources between departments; something that is currently limited by the lack of such standard measures of outcomes. In this respect, it is illustrative to compare the SWB effects between engagement and other factors that influence SWB.

These estimates of the effect of engagement in culture and sport on SWB are likely over-estimates. One possible explanation for this observation is that measures of engagement are picking up the effect of other lifestyle factors on SWB. The variance in SWB explained by SWB models tends to be small – as indicated by the low levels of goodness of fit (R-squares). This characteristic is common in this type of model and

has been observed in numerous other studies (e.g. Powdthavee, 2005; Cohen, 2008; Oswald and Powdthavee, 2008). In the context of such large levels of unexplained variance in SWB, it is possible that measures of engagement in culture and sport are picking up not only the effect of engagement, but also the effect of other lifestyle characteristics associated with engagement and not measured separately in the models.

A second challenge is the possibility that the relationship between SWB and engagement in culture and sport is endogenous. That is, not only is engagement expected to increase SWB, but an increase in SWB might be expected to make people more likely to engage in culture and sport. If this potential endogeneity is not taken account of, it is likely that the analysis will overestimate the effect of engagement on SWB. A similar challenge faces estimating the relationship between income and SWB. In that instance, endogeneity was addressed by instrumenting for income. Equivalent instrumental variables for engagement in culture or sport were not available in the BHPS.

The level of unexplained variance in the models may also help explain why no effect on SWB is observed for visiting a library. That is, to the extent that visiting a library is associated with factors that have a negative effect on SWB but which are not included in the analysis, then the visiting a library variable may be also picking up these effects, any positive impact of visiting a library on SWB may be thus offset. However, further research is required to verify this explanation.

Another challenge is that attempts to measure the effect of policy events on SWB raise questions about the temporal relationship between events and SWB. This is particularly important for rare events. For instance, to what extent will SWB data elicited in December reflect the SWB effect of doing sport in July? Such data is likely to better reflect the SWB effect of regular events than rare events. Thus, the reduction in SWB effects of engagement in culture and sport with reduced frequency of engagement may partly reflect the likely underestimate of the SWB effect of rare events with the methodology employed.

4.4.2 Estimating the monetary value of SWB gains associated with engagement in culture and sport

A second way in which SWB measures can be used to inform policy making is by estimating the monetary value of policy outcomes, which can be calculated using the income compensation (IC) approach. For instance, the IC for going to the cinema once a year or less was estimated to be £3,700.

These ICs can be compared against other ICs estimated in the literature. For instance, Delaney and Keaney (2005) estimate that “membership of a sports club has the same impact on individual wellbeing as an increase in income of £3,600 per year”. It might be expected that membership of a sports club would generate greater SWB gains than, for instance, doing sport once a year or less There are, however, important methodological

difference between the approach adopted by Delaney and Keaney and that reported in this section. For instance:

- The analysis undertaken in this study uses a panel dataset allowing unobservable individual variation to be controlled for, compared with the cross sectional data employed by Delaney and Keaney
- The regression models run in this study are more complete than those employed by Delaney and Keaney. For instance, Delaney and Keaney do not control for relative income, thus possibly overestimating the effect of income on SWB and underestimating the IC.

The monetary value estimate obtained using ICs can also be compared against previous estimates of the value of engaging in culture generated using more conventional economic valuation techniques. Existing UK-based estimates of people's willingness to pay to engage in culture, derived at using the contingent valuation methodology, are summarised in section 3. The highest WTP estimate derived from these studies was £27 to £50 per person to clean Lincoln Cathedral (Pollicino and Maddison, 1999).

The monetary values derived from the SWB analysis are not directly comparable with those observed in the 'willingness-to-pay' (WTP) literature. For instance, WTP values are generated for a specific site – whereas the values here are generated for a pattern of engagement. Furthermore, it is exactly the methodological problems with the WTP method that cause us to be interested in the SWB approach in the first place (see section 3). Nevertheless, it is clear that the SWB approach produces much larger values for engagement in culture than the WTP approach.

A key methodological challenge facing the calculation of ICs from the SWB approach is the currently limited understanding of the relationship between income and SWB and, thus, how models should be specified and how ICs should best be calculated. High values are generally obtained using the income compensation approach due to the relatively small effects of income on SWB (Clark and Oswald, 1996). The validity of these estimates remains a topic for further research, as, although much research has been undertaken, the relationship between income and SWB remains complex and subject of debate (Dolan et al., 2006).

The coefficient on the effect of income on SWB has been shown to change according to the structure of the utility function, the functional form employed, what variables are controlled for, and simply according to how income is measured. Most studies, however, find a significant relationship between individual or household income and well-being. Many studies find a significant positive effect of income when entered in logs, suggesting a curvilinear effect which would imply diminishing marginal returns to income. The models run in this research thus adopt this approach.

There is a strong theoretical basis for the inclusion of relative income within the utility function (Duesenberry, 1949; Frank, 1997), and many empirical studies have shown that relative income matters in addition to current income (e.g. Blanchflower and Oswald, 2004; Dorn et al., 2005; Ferrer-i-Carbonell, 2005; Graham and Felton, 2006;

Hudson, 2006; Luttmer, 2005; Weinzierl, 2005). The inclusion of relative income and the form in which it is included makes a substantial difference to the size of the absolute income coefficient (Blanchflower and Oswald, 2004; Ferrer-i-Carbonell; 2005). A number of studies have found that the coefficient on income changes considerably once additional controls have been added (Lelkes, 2006; Di Tella et al., 2003).

A further problem in estimating the income coefficient arises because income can have both a direct effect on SWB and an indirect effect. Additional income leads to improved life circumstances across a range of attributes, particularly housing conditions. If the benefits of higher income (such as better health care, living in a safer neighbourhood, owning your own home etc.) are controlled for through the addition of health status, housing tenure, etc., then the coefficient on income will be an underestimate. Further research is required to determine how the indirect effects of income on SWB are dealt with. For instance, should the variables whose effect on SWB reflects (possibly only partially) the indirect effect of income be excluded from the model? Should models be run with and without these variables in order to identify a range of ICs? In the absence of answers to these questions, the approach adopted in this report follows the convention in the extant literature.

Another challenge currently facing SWB research is the endogeneity in the relationship between well-being and income. In order to overcome this endogeneity, it is necessary to instrument income. Following Oswald and Powdthavee (2007), “interviewer saw payslip” was used as the instrument. The employment of instrumental variables in research on well-being is, however, still relatively new (Oswald and Powdthavee, 2007; Dolan and Metcalfe, 2008). Further research is required on the quality of different instrumental variables.

As well as the challenge estimating the effect of income on SWB that is required to estimate ICs, another explanation for the high ICs observed in this study is the possible lack of independence between the ICs for sport and culture. As the ICs for different engagement types have been estimated in separate models, they should not be treated as independent. That is, to the extent that a person who engages in one type of culture or sport is more likely to also engage in another, the ICs for that engagement type may also capture the effect of other types of engagement.

As well as the above methodological reasons, there are conceptual reasons why we might expect higher values obtained with ICs based on an analysis of the determinants of SWB. That is, the notion of utility captured by SWB is not confined to the narrow notion of value implicit in WTP estimates (see section 3.3.2), something that is particularly important in the field of culture. That is, SWB may be capturing more of the value of culture and sport.

4.4.3 Summary

Section 3 identified the possibility of employing SWB techniques to value engagement in culture and sport. Given the empirical and conceptual challenges to applying conventional economic valuation techniques to value engagement in culture and sport,

these techniques may provide an attractive alternative. The innovative nature of these methods, however, mean that further research is required to understand how the SWB method can be used to inform policy making. This section applies SWB methods to value engagement in culture and sport in order to explore the relevance of the method to policy making.

The preceding section discusses how the SWB method produces probable over-estimates of both the SWB impact and monetary value of engaging in culture and sport. The methodological challenges associated with the SWB method suggest that the estimated SWB effects (and their associated ICs) should be treated with caution until methodological developments improve the validity of these estimates. The discussion section to this report identifies a research agenda for taking forward the development of the SWB method.

5. The value of engagement: Measuring long-term value with decision modelling

5.1 Introduction

The previous section described the use of subjective well-being measures to short-term private benefits associated with engagement in culture and sport. As noted in section 3, however, there are many values generated by engagement beyond these immediate private benefits. Thus, relying solely on such measures would underestimate the value of engagement. The objective of this section is, consequently, to estimate the value of the longer-term benefits generated by engagement in culture and sport. Specifically, this section focuses on one of these long-term benefits – health. It is, thus, important to note that there are other benefits generated by engagement in culture and sport not captured in this analysis. Section 3 provide more detail on these benefits.

As in the previous section, value is conceived of here in monetary terms. That is, it is the objective of this section to estimate the monetary value of the longer-term benefits associated with engagement in culture and sport. It is acknowledged that there are alternative conceptions of value and that monetary valuations might not capture all the values associated with engagement (see section 3 for a more detailed discussion of these issues). The focus on monetary values was adopted, however, because the primary purpose of this exercise is to provide estimates of the value of engagement which will inform the appraisal of policies and interventions to increase engagement in line with H.M. Treasury's Green Book.

Given the lack of a single source containing the data necessary to estimate the value of the long-term benefit of engagement in culture and sport, a model-based approach was adopted. This approach draws on accepted best practice in the field of economics, in particular health economics, where it has been argued that the art of synthesising the best available evidence on the consequences of representations of "real world" choices between alternatives is an unavoidable fact of life (Marsh, 2010 in publication). Such decision models provide an explicit quantitative and systematic approach to synthesising data from different sources. This approach is part of the National Institute for Health and Clinical Excellence's (NICE) recommendation on how to conduct economic evaluations (Mugford, 2001; Cooper *et al.*, 2007).

Decision modelling splits a problem into component parts, which correspond to possible chains of events between, for instance, an activity and its consequences which generate value, and which can be evidenced from different data sources. Data are analysed by giving events a valuation (either in terms of resource use, utility gain or both), and by weighting valuations for uncertain events by the probability of occurrence.

Cooper et al. (2007) identified a number of specific reasons why decision models are employed in healthcare. One such reason relates very closely to the research problem

addressed in this section: to extrapolate primary data beyond the endpoint of a trial, or to link intermediate endpoints to ultimate measures of value (e.g. health gain measured in QALYs).

As summarised in Table 1 in section 3, some of the longer-term benefits associated with engagement in culture and sport include: health gains, improvements in employment and productivity, the social capital and cohesion benefits associated with shared experience and community-identify, bequest, reductions in crime and anti-social behaviour, and learning outcomes. Given the breadth and complexity of these outcomes, it was decided to focus on the outcomes for which it was known that data was available to apply a decision-modelling approach: health, learning, and social/community cohesion outcomes.

A key source of data for the construction of the decision models was the reviews undertaken by the EPPI-Centre as part of this project (see '*Understanding the impact of engagement in culture and sport: a systematic review of the research on learning impacts for young people*' published alongside this report on the CASE website). In particular, these reviews looked at the learning and other social outcomes generated by young peoples' engagement in culture and sport. Limitations with the evidence identified by these reviews meant that it was not possible to use the data generated by the review to model the long-term monetary benefits of learning and social outcomes[9]. While learning and social outcomes were identified by the reviews, two limitations with the data precluded such modelling. First, outcomes were often generated for an intervention designed to increase or enhance engagement, rather than for engagement itself. Second, the outcome measures used in the studies did not lend themselves to modelling. For instance, the economic literature provides estimates of the long-term monetary value of increases in productivity resulting from improvements in formal educational outcomes, while many of the learning outcomes employed in the literature were 'softer' transferable skills.

Given these limitations with the existing data, the modelling exercise focused solely on the monetary value of the long-term health gains associated with engagement in sport. More precisely, the exercise estimates the value of the improved health-related quality of life and the health care costs avoided as a result of engagement in sport. A similar exercise was not undertaken for engagement in culture, as it was not anticipated that there were likely to be substantial long-term health benefits associated with attendance at (as opposed to participation in) the cultural sectors.

5.2 Method

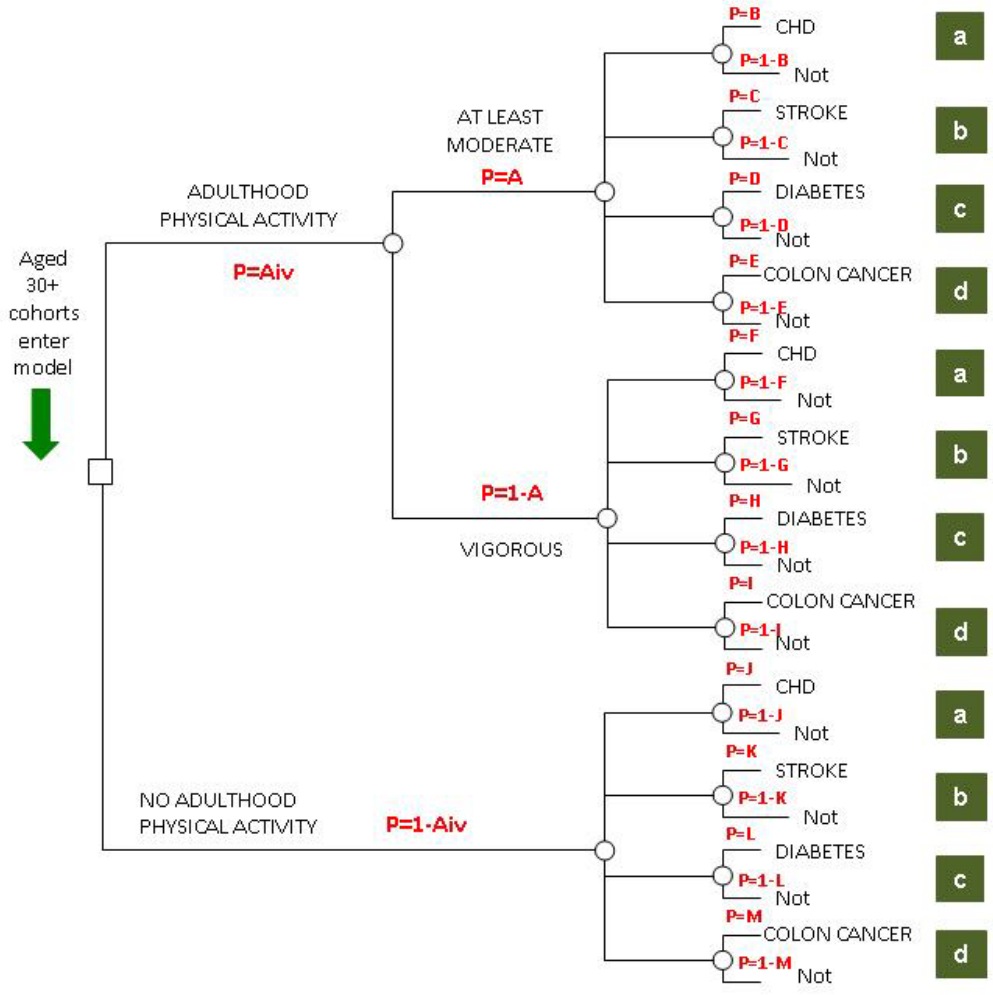
Models were built to estimate the value of the health gain associated with engaging in different sports and for different-aged cohorts. Separate models were built for the 10 most frequently engaged-in sports according to the Taking Part survey. Each of these

[9] It is important to note that alternative methodologies could be employed to model these outcomes, but they were beyond the scope of the research project reported in this paper. Further detail on alternative approaches is given in the discussion section.

models was run separately for the following age cohorts: 11-15; 16-29; 30-49; 50-65; and over 64 years old.

Two separate model structures were adopted depending on the age of the cohorts being modelled. These models follow a similar structure as those previously built by Matrix for NICE (Matrix, 2006). Figure 3 summarises the model structure adopted for adults (30 years old and over). It demonstrates the four steps involved in the modelling. First, estimating the probability that physical activity is being undertaken (p=Aiv). It was assumed that the alternative to undertaking sport was inactivity, rather than some other form of activity.

Figure 3: Model of the impact of sport on the value of long-term health gains for adults (aged 30+ years old)



Second, estimating the probability that those who are active are moderately or vigorously active (p=A). Moderate and vigorous activity levels were defined according to the levels of energy expended during the activity, or the metabolic equivalent (METs)[10]. A moderate

[10] A MET is the ratio of work metabolic rate to a standard resting metabolic rate of 1.0 (4.184 kJ).kg^{-1}.h^{-1} (Ainsworth et al., 2000).

activity was defined as an activity that expended between 3 and 6.4 METs per minute, and a vigorous activity was defined as an activity that expended greater than 6.5 METs per minute (Barker, 2006). Table 8 summarises the METs expended per minute undertaking different sports and the resulting categorisation of sports into moderate and vigorous activity levels.

Table 8: Energy levels expended per session of sport (Ridley et al, 2008)

Sport	Adult METs per session	Adults: Category	Children METs per session	Children: Category
Swimming	10	vigorous	10	vigorous
Cycling	7	vigorous	8	vigorous
Football	7	vigorous	9	vigorous
Athletics	6	moderate	7	vigorous
Golf	5	moderate	5	moderate
Badminton	5	moderate	5	moderate
Tennis	7	vigorous	8	vigorous
Squash	12	vigorous	13	vigorous
Cricket	5	moderate	4	moderate
Recreational	6	moderate	7	vigorous
Health, fitness	9	vigorous	6	moderate

In order to categorise sports into activity levels for the purpose of the modelling, the average duration and frequency of the sports, as measured in the Taking Part survey, were taken into account. That is, the estimates of METs per minute summarised in Table 8 were multiplied by the likelihood that someone who participates in the sport does so for the number of minutes per week required to classify as either moderate activity (450-974 METs per week) or vigorous activity (greater than 974 METs per week) (Barker, 2006). Table 9 summarises the resulting likelihood that participants in a sport do so in a moderate or a vigorous way. These estimates are based on an analysis of the frequency and duration of participation in Taking Part.

Table 9: Likelihood that a sport is undertaken in a manner to qualify as either moderate or vigorous activity

Sport	< moderate	moderate	vigorous
Swimming	50.4%	30.5%	19.1%
Cycling	50.0%	16.1%	33.9%
Football	49.2%	21.8%	29.0%
Athletics	63.0%	22.9%	14.1%
Golf	40.0%	20.8%	39.2%
Badminton	75.4%	18.5%	6.1%
Tennis	64.3%	18.2%	17.5%
Squash	49.2%	27.9%	22.9%
Cricket	60.9%	24.8%	14.3%
Recreational walking	22.1%	33.4%	44.5%
Health, fitness	22.4%	18.3%	59.3%

The third step in the model reported in Figure 3 is to transform variations in activity levels into the probability of experiencing long-term chronic health problems. Physical activity has been linked with a wide range of health benefits, including reduced risk of Chronic Heart Disease (CHD), numerous forms of cancer (colon, rectal, endometrial, ovarian, testicular, breast and prostate cancer), and non-insulin-dependent diabetes mellitus, depression and anxiety, osteoporosis, and reduced blood pressure in people with hypertension (Colditz, 1999; Katzmarzyk et al., 2000; Surgeon General, 1996). The modelling will focus on CHD, stroke, type-2 diabetes and colon cancer health states, as it was thought that these are most likely to be influenced by physical activity levels.

There are already a number of epidemiological studies comparing the physical activity levels and the incidence of diseases in those who exercise with those who do not. The Surgeon General's report examines the strength of the associations reported in these studies and concludes that:

> *The inverse association between physical activity and several disease states is moderate in magnitude, consistent across studies that different substantially in methods and populations, and biologically plausible. […] it is reasonable to conclude that physical activity is causally related to the health outcomes reported* (Surgeon General, 1996: 145).

A review of the epidemiological literature undertaken by Matrix Knowledge Group (2006) was drawn on to estimate the impact of physical activity on health outcomes. This literature provided estimates of the relative risk of experiencing poor health states of those who are active and those who are not active. The following equation was used to estimate the separate probabilities that those who are active and inactive experience the health problem:

$$D_{ti} = \frac{x}{t}.D_{xi} + \frac{y}{t}.D_{xi}.RR_{yi}$$

Where:

D_{ti} = The average population risk that someone experiences health state *i*.

x = The size of the active population.

y = The size of the non-active population.

t = The size of the total population.

D_{xi} = The risk that someone who is active experiences health state *i*.

RR_{yi} = The relative risk that someone who is not active experiences health state *i* compared to someone who is active.

Table 10 summarises the results of applying this equation and the sources of data used to populate the equation.

Table 10: Average lifetime risk of health states[11]

Activity level	Health state	Age (yrs)	Lifetime risk	Data	Model Ref.
CHD	Moderate	30-49	0.27	D = 0.4 (Lloyd-Jones et al, 1999) RR=1.7 (Matrix, 2006) x = 26.6% (Taking Part, 2008)	B
		50-64	0.23	D = 0.36 (Lloyd-Jones et al, 1999) RR=1.7 (Matrix, 2006) x = 17.3% (Taking Part, 2008)	B
		65+	0.17	D = 0.3 (Lloyd-Jones et al, 1999) RR=1.83 (Matrix, 2006) x=8.5% (Taking Part, 2008)	B
	Vigorous	30-49	0.21	D = 0.40 (Lloyd-Jones et al, 1999) RR=2.2 (Matrix, 2006) x = 22.2% (Taking Part, 2008)	F
		50-64	0.18	D = 0.36 (Lloyd-Jones et al, 1999) RR=2.2 (Matrix, 2006) x = 12.8% (Taking Part, 2008)	F
		65+	0.14	D = 0.30 (Lloyd-Jones et al, 1999) RR=2.2 (Matrix, 2006) x = 5.5% (Taking Part, 2008)	F
	Inactive	30-49	0.41	Estimated from data above	J
		50-64	0.37	Estimated from data above	
		65+	0.32	Estimated from data above	
Stroke	Moderate	30-49	0.11	D = 0.19 (Seshadri et al, 2006) RR=1.91 (Matrix, 2006) x = 26.6% (Taking Part, 2008)	C
		50-64	0.11	D = 0.19 (Seshadri et al, 2006) RR=1.91 (Matrix, 2006) x = 17.3% (Taking Part, 2008)	C
		65+	0.12	D = 0.19 (Seshadri et al, 2006) RR=1.6 (Matrix, 2006) x = 8.5% (Taking Part, 2008)	C
	Vigorous	30-49	0.09	D = 0.19 (Seshadri et al, 2006) RR=1.6 (Matrix, 2006) x = 22.2% (Taking Part, 2008)	G
		50-64	0.08	D = 0.19 (Seshadri et al, 2006) RR=2.44 (Matrix, 2006) x = 12.8% (Taking Part, 2008)	G
		65+	0.08	D = 0.19 (Seshadri et al, 2006) RR=2.44 (Matrix, 2006) x = 5.5% (Taking Part, 2008)	G

[11] The risk of health states for those who were moderately active was based on epidemiological data for those who were moderately and/or vigorously active. The estimates of risk associated with moderate activity are thus likely to be an underestimate.

Activity level	Health state	Age (yrs)	Lifetime risk	Data	Model Ref.
	Inactive	30-49	0.19	Estimated from data above	K
		50-64	0.2	Estimated from data above	
		65+	0.2	Estimated from data above	
Type 2 diabetes	Moderate	30-49	0.1	D = 0.17 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 26.6% (Taking Part, 2008)	D
		50-64	0.09	D = 0.16 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 17.3% (Taking Part, 2008)	D
		65+	0.07	D = 0.13 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 8.5% (Taking Part, 2008)	D
	Vigorous	30-49	0.1	D = 0.17 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 22.2% (Taking Part, 2008)	H
		50-64	0.08	D = 0.16 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 12.8% (Taking Part, 2008)	H
		65+	0.07	D = 0.13 (National Diabetes Audit) RR=1.97 (Matrix, 2006) x = 5.5% (Taking Part, 2008)	H
	Inactive	30-49	0.17	Estimated from data above	L
		50-64	0.16	Estimated from data above	
		65+	0.14	Estimated from data above	
Colon cancer	Moderate	30-49	0.03	D = 0.05 (National Cancer Registry) RR=1.53 (Matrix, 2006) x = 26.6% (Taking Part, 2008)	E
		50-64	0.03	D = 0.05 (National Cancer Registry) RR=1.53 (Matrix, 2006) x = 17.3% (Taking Part, 2008)	E
		65+	0.03	D = 0.04 (National Cancer Registry) RR=1.53 (Matrix, 2006) x = 8.5% (Taking Part, 2008)	E
	Vigorous	30-49	0.03	D = 0.05(National Cancer Registry) RR=1.53 (Matrix, 2006) x = 22.2% (Taking Part, 2008)	I
		50-64	0.03	D = 0.05 (National Cancer Registry) RR=1.53 (Matrix, 2006) x = 12.8% (Taking Part, 2008)	I
		65+	0.03	D = 0.04 (National Cancer Registry) RR=1.53 (Matrix, 2006) x = 5.5% (Taking Part, 2008)	I
	Inactive	30-49	0.05	Estimated from data above	M
		50-64	0.05	Estimated from data above	

Activity level	Health state	Age (yrs)	Lifetime risk	Data	Model Ref.
		65+	0.04	Estimated from data above	

The fourth step in the model was to value the health states experienced. Two types of value were included in the model. First, the health care cost of treating the health state. Table 11 summarises the health care costs included in the model.

A second value included in the model was the health-related quality of life loss associated with the health state (measured using Quality Adjusted Life Years – QALYs). Table 12 summaries the QALY losses associates with health states included in the model[12].

All health care cost and QALY loss estimates are discounted at 3.5% in line with H.M. Treasury guidance. The results of the analysis using a discount rate of 0% are reported in Appendix 6.

[12] The QALY is a standardised measure of health gain widely used in health economics. It comprises two dimensions: time and quality of life. The latter is measured on a scale between 0 (death) and 1 (perfect health). For instance, 1 year of perfect health is measured as 1 QALY. The advantage of this scale is twofold: not only does it allow different health effects to be expressed on a single scale; but there are also accepted monetary values for QALYs that allows these effects to be expressed as monetary values.

Table 11: Discounted health care costs (£, 2009)

Health state	Age (yrs)	Cost	Source	Model Ref.
CHD	30-49	£15,552	Annual cost: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 35.91 years (Matrix 2006)	a
	50-64	£14,444	Annual cost: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 18.41 years (Matrix 2006)	
	65+	£4,119	Annual cost: Matrix (2006) Age onset: 80 (assumption) Period onset-death: 8.1 years (Matrix 2006)	
Stroke	30-49	£21,929	Annual cost: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 22.62 years (Matrix 2006)	b
	50-64	£8,855	Annual cost: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 5.12 years (Matrix 2006)	
	65+	£3,219	Annual cost: Matrix (2006) Age onset: 80 (assumption) Period onset-death: 3.6 years (Matrix 2006)	
Type 2 diabetes	30-49	£31,411	Annual cost: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 45.63 years (Matrix 2006)	c
	50-64	£35,514	Annual cost: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 28.13 years (Matrix 2006)	
	65+	£10,873	Annual cost: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 10.2 years (Matrix 2006)	
Colon cancer	30-49	No estimate	No reliable annual cost data	d
	50-64	No estimate	No reliable annual cost data	
	65+	No estimate	No reliable annual cost data	

Table 12: Discounted health related-quality of life lost (£, 2009)

Health state	Age (yrs)	QALY loss	Source	Model Ref.
CHD	30-49	5.3	Annual utility loss: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 35.91 years (Matrix 2006)	a
	50-64	3.24	Annual utility loss: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 18.41 years (Matrix 2006)	
	65+	2.05	Annual utility loss: Matrix (2006) Age onset: 80 (assumption) Period onset-death: 8.1 years (Matrix 2006)	
Stroke	30-49	8.95	Annual utility loss: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 22.62 years (Matrix 2006)	b
	50-64	6.23	Annual utility loss: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 5.12 years (Matrix 2006)	
	65+	3.62	Annual utility loss: Matrix (2006) Age onset: 80 (assumption) Period onset-death: 3.6 years (Matrix 2006)	
Type 2 diabetes	30-49	1.22	Annual utility loss: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 45.63 years (Matrix 2006)	c
	50-64	0.77	Annual utility loss: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 28.13 years (Matrix 2006)	
	65+	0.42	Annual utility loss: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 10.2 years (Matrix 2006)	
Colon cancer	30-49	9.51	Annual utility loss: Matrix (2006) Age onset: 55 (assumption) Period onset-death: 35.91 years (Matrix 2006)	d
	50-64	5.81	Annual utility loss: Matrix (2006) Age onset: 68 (assumption) Period onset-death: 18.41 years (Matrix 2006)	
	65+	2.7	Annual utility loss: Matrix (2006) Age onset: 80 (assumption) Period onset-death: 8.1 years (Matrix 2006)	

QALYs gained as a result of engaging in sport were valued monetarily using the £20,000 lower bound of the values applied as part of NICE guideline development.

It was necessary to modify the above model to estimate the value of participating in sport as a young person (11-29). That is, it was necessary to estimate the relationship between undertaking sport as a young person, and being physically active as an adult (30-49 years old). Figure 4 summarises the model constructed for young people.

Figure 4: Model of the impact of sport on the value of long-term health gains for young people (aged 11-29 years old)

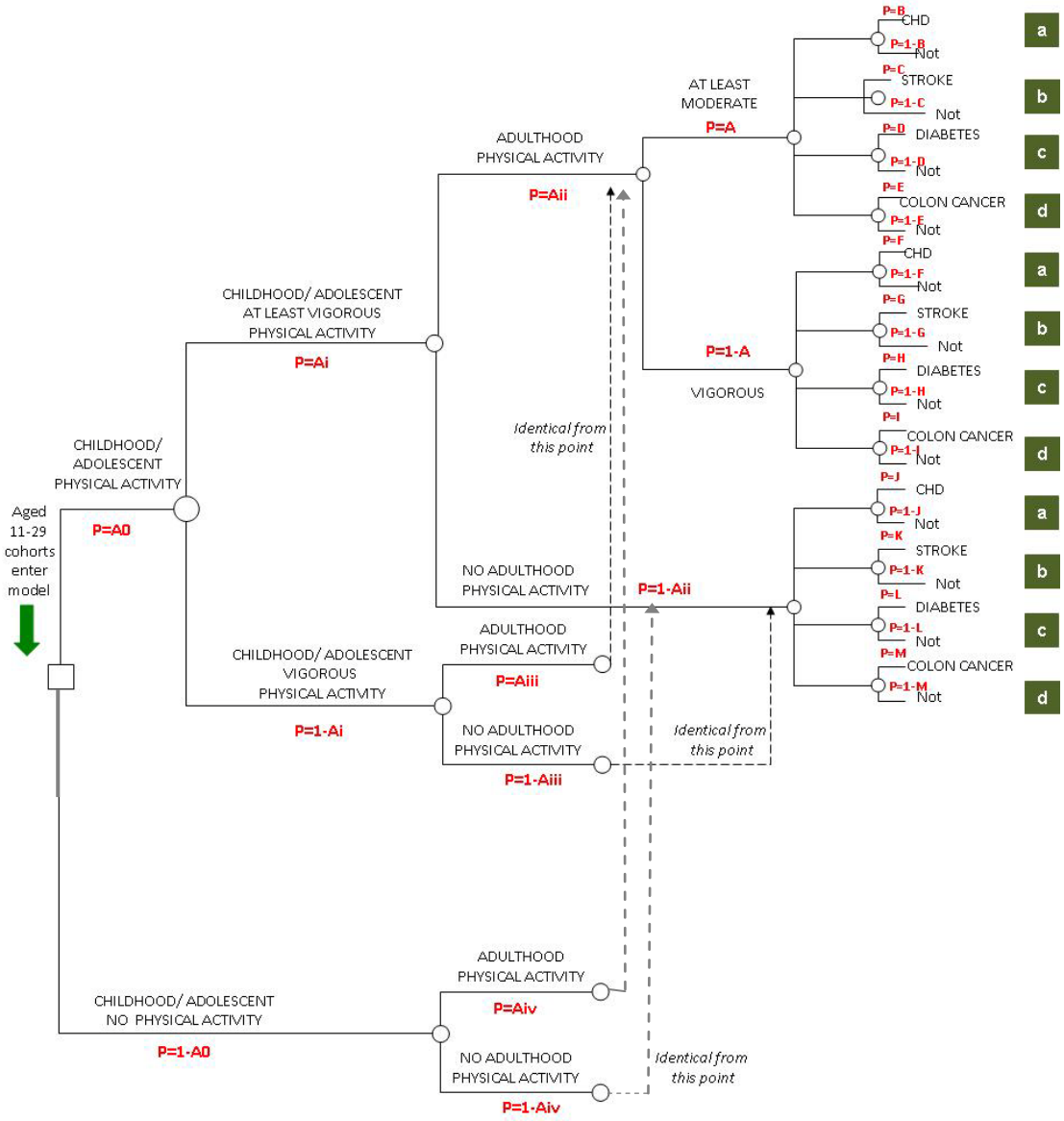


Table 13 summarises those parameters used in the young people's model that are not also include in the adult model.

Table 13: Transition Probabilities: Probability of physical activity in children and young people

Parameter	Age	Activity	Probability	Source	Model

		level			ref.
Baseline activity level	11-15	Moderate	0.24	HSE (2008)	Ai
		Vigorous	0.24	HSE (2008)	
	16-29	Moderate	0.37	Taking Part (2008)	
		Vigorous	0.33	Taking Part (2008)	
Activity as adult if moderate activity in childhood/young adulthood	11-15	Moderate	0.55	HSE (2006)	Aii
		Vigorous	0.43	HSE (2006)	
	16-29	Moderate	0.64	HSE (2006)	
		Vigorous	0.57	HSE (2006)	
Activity as adult if vigorous activity in childhood/young adulthood	11-15	Moderate	0.20	HSE (2006)	
		Vigorous	0.79	HSE (2006)	
	16-29	Moderate	0.12	HSE (2006)	
		Vigorous	0.86	HSE (2006)	
Activity as adult if inactivity in childhood/young adulthood	11-15	Moderate	0.18	HSE (2006)	Aiii
		Vigorous	0.06	HSE (2006)	
	16-29	Moderate	0.19	HSE (2006)	
		Vigorous	0.07	HSE (2006)	

5.3 Results

Tables 14 and 15 summarise the economic value of the health gain associated with playing different sports (compared with not playing sport) for different age groups. Tables 14 shows the long-term health costs saved as a result of participating in sports at different ages. Table 15 shows the total economic value associated with participating in sport at different ages. The total economic value comprises the health costs saved summarised in Table 14 and the health related quality of life is valued at £20,000 per Quality Adjusted Life Year (QALY) value of the health related quality of life gains (which is the lower bound of the values applied as part of NICE guideline development).

Tables 14 and 15 demonstrate the economic value generated by the health gains associated with getting people to do sports at different points in their life. For instance, compared with a person who does not play sport, a person who plays football at the age of 30-49 years old is expected to experience health outcomes worth about £27,600 over the remainder of their lifetime, comprising about £4,200 in avoided health care costs and £23,400 in improve quality of life.

Table 14: Discounted health cost savings associated with playing sport (based on actual frequency and duration of engagement)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£1,383	£2,955	£3,768	£3,061	£832
Cycling	£1,574	£3,362	£4,287	£3,285	£854
Football	£1,532	£3,274	£4,174	£3,264	£862
Athletics	£1,030	£2,201	£2,806	£2,282	£621

Golf	£1,870	£3,996	£5,095	£3,922	£1,023
Badminton	£645	£1,378	£1,756	£1,472	£409
Tennis	£1,042	£2,225	£2,837	£2,255	£603
Squash	£1,458	£3,114	£3,970	£3,181	£856
Cricket	£1,081	£2,310	£2,945	£2,403	£655
Recreational walking	£2,350	£5,021	£6,401	£5,005	£1,322
Health/fitness	£2,524	£5,393	£6,876	£5,190	£1,332

Table 15: Discounted total economic value of the health gain associated with playing sport (based on actual frequency and duration of engagement, and £/QALY = £20,000)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£9,023	£19,320	£24,681	£16,432	£7,953
Cycling	£10,418	£22,290	£28,473	£17,965	£8,471
Football	£10,093	£21,601	£27,594	£17,732	£8,438
Athletics	£6,718	£14,383	£18,375	£12,244	£5,928
Golf	£12,368	£26,463	£33,805	£21,417	£10,119
Badminton	£4,171	£8,934	£11,413	£7,827	£3,840
Tennis	£6,833	£14,627	£18,685	£12,186	£5,840
Squash	£9,543	£20,428	£26,097	£17,149	£8,249
Cricket	£7,045	£15,084	£19,270	£12,881	£6,246
Recreational walking	£15,481	£33,129	£42,321	£27,195	£12,940
Health/fitness	£16,772	£35,879	£45,831	£28,521	£13,355

Tables 14 and 15 both indicate that the economic value of doing sport increases between adolescence and middle age, before reducing to old age. This pattern is the result of a combination of two forces:

1. The effect of discounting: Economic value incurred in the future is discounted in line with H.M. Treasury guidance. Thus, for instance, if a stroke is likely to happen at the age of 60, a 15 year old avoiding that stroke in 45 years time is worth less than a 20 year old avoiding a stroke in 40 years time.
2. The timing of the health state: People in older age groups, if they experience a health problem will do so at an older age and will experience the problem for a shorter length of time. This reduces the value of avoiding the health state.

The economic value generated by doing sport is generated a number of years in the future. The exact timing of the gain depends on the age of doing sport, and the nature of the chronic disease avoided – stroke, diabetes, cancer, and CHD. Further detail on the timing of these effects for different age cohorts is included in the tables in the methods section.

From the data employed in the analysis, it is not possible to say how long a person needs to maintain the sporting activity to ensure these values are obtained. The epidemiological data identifies whether a person in this age group is active and

assesses the association between this activity and whether the person experiences a health state later in life. It does not, however, measure the maintenance of activity required to ensure the health state is avoided.

The results reported in Tables 14 and 15 assume that those people who do sport do so with frequency and duration of reported in the Taking Part survey. Tables 16 and 17 report the value of doing sport if it is undertaken 3 times a week for 30 minutes (assuming that other non-sport activity expends energy equivalent to 60 minutes of moderate exercise per week).

Table 16: Health cost savings associated with playing sport (based on target frequency and duration of engagement)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£3,618	£7,722	£9,843	£7,212	£1,849
Cycling	£2,243	£4,799	£6,119	£5,444	£1,529
Football	£2,243	£4,799	£6,119	£5,444	£1,529
Athletics	£2,243	£4,799	£6,119	£5,444	£1,529
Golf	£2,243	£4,799	£6,119	£5,444	£1,529
Badminton	£2,243	£4,799	£6,119	£5,444	£1,529
Tennis	£2,243	£4,799	£6,119	£5,444	£1,529
Squash	£3,618	£7,722	£9,843	£7,212	£1,849
Cricket	£2,243	£4,799	£6,119	£5,444	£1,529
Recreational walking	£2,243	£4,799	£6,119	£5,444	£1,529
Health/fitness	£3,618	£7,722	£9,843	£7,212	£1,849

Table 17: Total economic value of the health gain associated with playing sport (based on target frequency and duration of engagement, and £/QALY = £20,000)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£23,742	£50,767	£64,847	£39,009	£17,941
Cycling	£14,717	£31,551	£40,312	£29,448	£14,839
Football	£14,717	£31,551	£40,312	£29,448	£14,839
Athletics	£14,717	£31,551	£40,312	£29,448	£14,839
Golf	£14,717	£31,551	£40,312	£29,448	£14,839
Badminton	£14,717	£31,551	£40,312	£29,448	£14,839
Tennis	£14,717	£31,551	£40,312	£29,448	£14,839
Squash	£23,742	£50,767	£64,847	£39,009	£17,941
Cricket	£14,717	£31,551	£40,312	£29,448	£14,839
Recreational walking	£14,717	£31,551	£40,312	£29,448	£14,839
Health/fitness	£23,742	£50,767	£64,847	£39,009	£17,941

The QALY gains reported in the above tables differ from SWB estimates reported in the previous section in two important ways:

1. QALYs measure a more narrow definition of quality of life – health related quality of life rather than life satisfaction.
2. The QALY measures relate to longer-term gains, while the SWB estimates measure immediate improvements in quality of life.

As with any modelling exercise, the results reported above are subject to uncertainty. In particular, a key parameter in this analysis is the relationship between short-term physical activity and longer-term health outcomes. There are a number of challenges to modelling this long-term relationship, including:

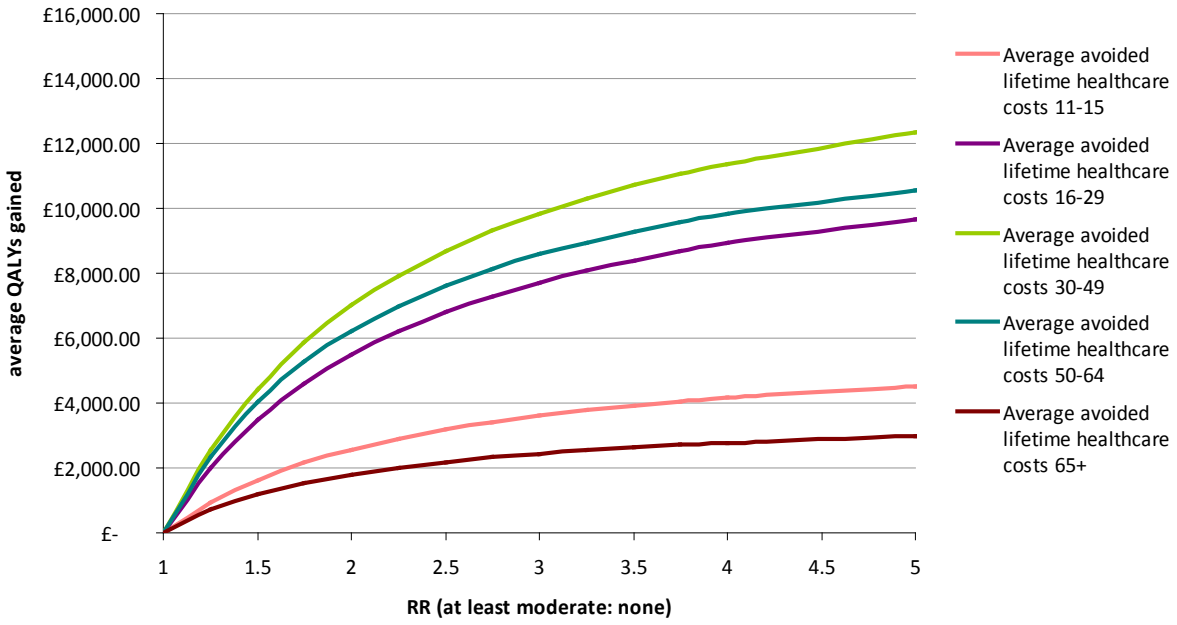
- The epidemiological data available in the current literature is rarely presented for the specific age cohorts for whom the models were run.
- The epidemiological literature employs a range of definitions of physical activity and the analysis is run for a range of physical activity categories, which do not always match precisely with the data on the activity levels associated with different sports.

Two types of analysis were undertaken to assess the impact of this uncertainty on model outcomes. First, the models were re-run using the intervals for the relative risk of health states, where these were presented in the literature. The results of this analysis are presented in Appendix 6. It is important to note that not all the epidemiological relationships used in the analysis were statistically significant from zero.

Second, sensitivity analysis was undertaken to determine how QALY gains and healthcare costs avoided vary with the relationship between physical activity levels and longer-term health outcomes. The complete results of this sensitivity analysis are available in Appendix 6. Figure 5 presents an example of this sensitivity analysis – the

sensitivity of health cost saved to the relative risk of experiencing health states with moderate activity, when compared with no activity.

Figure 5: Sensitivity of health cost saved to relative risk of experiencing health states with moderate activity (vs. no activity)



On its own, the sensitivity analysis presented in figure 5 is of little meaning. In conjunction with a measurement of the cost of an intervention to improve sport and physical activity levels, this type of sensitivity analysis can be employed to estimate the relationship between activity levels and health outcomes that would have to hold before the intervention proved to be value for money. That is, if the effect size of an intervention is known, the analysis reported in Figure 5 can be used to determine whether the value of this effect size exceeds the cost of the intervention.

5.4 Discussion

The objective of this section was to estimate the value of the longer-term health benefits generated by engagement in sport. It demonstrates that a number of sports generate substantial long-term economic value in terms of avoided health costs and improved health-related quality of life.

Implications for policy making

The economic value of engaging in sport can be used to inform the amount of money that government should invest in encouraging people to engage in sport. For instance, the analysis would suggest that the health gains associated with 30-49-year-olds playing football are £27,600 (over the lifetime of the individual, based on a QALY value of £20,000). If an intervention aimed at increasing the likelihood that a 30-49-year-old plays football resulted in one in every 100 people receiving the intervention starting to play football, then as long as the intervention costs less than £276 per person it will be considered value for money.

A number of caveats are necessary, however, before the results are applied to policy evaluation. First, the benefits included in the analysis are particularly relevant from a health policy perspective, while the costs of encouraging engagement in sport will most likely fall on a number of other departments. Understanding the distribution of costs and benefits is, however, important in order to facilitate informed policy discussion. In this vein, it is increasingly being recognised, especially in the field of public health, that economic analysis should be undertaken from a multi-sector perspective (Claxton et al., 2007). Such analysis makes transparent the distribution of costs and benefits, possibly enabling the winners to compensate the losers to ensure that the policy is implemented.

Second, the benefits captured in the analysis will be experienced in the long-term, while policy perspectives might dictate a shorter-term perspective is necessary to justify investment. Further work is required to elaborate the exact timing of the benefits associated with playing sport (see below).

Implications for research

As with many economic modelling exercises, a number of simplifying assumptions are necessary to conduct the modelling. These work both to underestimate and to overestimate the value of sport, including:

- The model focused on four health outcomes: CHD, stroke, diabetes and colon cancer. This ignores the positive impact of sport on other health outcomes, such as mental health. Such short-term subjective well-being impacts of sport are the subject of the valuation work undertaken in the previous section.
- It is assumed that the chances of experiencing the four health states included in the model are independent. This is unlikely to be the case.
- The model does not consider the costs to the health service of increased longevity as a result of the intervention.
- Negative effects of physical activity, such as injuries, are not considered in the model.

Two further methodological challenges are the focus of current research in health economics and thus might offer the potential for further improvements in the valuation of participation in sport. First, the models required assumptions to be made regarding

the age of onset of the four health states modeled. The estimate of the timing of the benefits could be improved by employing dynamic model structures, such as Markov structures.

Second, there is some uncertainty about the monetary value of health-related quality of life. The model employs a range of values from the literature. There are, however, two important considerations for how future sport valuation exercises are undertaken. First, there is uncertainty about the value of a QALY. NICE's current threshold of £20,000-£30,000 is based on an analysis of previous decisions taken by NICE guideline development committees, rather than population preference (as suggested by the H.M. Treasury Green Book). Furthermore, there are arguments for increasing (Towse, 2009) and decreasing (Raftery, 2009) the current NICE threshold.

Second, health economic analysis has conventionally relied on the assumption that each QALY gained has the same value to society. The idea that the value of a QALY might vary between contexts and across sub-groups of patients has, however, recently been acknowledged in NICE's supplementary advice on the treatment of QALYs gained by patients at the end of life (Rawlins et al, accepted article). To date, however, the empirical evidence to support such value judgments is limited. For example, most of the few studies that do exist explore ordinal preferences and thus do not enable the derivation of quantitative weights (for reviews, see Dolan and Tsuchiya, 2006; Shah, 2009).

As well as the specific questions about the models listed above, the research also points to larger gaps in the research, including:

- The epidemiological evidence on the relationship between physical activity levels and long-term health gains. When modelling actual engagement intensities, it was not possible to estimate the long-term health gain for all sports. This could be overcome through improvements in the epidemiological literature to allow more accurate measurement of the relationship between changes in physical activity levels and long-term health outcomes.
- The impact of engagement in culture and sport on other outcomes. The analysis focused on the health effects of sport because the range of evidence for these areas is insufficient to carry out a similar analysis. Further research should focus on analysing existing survey data to assess the effect of engagement in culture and sport on such longer-term effects.

6. Summary and conclusion

The objective of this report is to address the question: What is the economic value of engaging in sport and culture? The importance of this question for policy makers depends on the existence of benefits from engagement that cannot be provided by the market. Section 3 argued that culture and sport is characterised by the existence of externalities and information problems, and that elements of culture and sport have the properties of public goods. Thus, the market cannot be relied upon to deliver the benefits of engagement in culture and sport, justifying government intervention to increase levels of engagement.

Government intervention is currently limited by a lack of understanding of the economic value of engagement. That is, in order to justify expenditure on government activities to increase engagement it is important to understand that the benefits of these activities exceed their costs. A review of the current economic literature identified a paucity of evidence on the economic value of engagement. Furthermore, methodological challenges, as well as limitations to the scope of this research project, meant that conventional economic valuation techniques, such as stated preference and revealed preference approaches, could not be employed to fill this gap.

Given the scope of the project, estimating the value of engagement was restricted to analyses of secondary data. As a consequence, two innovative modelling approaches were adopted to estimate the value of engagement. Section 4 presented the results of an attempt to apply the SWB method to estimating the short-term private value of engagement. Section 5 summarised a decision model to estimate the long-term value of engagement. What do the results of these approaches imply for policy making, and what insights does having applied these methods have for further economic research in the area of culture and sport?

The SWB analysis has the potential to provide a number of insights for policy makers. Comparison of the SWB gains generated by different policy outcomes can be used to inform the level of investment that represents good value for money. Exactly how – and if – these figures are used in policy appraisal is a matter of debate.

Combined with the calculation of income compensation (IC) estimates, the SWB approach also has the potential to estimate the monetary value of engagement. The methodological challenges associated with the SWB method suggest that the SWB effects and ICs estimates should, however, be treated with caution until methodological developments improve the validity of these estimates. Specifically, the following key developments are required to improve the reliability of the SWB method:

1. More measures of engagement should be included in national longitudinal surveys, such as the British Household Panel Survey (BHPS). The inclusion of such measures in the successor to the BHPS, Understanding Society, will ensure such data is available in the future.

2. Further research is required on the relationship between income and SWB. The calculation of ICs requires coefficients for the relationship between income and SWB.

SWB models capture the short-term private value of policy outcomes. Decision modelling was undertaken to estimate the longer-term benefits of engagement. Specifically, a decision-modelling approach was adopted to estimate the economic value generated by the long-term health gains associated with doing sport. This demonstrates that a number of sports generate substantial long-term economic value in terms of avoided health costs and improved health-related quality of life. For instance, compared with a person who does not play sport, a person who plays football at the age of 30-49 years old is expected to experience health outcomes worth £27,600 over the remainder of his lifetime.

Once again, a number of research implications are derived from having undertaken the decision modelling. In particular, limitations with the existing data meant that the scope of the decision modelling was limited to estimating the economic value generated by the long-term health gains associated with doing sport. Further research should focus on analysing existing survey data to assess the effect of engagement in culture and sport on other longer-term effects, such as community cohesion and learning outcomes.

In summary, this report has demonstrated the potential of a number of modelling approaches to valuing engagement in culture and sport. These approaches have the advantage of not requiring the same level of resources as primary research, such as would be required to apply a stated preference approach, and thus providing policy makers with information in a shorter timescale. However, further methodological development is required before some of these methods, in particular the SWB approach, is able to generate policy relevant results.

Other approaches not discussed in this paper should also be considered when developing methods for valuing engagement in culture and sport. For instance, another approach to measuring and valuing outcomes that has been adopted in health economics is referred to as the “extra-welfarist” approach. A key feature of this approach is the use of the Quality Adjusted Life Year (QALY) as a standard outcome measure. One avenue for further research could be the development of standard outcome measures for the fields of culture and sport, analogous to the QALY in healthcare.

There are a number of outcomes associated with engagement, such as impacts on identity, which will be challenging to capture in WTP approaches. Furthermore, the benefits of engagement are multi-dimensional. Again, one way to incorporate such outcomes into an economic analysis would be to develop a QALY-style outcome metric. A number of other fields are developing similar metrics. For instance, the Personal Social Services Research Unit is currently undertaking research to produce a QALY-type metric for social care outcomes. The advantage of such a metric would be that it would allow comparison of outcomes across cultural activities. The starting point

for such an exercise could be Throsby's (2001) dimensions of cultural value: aesthetic, spiritual, social, historical, symbolic, and authenticity.

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8. Appendix 1: Evidence on the well-being impact of engagement in culture and sport

This appendix provides detail on the studies identified by Galloway (2005) in her review of the literature on the impact of participating in culture and sport on quality of life (QOL) and well-being.

Culture

Galloway (2005) reviewed the evidence on the impact of participation on cultural programmes and activities on QOL and well-being. From the studies identified by the review, four were considered relevant ato this project. Other studies were not considered relevant for two reasons:

- Two studies were excluded from consideration because they suffered from methodological limitations: one was a qualitative study and the other one did not make use of a comparator group.
- Four studies were excluded as they did not have a particular focus on culture-related activities, but on leisure and daily activities.

Table 18 provides a summary of the selected studies. As reported in Galloway (2005), the following details are included: country, target population, aims, methodology, and sample. In addition, the table presents the type of engagement with cultural activities and the main findings of the studies in relation to the purpose of this report.

Two of the papers are within the gerontology and music therapy disciplines. Burack et al (2002) and VanderArk et al (1983) both looked at the effect of music sessions on nursing home residents, but they applied different methods. Burack et al (2002) analysed individuals before and after exposure to 30 minutes of music of their own selection, while VanderArk et al (1983) compared individuals exposed to music with age-matched residents of another nursing home that had no music programme. In Burack et al's study, individuals expressed having experienced positive emotions of satisfaction, but no statistically significant differences were found between the 'before' and 'after' tests relating to global QOL. In contrast, according to VanderArk et al (1983), residents in the experimental group had much improved ratings of life satisfaction compared with the control group. However, no statistical measure of this effect is available. Moreover, information on the quality of life or life satisfaction scales is not available; therefore it is not possible to provide any further interpretation of the results and their comparability.

Michalos (2005) measured the impact of arts-related activities on various measures associated with well-being (including, among others, satisfaction with life as a whole, overall quality of life, living standards, happiness, and an index of subjective well-being) on a sample of 315 adult residents from one Canadian city. Respondents were asked to rate, on a 7-point scale, the satisfaction gained from 66 arts-related activities. They were also asked about the frequency and intensity of participation. No significant

correlation was found between the average amounts of time spent on activities and the average levels of satisfaction obtained from them. However, for some of the activities, the frequency of engagement and/or the levels of satisfaction obtained from them were positively correlated with various measures of quality of life and well-being. Yet, relative to the satisfaction obtained from other domains of life –such as friendships and family relationships, it was found that the arts had a very small impact on life satisfaction, overall quality of life, happiness and subjective well being.

Given the paucity of evidence, a study investigating the effect of culture on survival – rather than quality of life or well-being– was included in the summary. Bygren et al (1996) investigated whether engagement in cultural activities had an effect on the risk of death among the general population of Sweden. They looked at the frequency of attendance at cultural activities (including to the cinema, theatre, concert and live music, museum, art exhibition, sermon, or sports events as a spectator) and frequency of playing music or singing in a choir. The results indicate that, controlling for age, sex, educational level, income, disease prevalence, social network, smoking, and physical exercise, people attending cultural events seem to live longer than those who attend rarely. However, this result was obtained using an overall index of attendance, rather than measuring the effect of each activity separately.

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Table 18: Evidence on the relationship between culture and well-being

Reference	Country	Target population	Aims	Methodology	Sample	Type of engagement	Findings
Burack et al (2002)	US	Nursing home residents (older people)	To investigate the effect on immediate satisfaction and global QOL of providing cognitively intact nursing home residents with music	Quantitative and qualitative. Before and after study. Closed question survey instrument administered in face to face interviews, and structured open questions.	13 nursing home residents meeting study criteria	Exposure to 30 minutes of music of their own selection	Positive emotions of satisfaction, but no statistically significant differences found between the 'before' and 'after' tests relating to global QOL
VanderArk et al (1983)	n/a	Nursing home residents	To investigate the effect of a music program on life satisfaction	Quantitative. Using control groups	Sample of nursing home residents, aged 60-95 years, and age-matched with residents of another nursing home that had no music programme	Exposure to 45 minute participatory music sessions, held weekly for five weeks	Residents in the experimental group had much improved ratings of life satisfaction, attitude towards music, and music self-concept, compared with the control group

Reference	Country	Target population	Aims	Methodology	Sample	Type of engagement	Findings
Michalos (2005)	Canada	Adult residents of Prince George	To measure the impact of the arts on the perceived QOL of residents (eight measures including, among others, satisfaction with life as a whole, overall quality of life, living standards, happiness, and an index of subjective well-being)	Quantitative. Statistical analysis using step-wise multiple regression. Postal survey: self-completion questionnaire	315 residents representing 13% of the random sample of 2,500 households to whom questionnaires sent	Average weekly and yearly participation rates in 66 arts-related activities	No significant correlation between the average amounts of time spent on activities and the average levels of satisfaction obtained from them. The level of engagement and satisfaction attached to the arts-related activities was correlated with some of the QOL measures considered.
Bygren et al (1996)	Sweden	General population	To investigate whether cultural activities have an effect on survival/death risk	Quantitative. Using interviews and a proportional hazards model	12,982 people aged 16-74 years	Frequency of attendance to cultural activities and frequency of playing music or singing in a choir	People attending cultural events seem to live longer than those who attend rarely. No significant effect of making-music activities.

Sport

The aim of Galloway's review was to synthesise the literature relating to sport, QOL and well-being. Given the paucity of sport-specific evidence, the review drew on the wider exercise literature. From the studies identified by the review, three were selected for discussion in this appendix.

As well as non-quantitative studies, those related to walking interventions were not considered relevant for the purpose of this report. Table 19 provides a summary of the selected studies. As reported in Galloway (2005), the following details are included: country, target population, aims, methodology, and sample. In addition, the table presents the type of engagement with sport activities and the main findings of the studies in relation to the purpose of this report. As with those related to culture, most studies provide very little detail on how and with what frequency the subjects under study engage in sport activities.

Snyder and Spreitzer (1974) and Edwards et al (2004) explored the relationship between participation in sports and psychological well-being. Both studies found a positive relationship between both variables. Edwards et al (2004) compared actively engaged individuals with non-exercising individuals. Two measurement scales were used:

- A scale of psychological well-being including the following six dimensions: self acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth
- A scale of physical self-perception, which is related to self-esteem, well-being, health and life, and measures self-perception in five categories: sports competence, physical condition, body attractiveness, physical strength, and physical self worth.

The authors found that hockey players and health club members (involved in relatively more aerobic and resistance exercise) were generally more psychologically well and had more positive physical self-perception than non-exercising students.

Similarly, in Snyder and Spreitzer (1974) the findings support the thesis that there is a positive relationship between sports involvement and psychological well-being. However, it is not clear from the information available what it is meant by psychological well-being or what comparator group was used. The authors looked at both active and passive participants –e.g. participants in sport and those watching sports– but no details are available on the differential effect, if any, of these two levels of engagement on psychological well-being.

Interestingly, Edwards et al (2004) found that hockey players had significantly higher scores than health club members on positive relations with others, sports competence

and sport importance. This could possibly be linked to the fact that hockey is a team sport while health club activities such as aerobic and resistance exercise tend to be individual activities.

Hills and Argyle (1998) explored four leisure activities: sport/exercise, music, church and watching TV-soaps. The four activities were a significant source of positive moods. As a measure of happiness, the authors used the Oxford Happiness Inventory (OHI), which includes seven factors: satisfaction with life, efficacy, sociability/empathy, a positive outlook, well-being, cheerfulness, and self-esteem. The study found that membership of sport/exercise groups was the only activity having a significant effect on the full OHI, and it also correlates positively with the sociability, well-being and cheerfulness factors. The study compared members of sport/exercise clubs with non-members but further details on the type or intensity of engagement are not provided and no distinction is made between sport and exercise.

Figure 19: Evidence on the relationship between sport/exercise and well-being

Reference	Country	Target population	Aims	Methodology	Sample	Type of engagement	Findings
Snyder and Spreitzer (1974)	US	Residents of Toledo, Ohio	To investigate whether involvement in sports leads to improved perceived life satisfaction and happiness	Quantitative. Used established measurement instruments for psychological well-being	Systematic probability sample based on city street directory – sample size 510	Different levels of engagement, including watching sport as well as participation in sport	Positive relationship between sports involvement and psychological well-being. No further details allow determining the strength of the relationship for different types/frequency of engagement
Hills and Argyle (1998)	UK	Members of leisure groups, resident in Oxfordshire	To explore the relationship between personality and happiness, and the impact of leisure participation	Quantitative. Used Oxford Happiness Inventory (OHI) as a measure of happiness. Factor analysis	275 participants aged between 18 and 82 years, mainly professional, graduates and living with a partner	Membership in sports clubs compared against music and church membership, and TV-soaps watchers	Membership of sports clubs appeared to result in increased happiness (compared to non-members). Membership of sports groups also correlated positively with the sociability, well-being and cheerfulness component factors of the OHI.

Reference	Country	Target population	Aims	Methodology	Sample	Type of engagement	Findings
Edwards et al (2004)	South Africa	Students	To examine the relationship between mental health and diverse types of exercise and sport	Quantitative. Used control group to compare change in psychological well-being between exercising and non-exercising subjects.	60 university hockey players, 27 health club members and 111 non-exercising students	Membership and activity participation compared against non-exercise	Hockey players and health club members were generally more psychologically well and had more positive physical self-perception than non-exercising students.

9. Appendix 2: Mapping the literature on the economic value of culture and sport

Section 3.3.2 presents a map of the evidence available to value engagement in culture and sport using economic values. This annex summarises the method employed to identify and map the literature.

Identifying studies

Two approaches were employed to identify studies of the monetary value of sport and culture assets and engagement in culture and sport: contacts with stakeholders and experts in the field; and searches of databases, journals, and other

Table 20 summarises the search terms employed as part of the second of these approaches.

Table 20: Summary of search terms employed

Search Source	Key search terms
Econlit (database)	'Value' OR 'willingness to pay' OR 'contingency analysis' OR 'Cost benefit' OR 'model*' OR 'choice modelling' OR 'impact' AND 'Culture' OR 'sport' OR 'heritage' OR 'libraries' OR 'museums' OR 'art'
Journal of cultural economics and Journal of sports economics	Hand searching of some recent issues for relevant articles.
Lists of studies that estimate the value of sports and culture prepared by Snowball (2008) and Noonan (2002)	Hand searched articles listed by the two authors.
Snowballing	Searching the reference lists of reviews, reports and meta-analysis on the topic for relevant studies. Google scholar's function called 'related search' will also be used to identify related studies to some of the key papers
Google scholar 1st 10 pages	'value' 'pay for' 'culture' 'sport' 'heritage' 'libraries' 'museums' 'art'
Google scholar 1st 5page	'economic value' 'willingness to pay' 'sports'
Contacting authors	Some researchers who have knowledge or expertise in this field.

The titles and abstracts of the studies identified through the above sources were reviewed to assess their relevance, defined as containing a monetary value of a sport or cultural asset or engagement in sport or culture (for more detail, see Working Paper 4 in this series). The search identified **94 studies** that were relevant to this project.

Coding studies

Each study was coded according to the following criteria:

- Whether it was undertaken in the UK or not.
- The 'domain' of sport and culture: art, archives, heritage, libraries, museums, or sport.
- The nature of the good being valued, including:
    a. The improvement of an asset or the prevention of damage to an asset, such as restoration work on a heritage site.
    b. The production of an asset or work to ensure the continued existence of an asset, e.g. the building of a sport arena, or avoiding closing a library.
    c. The purchase of the flow of services provided by an asset, e.g. the annual funding for a museum, or the income generated by an art gallery.
    d. The purchase of one unit of engagement with an asset, e.g. willingness to pay to attend a festival or gain entrance to a heritage site.
- The valuation method employed, including:
    a. Monetary valuation techniques, such as contingent valuation, the travel cost method, choice experiments, or hedonic pricing.
    b. Analysis of funding.
    c. Analysis of the cost of providing a service.
    d. Analysis of market prices.
    e. Analysis of income generated, including:
        i. Direct income: the income generated from people paying to use the good.
        ii. Indirect income: the income generated as a result of users of sporting and/or cultural assets spending on goods and services other than the sporting and/or cultural asset.
        iii. Total income: the total income generated as a result of the sporting and/or cultural asset, including an assessment of the multiplier effect of spending by users of the asset.
- The type of value estimates reported, including:
    a. Use and / or non-use value.
    b. Total and / or average value.
    c. One-off payment, payment per visit, and/or payment per unit of time.

Where a study reported the results of more than one method, or more than one type of value estimates, it was coded multiple times. Following the coding exercise, approximately 220 data types had been coded.

A number of rules where then applied to avoid double counting of data and identify the data of most use to the project, including:

- Where a study produced the same data for a number of sub-groups, e.g. non-use value for people of different income levels, the data was only coded once (in this case as data on non-use value).
- Where a study produced estimates of total population value, as well as estimates of the average value for individuals, the data was only coded once – as average values.
- Estimates of the use-value of a single visit to an asset were divided into two: estimates derived from the actual amount paid to enter the asset (e.g. entrance fees) and estimates of willingness to pay (e.g. those produced using the travel cost or contingent valuation methods)
- Where a study reported separate estimates of value for those who used an asset and those who did not use an asset, this was coded as providing both non-use and use values. Where a study did not distinguish between users and non-users, or where a study reported values elicited from just users, it was coded as providing a combination of use and non-use value.
- Where values were disaggregated into separate estimate for museums, libraries, and archives, these were coded, rather than coding for MLA.

Not attempt was made to assess the quality of the studies.

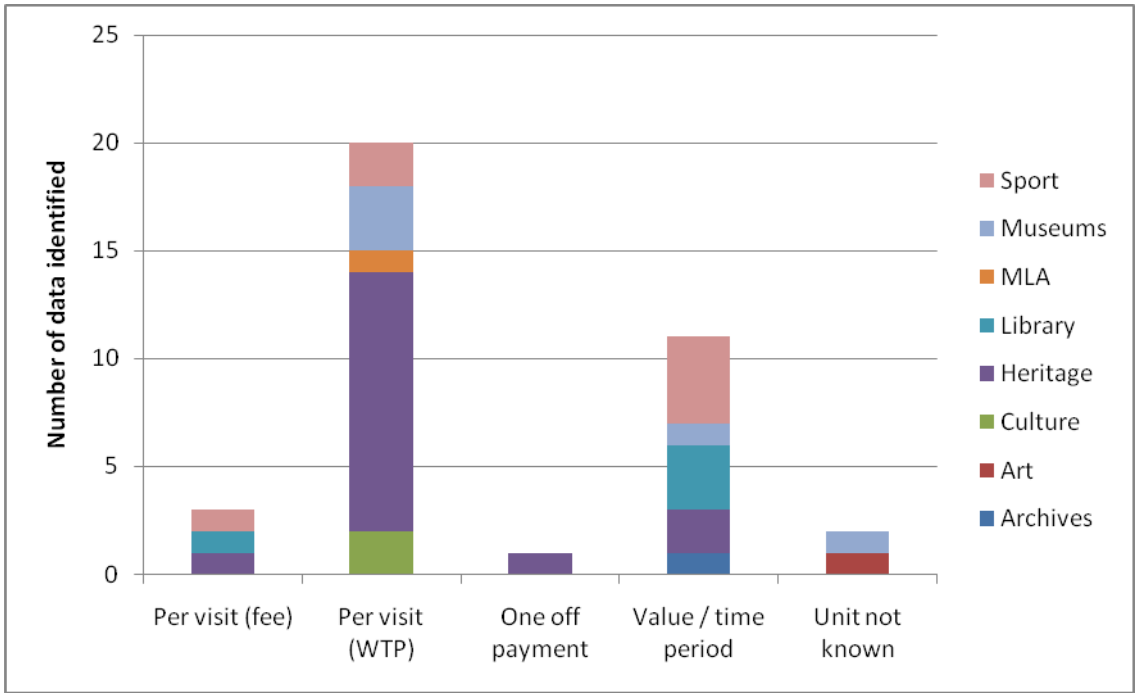
10. Appendix 3: Estimates of the economic value of engagement in culture and sport

Section 3.3.2 summaries the results of a review of studies of the economic value of engaging in culture and sport. Figures 6 to 10 provide more detail on the data identified in the review. Table 21 summarises the definitions of the data types used.

Figure 6 summarises the data on use-value. A total of 37 estimates of use value were identified. It demonstrates that the estimates of use value were primarily derived from two types of study:

- Estimates of users WTP to enter a site or asset. The majority of this data is available for heritage sites, with fewer data available for museums and sports assets.
- Estimates of users WTP to improve or produce a site or asset, where similar estimates were also available from non-users. The majority of this data is available for sporting assets (e.g. building sports arena), libraries, and heritage sites.

Figure 6: Data on use-value



'Per visit fee' identifies a market price. All other categories identify non-market estimates of WTP.

Figure 7 summarises the data on non use-value. For instance, the amount people are willing to pay to preserve a heritage site without any intention of visiting it. this is the first time the distinction is made between use and non-use and it is not well-defined (and unclear how it relates to the concepts you have set out before) A total of 26 estimates of non use-value were identified. Figure 9 demonstrates that most of these estimates were derived from studies that elicited non-users WTP monthly or

annually to improve or produce a site or asset, such as contingent valuation studies. Most of the data is provided by studies on sport, heritage or libraries, with 4-5 estimates on each. A further 6 estimates are derived from studies that elicit non-users WTP a one-off amount to improve a heritage site.

Figure 7: Data on non-use value

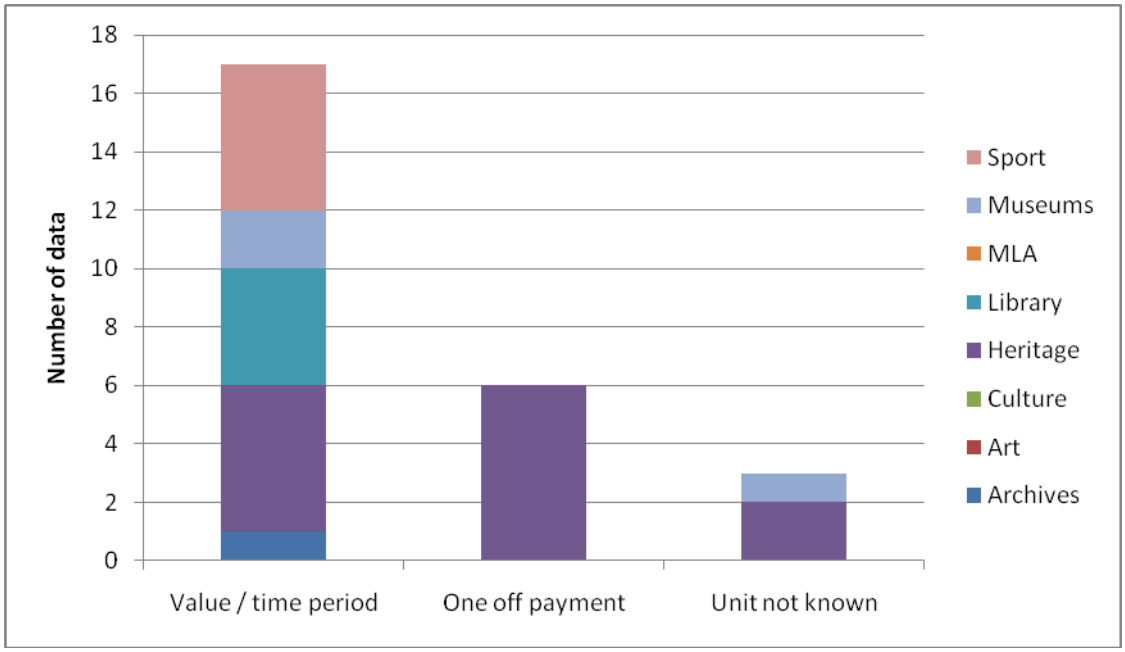


Figure 8 summarises the data on combined estimates of both use and non use-value. For instance, estimates of WTP that do not distinguish between users and non-users. A total of 33 estimates were identified. Half of these estimates were derived from studies that elicited WTP monthly or annually to improve or produce a site or asset, such as contingent valuation. Most of the data is provided by studies on art, culture or heritage, with 4-5 estimates on each. A further 16 estimates are derived from studies that elicit WTP a one-off amount, or from studies in which the payment vehicle is not clear. Most of these estimates relate to heritage sites.

Figure 8: Data on use and non-use data (combined)

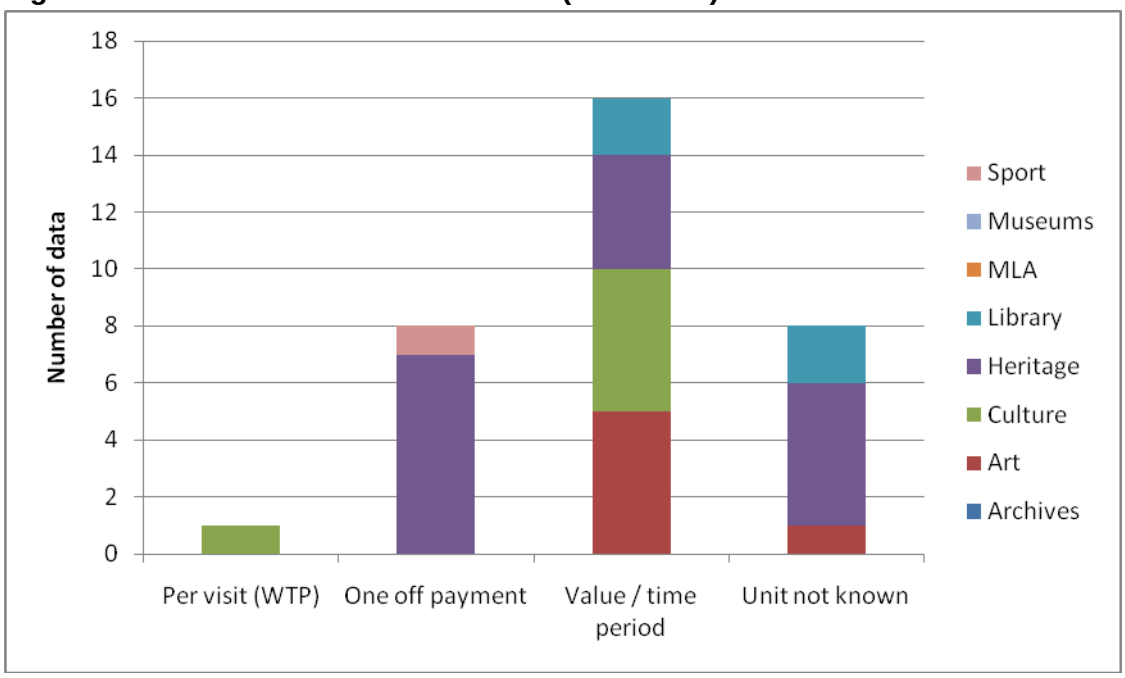


Figure 9 summarises the data on the cost of delivering sporting and cultural services. A total of 17 estimates were identified. The majority of these were estimates of the annual cost of delivery. The studies were primarily of museums, libraries, and heritage sites.

Figure 9: Data on the cost of delivery

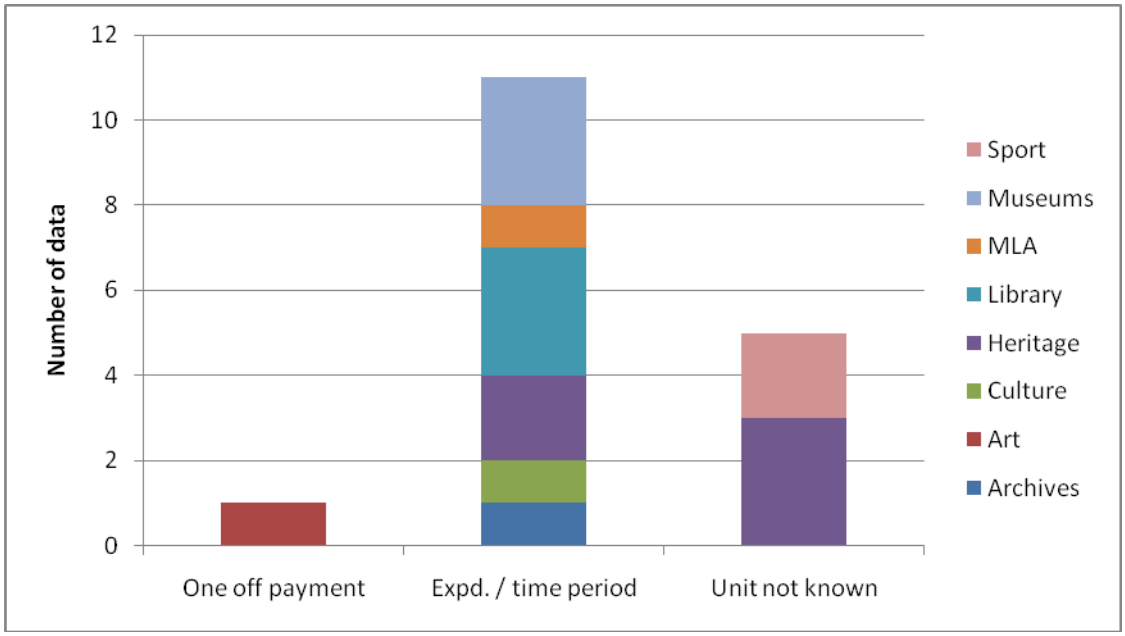


Figure 10: Data on income generated

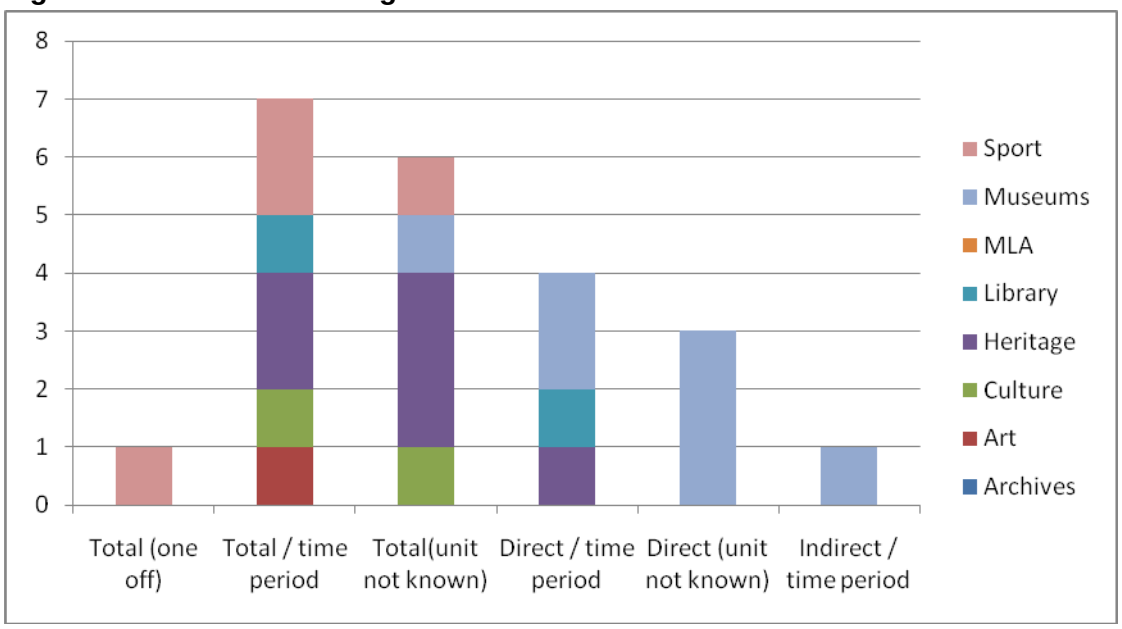


Figure 10 summarises the data on income generation. A total of 22 estimates were identified. Most of these estimates (14) were of the total impact on income, estimating both the direct and indirect income generation, as well as the effect on the broader economy via the multiplier effect. These estimates were primarily available for sporting events, heritage sites. A further 7 estimates were available on the direct income generation. Most of these estimates were available for museums.

Table 21: Definition of data types identified

Value types		Definition
Average use value	Per visit (fee)	Entrance fee paid to access culture / sport asset
	Per visit (WTP)	Amount willing to pay to visit a culture / sport asset, estimating using either the travel cost method, contingent valuation or choice experiments.
	One off payment	One off payment to conserve / improve an asset from users elicited via a contingent valuation approach. While users also experience non-use value, which would be reflected in their responses, use value could be isolated as estimates were elicited from non-users.
	Value / time period	On-going payments (monthly or annually) to conserve / improve an asset from users elicited via a contingent valuation approach. While users also experience non-use value, which would be reflected in their responses, use value could be isolated as similar estimates were elicited from non-users.
	Unit not known	Payments to conserve / improve an asset from users elicited via a contingent valuation approach, but no information on the payment vehicle was available (on-going, one off payment etc). While users also experience non-use value, which would be reflected in their responses, use value could be isolated as similar estimates were elicited from non-users.
Average non-use value	Value / time period	On-going payments (monthly or annually) to conserve / improve an asset from non-users elicited via a contingent valuation approach.
	One off payment	One off payment from non-users to conserve / improve an asset elicited via a contingent valuation approach.

Value types		Definition
	Unit not known	Payments from non-users to conserve / improve an asset elicited via a contingent valuation approach, but no information on the payment vehicle was available (on-going, one off payment etc).
Average use + non-use value	Per visit (WTP)	Amount willing to pay to visit a culture / sport asset, estimating using either contingent valuation or choice experiments. Respondents were told that the payment would allow them access to the site, and that part of the payment would fund the conservation of the asset.
	One off payment	One off payment from a sample to conserve / improve an asset elicited via a contingent valuation approach. It was likely that the sample contained both users and non-users. One data point in this group was the impact of heritage value on property prices.
	Value / time period	On-going payments (per month or year) from a sample to conserve / improve an asset elicited via a contingent valuation approach. It was likely that the sample contained both users and non-users.
	Unit not known	Payments from a sample to conserve / improve an asset elicited via a contingent valuation approach, but no information on the payment vehicle was available (on-going, one off payment etc). It was likely that the sample contained both users and non-users.
Total cost of delivery	One off payment	The one-off cost of delivering a cultural or sporting event, including funding amounts, budgets, and cost estimates.

Value types		Definition
	Expd. / time period	The on-going cost of delivering a sporting or cultural service, including funding amounts, budgets, and cost estimates.
	Unit not known	The cost of delivering a sporting or cultural service, including funding amounts, budgets, and cost estimates. It was not possible to determine whether the cost was annual or one off.
Income generated	Total (one off)	The value added to the local economy of a sporting or cultural event, including the income generated by the event, the increased spending by attendees in the local economy, and the effect on other sectors (via the multiplier).
	Total / time period	The value added to the local economy of a sporting or cultural asset per period of time (monthly, annually), including the income generated by the asset, the increased spending by attendees in the local economy, and the effect on other sectors (via the multiplier).
	Total (unit not known)	The value added to the local economy of a sporting or cultural asset, including the income generated by the asset, the increased spending by attendees in the local economy, and the effect on other sectors (via the multiplier). It was not possible to determine whether the estimate was a one-off or for a period of time.
	Direct / time period	The income generated by a sporting or cultural asset over period of time (monthly, annually).
	Direct (unit not known)	The income generated by a sporting or cultural asset. It was not possible to determine whether this was a one-off estimate or for a period of time.

Value types		Definition
	Indirect / time period	The increased spending in the local economy by attendees of a sporting of cultural asset over period of time (monthly, annually).

11. Appendix 4: Estimates of the impact of engagement in culture and sport on SWB

11.1 Data

Table 22 presents descriptive statistics of the variables drawn from the BHPS to estimate the impact of engagement in culture and sport on SWB.

Table 22: Descriptive statistics

	Mean	St. Dev.	Min.	Max.
Subjective well-being				
Life satisfaction	0.7053	0.2160	0	1
Engagement variables				
Heritage	0.7913	0.0908	0.1377	0.9493
Historic buildings	0.3963	0.1308	0.0387	0.7831
Art	0.6657	0.0980	0.1549	0.8996
Sport	0.1148	0.0718	0.0056	0.4379
Museums	0.4345	0.1055	0.0638	0.7836
Libraries	0.4229	0.1106	0.1204	0.8547
Income variables				
Absolute annual income: log of real equivalent household income	10.0371	0.7068	-0.6309	14.1578
Relative annual income: log of individual income - log of average income for reference group	9.5351	0.4329	8.8397	10.1915
Personal and household controls				
Female	0.5379	0.4986	0	1
Age	45.3706	18.6172	15	102
Age-sqr / 1000	2.4051	1.8492	0.2250	10.4040
Marital status: single	0.2108	0.4079	0	1
Marital status: married or living as couple	0.6422	0.4794	0	1
Marital status: widowed, divorced or separated	0.1471	0.3542	0	1
Household size	2.8673	1.3904	1	14
Number of children	0.2853	0.4516	0	1
Health problems: none	0.4050	0.4909	0	1
Health problems: few	0.5203	0.4996	0	1
Health problems: many	0.0747	0.2629	0	1
Health problems: heart and blood pressure	0.1560	0.3629	0	1
Health problems: diabetes	0.0326	0.1776	0	1
Health problems: cancer	0.0070	0.0835	0	1
Health problems: stroke	0.0084	0.0912	0	1
GP visits	2.4190	1.2046	1	5
Employed	0.5702	0.4951	0	1
Unemployed	0.0383	0.1919	0	1

	Mean	St. Dev.	Min.	Max.
Inactive	0.1322	0.3388	0	1
Student	0.0589	0.2355	0	1
Retired	0.2004	0.4003	0	1
Full-time carer	0.0325	0.1774	0	1
Education: low	0.3326	0.4712	0	1
Education: medium	0.5514	0.4974	0	1
Education: high	0.1160	0.3202	0	1
Contact with family: less than once a month	0.0907	0.2872	0	1
Contact with family: once or twice a month	0.1389	0.3458	0	1
Contact with family: once or twice a week	0.3822	0.4859	0	1
Contact with family: on most days	0.3882	0.4873	0	1
Contact with friends: less than once a month	0.0266	0.1608	0	1
Contact with friends: once or twice a month	0.1015	0.3021	0	1
Contact with friends: once or twice a week	0.4046	0.4908	0	1
Contact with friends: on most days	0.4673	0.4989	0	1

Table 23 presents the multicollinearity test of variables included in estimations of the impact of engagement in culture and sport on life satisfaction.

Table 23: Multicollinearity test (VIF statistics) of variables included in estimations of the impact of engagement in culture and sport on life satisfaction

	Heritage		Historic buildings		Art		Sport		Museums		Libraries	
	All variables	Excluding variables	All variables	Excluding variables	All variables	Excluding variables	All variables	Excluding variables	All variables	Excluding variables	All variables	Excluding variables
Log of real equivalent household income	1.52	1.52	1.49	1.57	1.48	1.48	1.42		1.44	1.44	1.44	1.44
Relative individual income	5.07	5.07	4.85	4.85	5.18	5.18	4.7		4.9	4.9	4.9	4.9
Engagement	2.01	2.01	2.29	2.29	2.85	2.85	6.69		2.24	2.24	2.04	2.04
Female	3.57	3.57	3.42	3.42	4.07	4.07	2.96		3.51	3.51	3.68	3.68
Age	65.17	65.17	64.49	64.65	73	73	93.57		65.32	65.32	60.71	60.71
Age-square	73.14	73.14	71.35	71.46	80.34	80.34	80.49		73.49	73.49	69.23	69.23
Marital status: married or living as couple	-9.01E+15	1.46	-7.56E+30	1.43	-9.01E+15		2.74		-1.80E+15		-1.80E+15	
Marital status: widowed, divorced or separated	-9.01E+15		-7.56E+30		-9.01E+15	1.44	2.41		-1.80E+15	1.40	-1.80E+15	1.40
Household size	2.36	2.36	1.63	2.28	2.34	2.34	1.9		2.23	2.23	2.23	2.23
Number of children	2.39	2.39	2.14	2.29	2.39	2.39	2.02		2.23	2.23	2.22	2.22
Health problems: few	1.45	1.45	1.42	1.42	1.47	1.47	1.46		1.43	1.43	1.43	1.43
Health problems: many	1.67	1.67	1.62	1.62	1.72	1.72	1.66		1.65	1.65	1.65	1.65
Health problems: heart or blood pressure	1.44	1.44	1.43	1.43	1.46	1.46	1.48		1.46	1.46	1.46	1.46
Health problems: diabetes	1.09	1.09	1.09	1.09	1.1	1.1	1.1		1.11	1.11	1.11	1.11
Health problems: cancer	1.02	1.02	0.32	1.02	1.03	1.03	1.03		1.03	1.03	1.03	1.03
Health problems: stroke	1.02	1.02	1.02	1.02	1.03	1.03	1.03		1.03	1.03	1.03	1.03
GP visits	1.37	1.37	1.35	1.35	1.39	1.39	1.4		1.35	1.35	1.34	1.34
Unemployed	1.19	1.19	1.19	1.19	1.19	1.19	1.26		1.17	1.17	1.2	1.2

	Heritage		Historic buildings		Art		Sport		Museums		Libraries	
	All variables	**Excluding variables**	**All variables**	**Excluding variables**	**All variables**	**Excluding variables**	**All variables**	**Excluding variables**	**All variables**	**Excluding variables**	**All variables**	**Excluding variables**
Inactive	2.03	2.03	1.99	1.99	2.02	2.02	1.87		1.87	1.87	2.02	2.02
Student	1.06	1.06	1.06	1.06	1.06	1.06	1.67		1.06	1.06	1.06	1.06
Retired	4.2	4.2	4.17	4.18	4.3	4.3	4		4.05	4.05	4.26	4.26
Full-time carer	1.03	1.03	1.03	1.03	1.03	1.03	1.03		1.03	1.03	1.03	1.03
Education: medium	2.03	2.03	2.18	2.18	2.07	2.07	1.76		2.16	2.16	2.31	2.31
Education: high	2.22	2.22	2.71	2.71	2.77	2.77	1.87		3	3	2.16	2.16
Contact with family: once or twice a month	4.27	4.27	4.16	4.16	4.24	4.24	3.5		4.14	4.14	4.15	4.15
Contact with family: once or twice a weak	4.15	4.15	4.07	4.07	4.13	4.13	3.4		4.07	4.07	4.07	4.07
Contact with family: on most days	2.55	2.55	2.54	2.54	2.58	2.58	2.27		2.62	2.62	2.62	2.62
Contact with friends: once or twice a month	9.38	9.38	8.53	8.53	9.83	9.83	10.6		8.63	8.63	8.63	8.63
Contact with friends: once or twice a weak	9.3	9.3	8.56	8.56	9.75	9.75	10.22		8.69	8.69	8.69	8.69
Contact with friends: on most days	4.42	4.42	4.45	4.45	4.58	4.58	4.52		4.56	4.56	4.56	4.56
Instrument 1	1.23	1.23	1.28	1.28	1.22	1.22	1.2		1.28	1.28	1.28	1.28
Instrument 2	1.02	1.02	1.03	1.03	1.02	1.02	1.02		1.03	1.03	1.03	1.03
Instrument 3	2.78	2.78	2.82	2.82	2.73	2.73	2.55		2.73	2.73	2.74	2.74
Mean	-5.46E+14	6.83	-4.58E+29	6.72	-5.46E+14	7.4	7.9		-1.09E+14	6.81	1.09E+14	6.52

11.2 Regression outputs

Table 24 presents full regression outputs of the fixed effect and random effect estimations of the impact of engagement in culture and sport on LS.

Table 24: Fixed effect and random effect estimations of the impact of engagement in culture and sport on life satisfaction

	Heritage		Historic buildings		Art		Sport		Museums		Libraries	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11	(12)
Log of real equivalent household income	0.029	0.027	0.017	0.017	0.043	0.035	0.039	0.036	0.026	0.019	0.040	0.013
	(1.83)*	(2.20)**	(0.94)	(1.11)	(2.60)***	(2.87)***	(3.51)***	(4.16)***	(1.26)	(1.18)	(0.82)	(0.48)
Relative individual income	-0.015	-0.023	-0.016	-0.021	-0.016	-0.025	-0.009	-0.025	-0.016	-0.021	-0.017	-0.020
	(3.45)***	(6.05)***	(3.14)***	(4.31)***	(3.77)***	(6.55)***	(2.52)**	(7.73)***	(3.12)***	(4.08)***	(3.03)***	(3.48)***
Engagement	-0.102	0.005	0.022	0.053	0.026	0.133	0.110	0.241	0.097	0.089	0.101	-0.003
	(2.23)**	(0.13)	(0.62)	(1.70)*	(0.75)	(4.53)***	(2.00)**	(5.25)***	(3.35)***	(3.69)***	(0.91)	(0.05)
Female	-0.362	0.008	0.000	0.007	0.000	-0.003	0.000	0.011	0.000	0.006	0.000	0.008
	(0.00)	(2.54)**	(.)	(1.69)*	(.)	(0.79)	(.)	(3.61)***	(.)	(1.57)	(.)	(1.26)
Age	0.002	-0.001	0.001	-0.002	0.001	-0.003	-0.001	-0.001	-0.000	-0.003	0.000	-0.001
	(2.57)**	(3.19)***	(1.16)	(3.56)***	(0.67)	(6.45)***	(0.80)	(2.89)***	(0.31)	(4.65)***	(0.21)	(1.71)*
Age-sqr / 1000	-0.042	0.024	-0.035	0.023	-0.031	0.039	-0.019	0.029	-0.024	0.029	-0.030	0.018
	(5.48)***	(5.56)***	(4.18)***	(4.47)***	(3.93)***	(8.38)***	(3.37)***	(7.81)***	(2.90)***	(5.49)***	(2.81)***	(2.51)**
Marital status: married or living as couple	0.060	0.077	0.065	0.075	0.057	0.073	0.020	0.036	0.063	0.076	0.061	0.077
	(14.32)***	(23.11)***	(12.29)***	(16.98)***	(13.09)***	(21.24)***	(5.23)***	(12.44)***	(10.81)***	(14.81)***	(6.43)***	(11.19)***
Marital status: widowed, divorced or separated	dropped	dropped	dropped	dropped	dropped	dropped	-0.035	-0.034	dropped	dropped	dropped	dropped
							(7.69)***	(10.51)***				
Household size	-0.007	-0.008	-0.009	-0.008	-0.007	-0.006	-0.004	-0.002	-0.009	-0.008	-0.009	-0.008
	(5.87)***	(7.45)***	(5.75)***	(6.12)***	(5.36)***	(6.33)***	(4.72)***	(2.37)**	(5.23)***	(5.71)***	(4.16)***	(5.36)***
Number of children	0.007	0.004	0.004	0.001	0.009	0.004	0.007	-0.003	0.005	0.001	0.007	0.000
	(2.15)**	(1.32)	(0.89)	(0.16)	(2.46)**	(1.15)	(1.93)*	(1.04)	(1.00)	(0.15)	(0.89)	(0.05)
Health problems: few	-0.018	-0.030	-0.019	-0.027	-0.018	-0.029	-0.018	-0.029	-0.018	-0.026	-0.019	-0.027
	(11.12)***	(19.26)***	(8.79)***	(13.46)***	(11.08)***	(18.95)***	(12.16)***	(21.20)***	(8.56)***	(13.20)***	(8.61)***	(13.18)***

	Heritage		Historic buildings		Art		Sport		Museums		Libraries	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11	(12)
Health problems: many	-0.045	-0.086	-0.048	-0.080	-0.045	-0.084	-0.046	-0.086	-0.047	-0.079	-0.047	-0.080
	(14.22)***	(29.19)***	(11.58)***	(20.70)***	(14.20)***	(28.69)***	(15.44)***	(31.51)***	(11.25)***	(20.33)***	(11.20)***	(20.04)***
Health problems: heart or blood pressure	0.004	0.003	0.005	0.003	0.004	0.003	0.003	0.002	0.004	0.002	0.004	0.002
	(1.83)*	(1.29)	(1.61)	(1.00)	(2.02)**	(1.43)	(1.46)	(1.33)	(1.48)	(0.87)	(1.40)	(0.87)
Health problems: diabetes	0.010	0.002	0.018	0.009	0.009	0.002	0.010	0.004	0.017	0.008	0.017	0.009
	(1.90)*	(0.56)	(2.77)***	(1.66)*	(1.86)*	(0.62)	(2.06)**	(0.92)	(2.63)***	(1.57)	(2.67)***	(1.60)
Health problems: cancer	-0.010	-0.023	-0.008	-0.023	-0.009	-0.022	-0.009	-0.022	-0.007	-0.023	-0.007	-0.023
	(1.63)	(4.06)***	(0.93)	(2.91)***	(1.59)	(3.97)***	(1.52)	(3.97)***	(0.86)	(2.89)***	(0.89)	(2.88)***
Health problems: stroke	-0.036	-0.057	-0.027	-0.050	-0.034	-0.055	-0.036	-0.057	-0.030	-0.052	-0.031	-0.052
	(5.09)***	(8.48)***	(2.87)***	(5.42)***	(4.90)***	(8.34)***	(5.33)***	(8.84)***	(3.07)***	(5.52)***	(3.15)***	(5.45)***
GP visits	-0.010	-0.014	-0.010	-0.013	-0.010	-0.014	-0.011	-0.014	-0.010	-0.013	-0.010	-0.013
	(16.66)***	(25.68)***	(12.32)***	(18.01)***	(16.49)***	(24.84)***	(18.86)***	(27.87)***	(11.95)***	(17.78)***	(12.14)***	(18.28)***
Unemployed	-0.030	-0.052	-0.036	-0.055	-0.036	-0.059	-0.043	-0.059	-0.040	-0.057	-0.043	-0.051
	(4.95)***	(8.72)***	(4.72)***	(6.96)***	(5.94)***	(9.44)***	(9.77)***	(13.36)***	(5.75)***	(7.70)***	(4.89)***	(9.84)***
Inactive	-0.012	-0.029	-0.020	-0.031	-0.016	-0.033	-0.019	-0.030	-0.022	-0.032	-0.024	-0.028
	(2.40)**	(5.95)***	(3.17)***	(4.99)***	(3.19)***	(6.84)***	(5.54)***	(9.32)***	(4.06)***	(5.67)***	(5.53)***	(8.46)***
Student	0.018	0.008	0.007	-0.003	0.019	0.004	0.022	0.023	0.004	-0.005	0.003	0.001
	(1.80)*	(0.84)	(0.49)	(0.21)	(1.85)*	(0.38)	(4.27)***	(5.00)***	(0.32)	(0.35)	(0.30)	(0.05)
Retired	0.021	0.019	0.015	0.015	0.018	0.014	0.017	0.020	0.014	0.015	0.013	0.019
	(3.14)***	(3.30)***	(1.76)*	(1.92)*	(2.67)***	(2.38)**	(3.79)***	(5.16)***	(1.76)*	(2.06)**	(2.93)***	(4.30)***
Full-time carer	-0.018	-0.026	-0.022	-0.031	-0.019	-0.026	-0.018	-0.025	-0.023	-0.031	-0.022	-0.030
	(5.47)***	(8.29)***	(4.89)***	(7.11)***	(5.68)***	(8.35)***	(5.72)***	(8.44)***	(4.90)***	(7.13)***	(4.74)***	(7.02)***
Education: medium	0.015	-0.016	0.008	-0.027	0.006	-0.030	0.012	-0.018	0.006	-0.029	0.005	-0.017
	(1.16)	(5.31)***	(0.48)	(6.40)***	(0.46)	(9.58)***	(1.29)	(6.24)***	(0.35)	(5.87)***	(0.27)	(1.22)
Education: high	0.021	-0.022	0.016	-0.039	0.003	-0.053	-0.002	-0.037	0.005	-0.047	0.012	-0.020
	(1.37)	(4.64)***	(0.84)	(6.11)***	(0.21)	(10.88)***	(0.19)	(8.67)***	(0.26)	(6.01)***	(0.56)	(0.89)

	Heritage		Historic buildings		Art		Sport		Museums		Libraries	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11	(12)
Contact with family: once or twice a month	0.028	0.042	0.028	0.039	0.011	0.016	0.007	0.012	0.012	0.015	0.012	0.015
	(10.37)***	(16.79)***	(8.15)***	(12.23)***	(4.21)***	(6.42)***	(3.19)***	(5.40)***	(3.54)***	(4.66)***	(3.59)***	(4.75)***
Contact with family: once or twice a week	0.020	0.030	0.020	0.027	0.020	0.029	0.014	0.024	0.020	0.028	0.021	0.028
	(7.78)***	(12.45)***	(6.20)***	(9.00)***	(7.66)***	(12.34)***	(6.78)***	(12.30)***	(6.30)***	(9.09)***	(6.33)***	(9.15)***
Contact with family: on most days	0.011	0.017	0.012	0.015	0.028	0.042	0.021	0.036	0.029	0.040	0.029	0.040
	(4.32)***	(6.59)***	(3.46)***	(4.60)***	(10.26)***	(16.77)***	(9.43)***	(17.62)***	(8.25)***	(12.23)***	(8.31)***	(12.27)***
Contact with friends: once or twice a month	0.019	0.032	0.019	0.033	0.009	0.015	0.011	0.018	0.009	0.016	0.009	0.016
	(5.29)***	(9.28)***	(4.31)***	(7.56)***	(2.37)**	(4.35)***	(3.11)***	(5.44)***	(1.91)*	(3.62)***	(1.94)*	(3.67)***
Contact with friends: once or twice a week	0.015	0.025	0.012	0.023	0.014	0.025	0.015	0.027	0.012	0.023	0.012	0.023
	(4.11)***	(7.45)***	(2.69)***	(5.40)***	(4.03)***	(7.33)***	(4.64)***	(8.60)***	(2.63)***	(5.41)***	(2.63)***	(5.47)***
Contact with friends: on most days	0.009	0.016	0.009	0.016	0.019	0.032	0.020	0.034	0.019	0.033	0.019	0.033
	(2.40)**	(4.43)***	(1.97)**	(3.66)***	(5.23)***	(9.17)***	(5.96)***	(10.74)***	(4.25)***	(7.57)***	(4.29)***	(7.63)***
Constant	0.813	0.623	0.696	0.730	0.438	0.546	0.455	0.543	0.611	0.693	0.463	0.747
	(0.00)	(6.27)***	(3.82)***	(5.23)***	(2.85)***	(5.21)***	(5.05)***	(8.60)***	(3.05)***	(4.80)***	(0.98)	(3.12)***
Observations	103,447	103,447	58,317	58,317	103,782	103,782	129,824	129,824	58,127	58,127	58,134	58,134
Number of individuals	18,635	18,635	9,520	9,520	18,670	18,670	24,621	24,621	9,500	9,500	9,501	9,501
R-square	0.0018	0.1313	0.0133	0.1204	0.0102	0.1307	0.0099	0.1240	0.0209	0.1197	0.0159	0.1198
Wald-test	1734.14	5177.75	1.43e+06	2632.76	2.43e+06	5479.93	2.92e+06	6881.71	1.42e+06	2629.15	1.42e+06	2572.08
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in brackets. Baseline category: non-disabled.

* significant at 5%; ** significant at 1%.

Table 25: Hausman test of fixed effect and random effect estimations of the impact of engagement in culture and sport on life satisfaction

	Heritage	Historic buildings	Art	Sport	Museums	Libraries
Chi-2 value	0.00	1108.36	1362.64	1623.75	581.68	460.72
Degrees of freedom	1	28	28	29	28	28
P value	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 26 presents full regression outputs of the fixed effect and random effect estimations of the impact of actual engagement in culture and sport on LS.

Table 26: Fixed effect and random effect estimations of the impact of actual engagement in culture and sport on life satisfaction

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	**LS**		**LS**		**LS**	
Independent of interest	**Sport**		**Cinema**		**Concert**	
Baseline	**Never/almost never**					
Specification	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Log of real equivalent household income	0.053	0.029	0.052	0.028	0.052	0.028
	(3.00)***	(2.44)**	(2.92)***	(2.36)**	(2.89)***	(2.35)**
Relative individual income	-0.012	-0.030	-0.011	-0.031	-0.011	-0.030
	(2.29)**	(7.09)***	(2.23)**	(7.35)***	(2.20)**	(7.02)***
Once a year or less	0.005	0.009	0.01	0.01	0.01	0.01
	(1.13)	(2.36)**	(2.90)***	(2.63)***	(4.17)***	(6.95)***
Several times a year	0.015	0.025	0.013	0.012	0.02	0.03
	(4.41)***	(8.15)***	(4.69)***	(4.69)***	(7.66)***	(10.78)***
At least once a month	0.019	0.033	0.019	0.020	0.022	0.028
	(6.03)***	(11.77)***	(5.08)***	(6.33)***	(4.70)***	(7.03)***
At least once a week	0.025	0.042	0.019	0.017	0.019	0.023
	(9.83)***	(19.48)***	(2.42)**	(2.64)***	(1.78)*	(2.53)**
Female	0.000	0.004	0.000	0.002	0.000	0.001
	(.)	(1.40)	(.)	(0.60)	(.)	(0.30)
Age	-0.001	-0.003	-0.001	-0.002	-0.001	-0.003
	(1.53)	(7.22)***	(0.82)	(5.69)***	(1.63)	(7.31)***
Age-sqr / 1000	-0.019	0.044	-0.024	0.037	-0.019	0.042
	(2.19)**	(10.20)***	(2.81)***	(8.60)***	(2.13)**	(9.81)***
Marital status: married or living as couple	0.020	0.046	0.020	0.047	0.021	0.047
	(3.35)***	(11.93)***	(3.42)***	(11.90)***	(3.49)***	(12.02)***
Marital status: widowed, divorced or separated	-0.037	-0.028	-0.036	-0.030	-0.036	-0.028
	(5.41)***	(6.96)***	(5.37)***	(7.33)***	(5.33)***	(6.93)***

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	**LS**		**LS**		**LS**	
Independent of interest	**Sport**		**Cinema**		**Concert**	
Baseline	**Never/almost never**					
Specification	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Household size	-0.005	-0.002	-0.004	-0.002	-0.004	-0.002
	(3.44)***	(1.87)*	(3.33)***	(2.09)**	(3.25)***	(1.83)*
Number of children	0.007	-0.006	0.008	-0.006	0.008	-0.004
	(1.51)	(1.52)	(1.65)*	(1.45)	(1.69)*	(1.12)
Health problems: few	-0.018	-0.034	-0.019	-0.035	-0.019	-0.035
	(8.08)***	(18.14)***	(8.25)***	(18.57)***	(8.25)***	(18.55)***
Health problems: many	-0.049	-0.105	-0.050	-0.108	-0.051	-0.107
	(10.90)***	(27.56)***	(11.13)***	(28.47)***	(11.20)***	(28.35)***
Health problems: heart or blood pressure	0.001	0.003	0.002	0.003	0.002	0.003
	(0.43)	(1.16)	(0.53)	(1.26)	(0.54)	(1.20)
Health problems: diabetes	0.009	0.009	0.007	0.007	0.008	0.008
	(1.21)	(1.77)*	(1.01)	(1.39)	(1.04)	(1.53)
Health problems: cancer	-0.004	-0.020	-0.005	-0.022	-0.005	-0.022
	(0.45)	(2.68)***	(0.61)	(2.90)***	(0.61)	(2.86)***
Health problems: stroke	-0.02	-0.04	-0.02	-0.05	-0.02	-0.05
	(1.66)*	(5.00)***	(1.76)*	(5.28)***	(1.73)*	(5.19)***
GP visits	-0.010	-0.016	-0.010	-0.016	-0.010	-0.016
	(12.42)***	(22.62)***	(12.55)***	(23.17)***	(12.57)***	(23.13)***
Unemployed	-0.048	-0.067	-0.047	-0.065	-0.047	-0.064
	(8.02)***	(11.39)***	(7.75)***	(11.12)***	(7.78)***	(11.03)***
Inactive	-0.009	-0.027	-0.008	-0.027	-0.008	-0.026
	(1.90)*	(6.29)***	(1.70)*	(6.19)***	(1.75)*	(6.05)***
Student	0.024	0.021	0.025	0.023	0.025	0.021
	(3.01)***	(3.53)***	(3.09)***	(3.85)***	(3.12)***	(3.60)***

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	**LS**		**LS**		**LS**	
Independent of interest	**Sport**		**Cinema**		**Concert**	
Baseline	**Never/almost never**					
Specification	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Retired	0.024	0.022	0.026	0.026	0.026	0.026
	(3.67)***	(4.38)***	(3.97)***	(5.23)***	(3.95)***	(5.22)***
Full-time carer	-0.017	-0.027	-0.018	-0.029	-0.017	-0.028
	(3.57)***	(6.70)***	(3.72)***	(7.03)***	(3.64)***	(6.84)***
Education: medium	0.017	-0.017	0.018	-0.015	0.019	-0.017
	(1.18)	(4.43)***	(1.27)	(3.81)***	(1.32)	(4.62)***
Education: high	0.002	-0.028	0.003	-0.024	0.004	-0.030
	(0.11)	(3.97)***	(0.20)	(3.51)***	(0.25)	(4.36)***
Contact with family: once or twice a month	0.021	0.038	0.022	0.041	0.022	0.040
	(6.01)***	(13.07)***	(6.43)***	(14.14)***	(6.36)***	(14.03)***
Contact with family: once or twice a week	0.012	0.024	0.013	0.026	0.013	0.026
	(3.66)***	(8.67)***	(3.98)***	(9.48)***	(3.93)***	(9.38)***
Contact with family: on most days	0.005	0.009	0.006	0.011	0.006	0.011
	(1.52)	(2.99)***	(1.76)*	(3.52)***	(1.76)*	(3.46)***
Contact with friends: once or twice a month	0.023	0.042	0.024	0.044	0.023	0.042
	(4.57)***	(9.44)***	(4.69)***	(9.75)***	(4.50)***	(9.39)***
Contact with friends: once or twice a week	0.018	0.035	0.019	0.036	0.018	0.035
	(3.71)***	(7.90)***	(3.78)***	(8.15)***	(3.62)***	(7.81)***
Contact with friends: on most days	0.013	0.024	0.014	0.025	0.013	0.024
	(2.62)***	(5.27)***	(2.67)***	(5.41)***	(2.53)**	(5.15)***
Constant	0.362	0.696	0.363	0.721	0.384	0.726
	(2.15)**	(6.56)***	(2.16)**	(6.77)***	(2.28)**	(6.82)***
Observations	67028	67028	67007	67007	67014	67014
Number of individuals	22484	22484	22484	22484	22481	22481

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent	**LS**		**LS**		**LS**	
Independent of interest	**Sport**		**Cinema**		**Concert**	
Baseline	**Never/almost never**					
Specification	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
R-square	0.0092	0.1359	0.0072	0.1280	0.0083	0.1300
Wald-test	1.53e+06	5460.55	1.52e+06	5015.66	1.53e+06	5185.00
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in brackets. Baseline category: non-disabled.

* significant at 5%; ** significant at 1%.

Table 27: Hausman test of fixed effect and random effect estimations of the actual impact of engagement in culture and sport on life satisfaction

	Sport	Cinema	Concert
Chi-2 value	1315.17	1312.81	1275.52
Degrees of freedom	32	32	32
P value	0.0000	0.0000	0.0000

12. Appendix 5: Income compensation figures from the predicted engagement coefficients

Table 28 shows that the IC for engagement in culture and sport ranges from -£980,360 for attending a heritage site to £31,000 for visiting a museum (based on a FE models). These ICs represent the change in annual household income that would produce the equivalent change in SWB as engaging in culture or sport. The IC for visiting a heritage site is clearly much lower than might be reasonably expected. This peculiar result is probably a consequence of the limited variation in the estimate of predicted likelihood of visiting a heritage site, as well as the challenge associated with generating accurate estimates of predicted probability of engagement.

As with the estimates of the effect of engagement on SWB, these ICs are higher than reasonably acceptable, and the IC for visiting heritage sites is very large and negative. Once again, this could be explained by the fact that these estimates are based on predicted engagement and do not distinguish different levels of engagement. Given the nature of these results, the IC estimates based on predicted engagement variables should be interpreted with caution. That is, further work is required before estimates of predicted engagement can generate robust estimates ICs.

Table 28: Income compensation estimates for predicted engagement in culture and sport (£ 2008/9)

	Heritage		**Historic building**		**Art**		**Sport**		**Museums**		**Libraries**	
	FE	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Mean income compensations (£2008/9)	-980,360	-	-	30,105	-	29,313	27,654	29,369	30,752	31,217	-	-

13. Appendix 6: Decision modelling

Tables 29 and 30 show the undiscounted value of doing sport at different ages.

Table 29: Undiscounted health cost savings associated with playing sport (based on actual frequency and duration of engagement)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£4,943	£10,561	£13,463	£6,443	£1,189
Cycling	£5,577	£11,914	£15,189	£6,857	£1,215
Football	£5,445	£11,633	£14,831	£6,832	£1,228
Athletics	£3,681	£7,865	£10,027	£4,802	£887
Golf	£6,632	£14,169	£18,064	£8,192	£1,456
Badminton	£2,315	£4,946	£6,305	£3,112	£586
Tennis	£3,710	£7,926	£10,105	£4,730	£860
Squash	£5,198	£11,105	£14,158	£6,681	£1,222
Cricket	£3,866	£8,259	£10,530	£5,060	£937
Recreational walking	£8,352	£17,842	£22,746	£10,478	£1,883
Health/fitness	£8,926	£19,070	£24,312	£10,808	£1,892

Table 30: Undiscounted total economic value of the health gain associated with playing sport (based on actual frequency and duration of engagement, and £/QALY = £20,000)

	Age (years)				
	11-15	16-29	30-49	50-64	65+
Swimming	£32,310	£69,026	£88,000	£34,511	£11,413
Cycling	£36,971	£78,983	£100,695	£37,411	£12,098
Football	£35,927	£76,754	£97,853	£37,035	£12,071
Athletics	£24,058	£51,396	£65,524	£25,718	£8,507
Golf	£43,921	£93,830	£119,623	£44,628	£14,458
Badminton	£15,011	£32,069	£40,885	£16,513	£5,524
Tennis	£24,383	£52,091	£66,410	£25,511	£8,366
Squash	£34,095	£72,838	£92,861	£35,943	£11,824
Cricket	£25,243	£53,928	£68,752	£27,070	£8,966
Recreational walking	£55,102	£117,718	£150,078	£56,797	£18,512
Health/fitness	£59,388	£126,875	£161,751	£59,258	£19,048

Figures 13 - 20 show how the QALY gains associated with changes in physical activities levels vary according to the confidence intervals identified in the epidemiological literature.

Figure 13: QALY gained due to avoided CHD with moderate physical activity

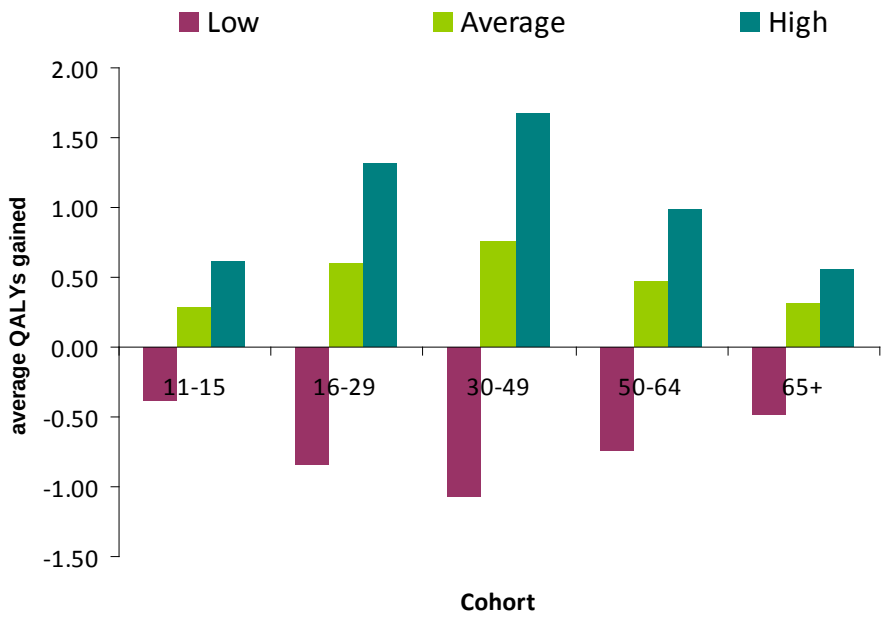


Figure 14: QALY gained due to avoided CHD with vigorous physical activity

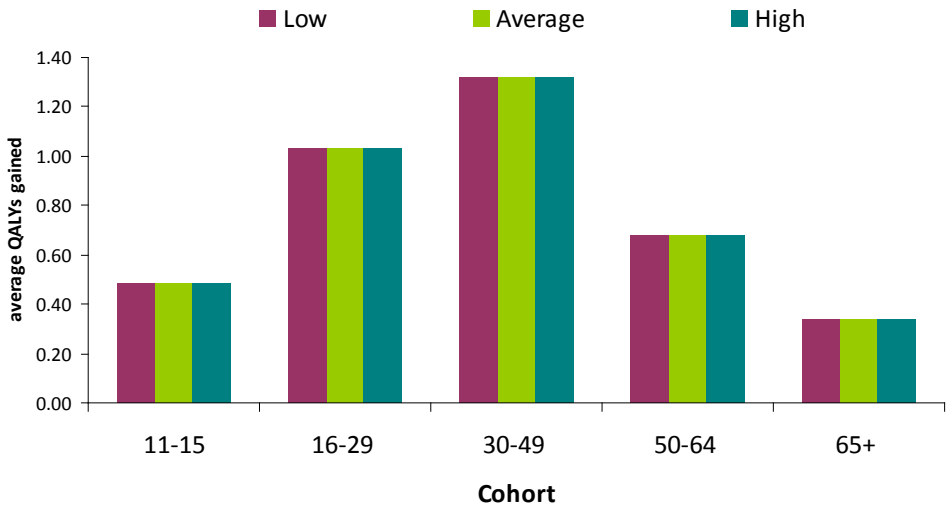


Figure 15: QALY gained due to avoided stroke with moderate physical activity

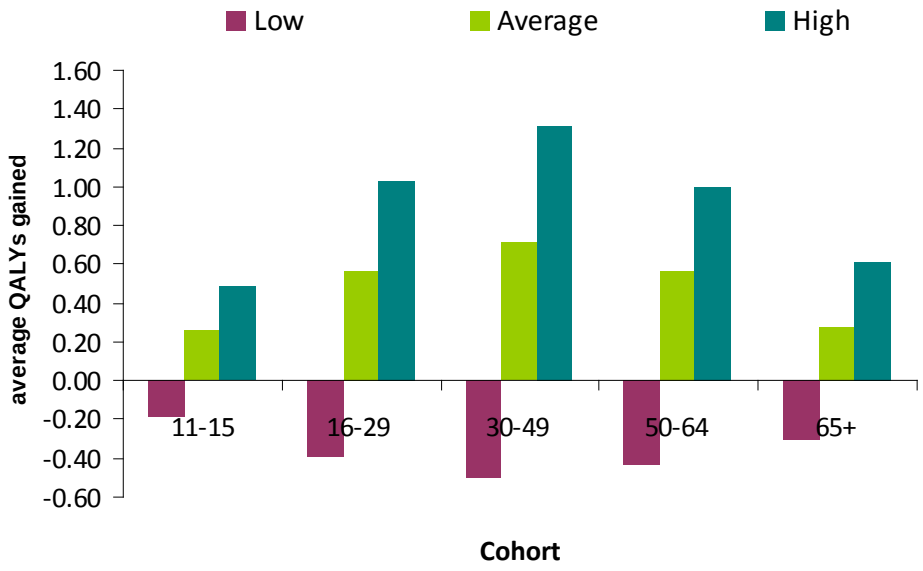


Figure 16: QALY gained due to avoided stroke with vigorous physical activity

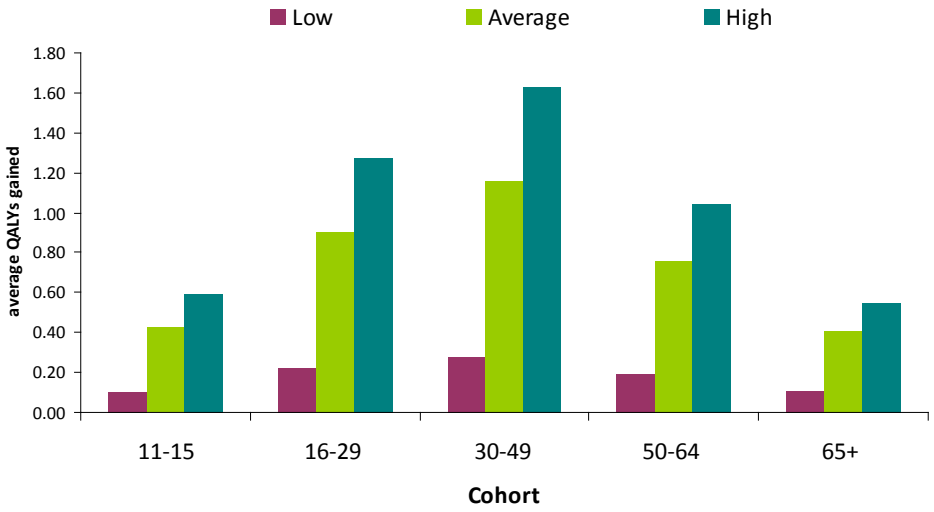


Figure 17: QALY gained due to avoided type 2 diabetes with moderate physical activity

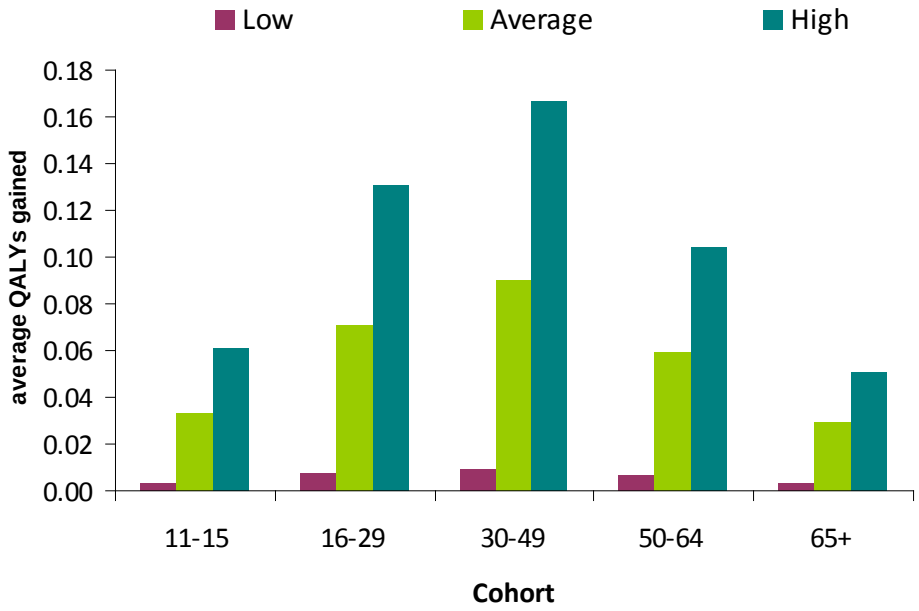


Figure 18: QALY gained due to avoided type 2 diabetes with vigorous physical activity

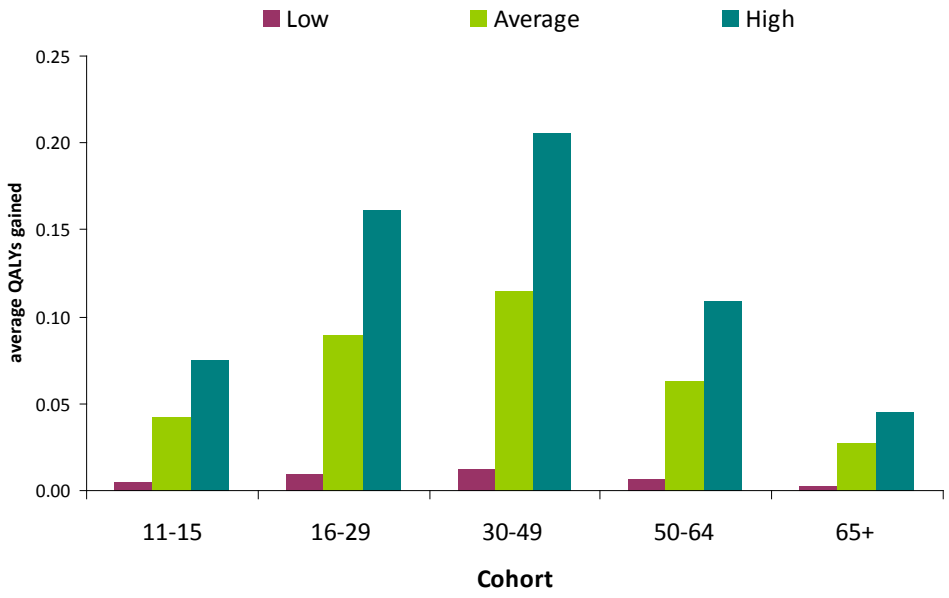


Figure 19: QALY gained due to avoided colon cancer with moderate physical activity

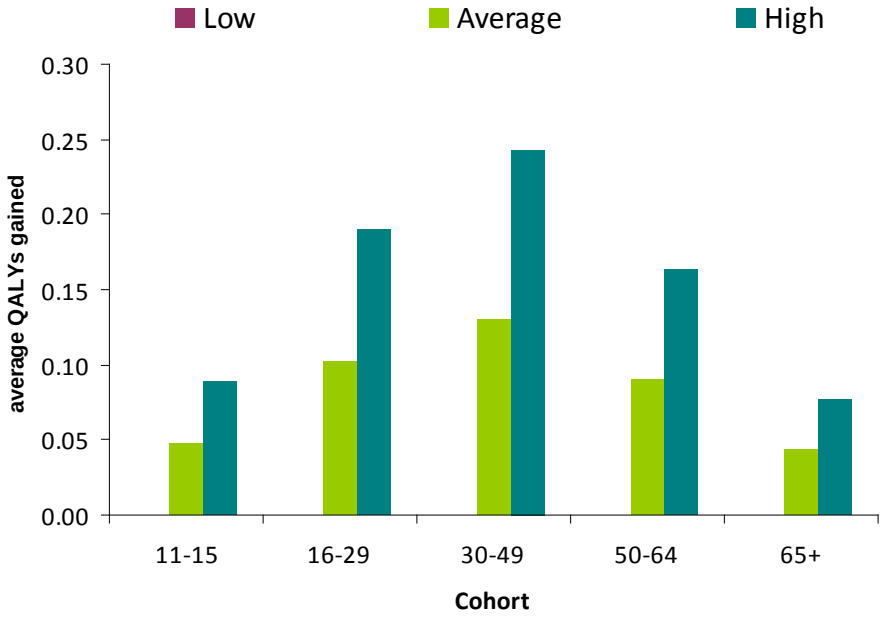
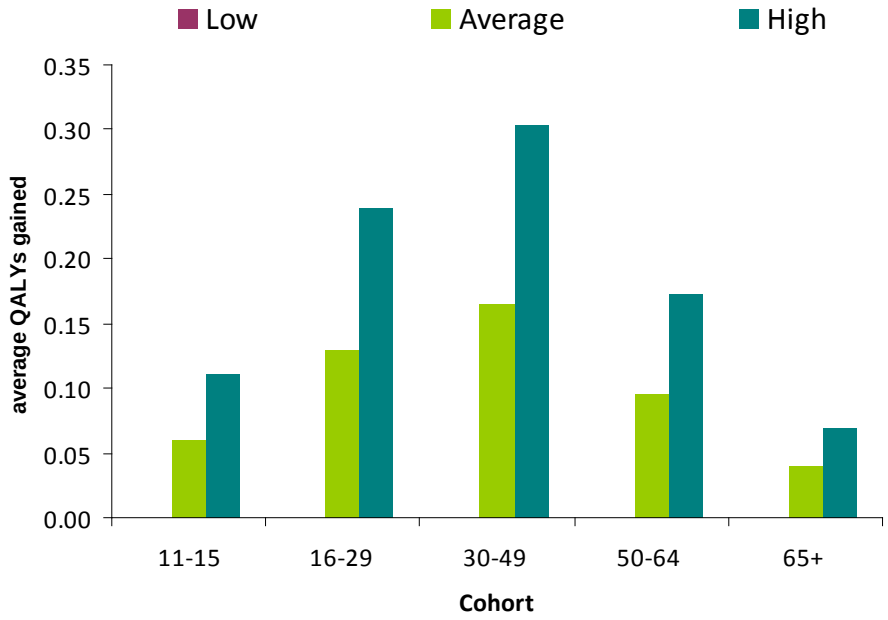


Figure 20: QALY gained due to avoided colon cancer with vigorous physical activity



Figures 21 - 26 show how the long-term health costs avoided associated with changes in physical activities levels vary according to the confidence intervals identified in the epidemiological literature.

Figure 21: Health costs avoided due to avoided CHD with moderate physical activity

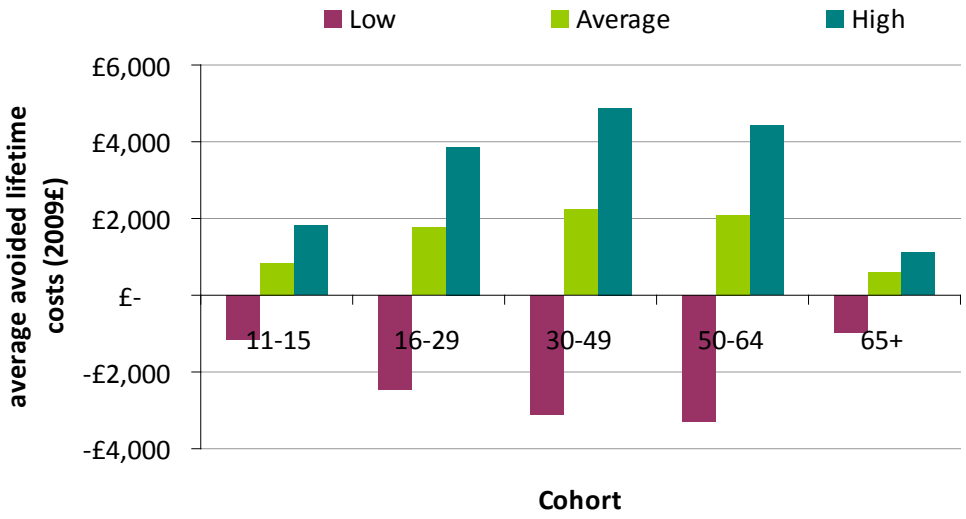


Figure 22: Health costs avoided due to avoided CHD with vigorous physical activity

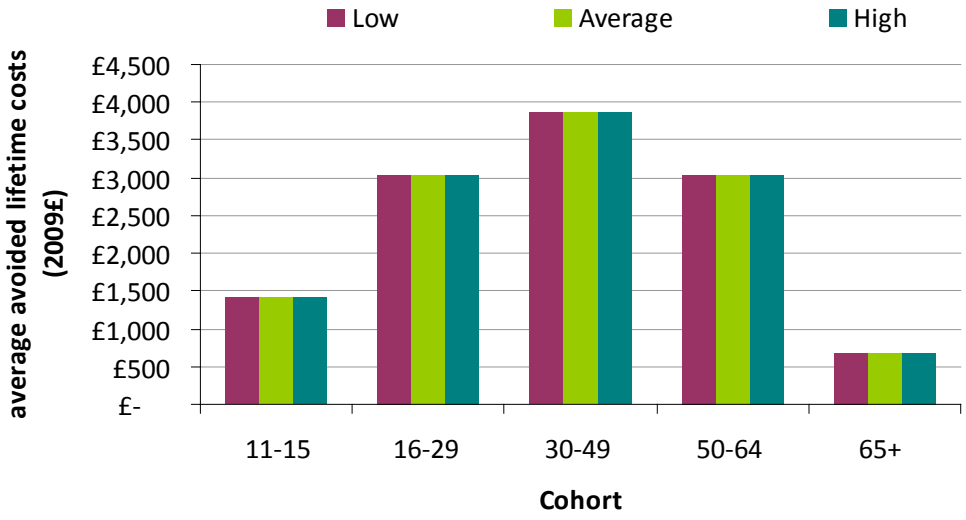


Figure 23: Health costs avoided due to avoided stroke with moderate physical activity

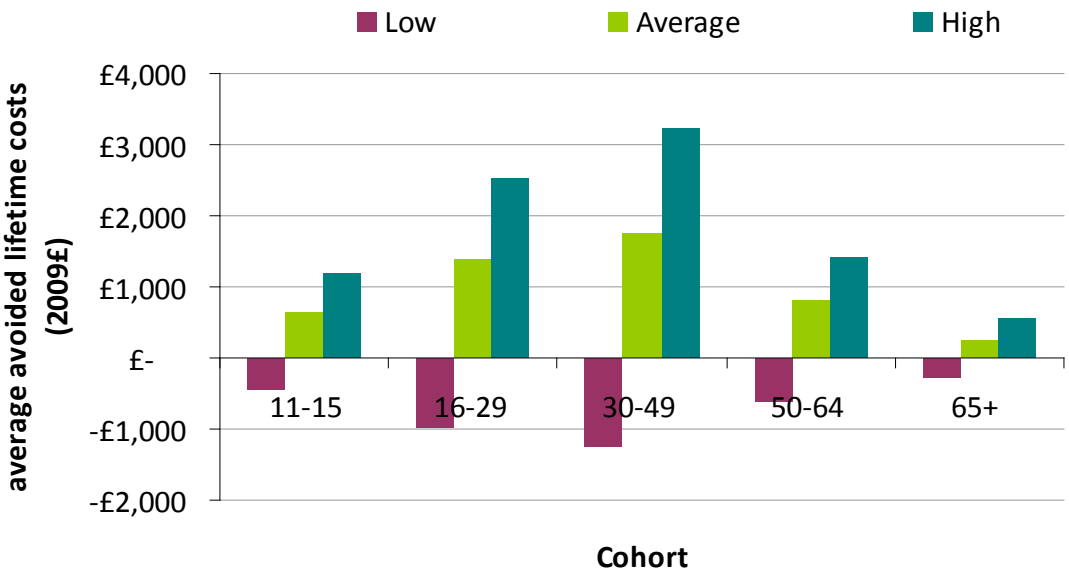


Figure 24: Health costs avoided due to avoided stroke with vigorous physical activity

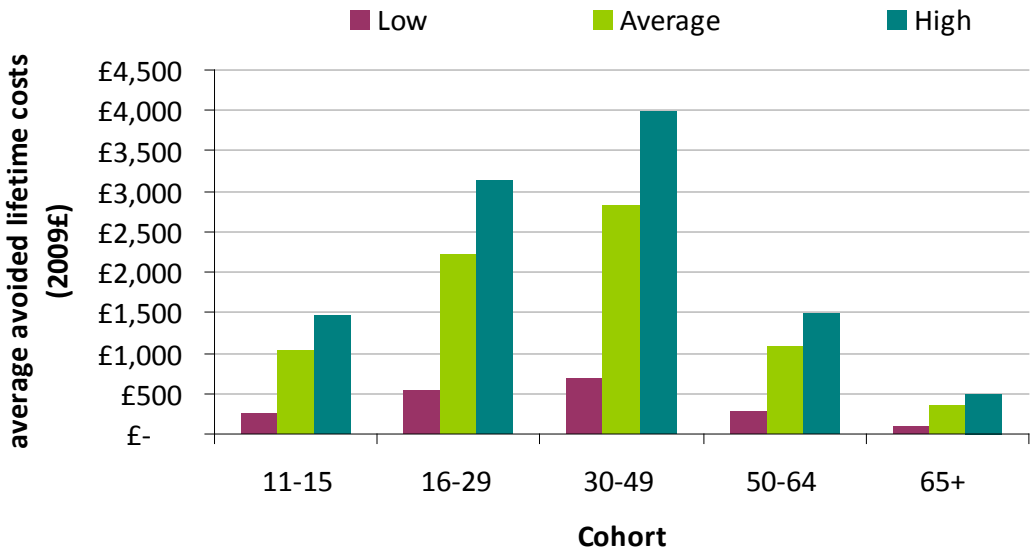


Figure 25: Health costs avoided due to avoided type 2 diabetes with moderate physical activity

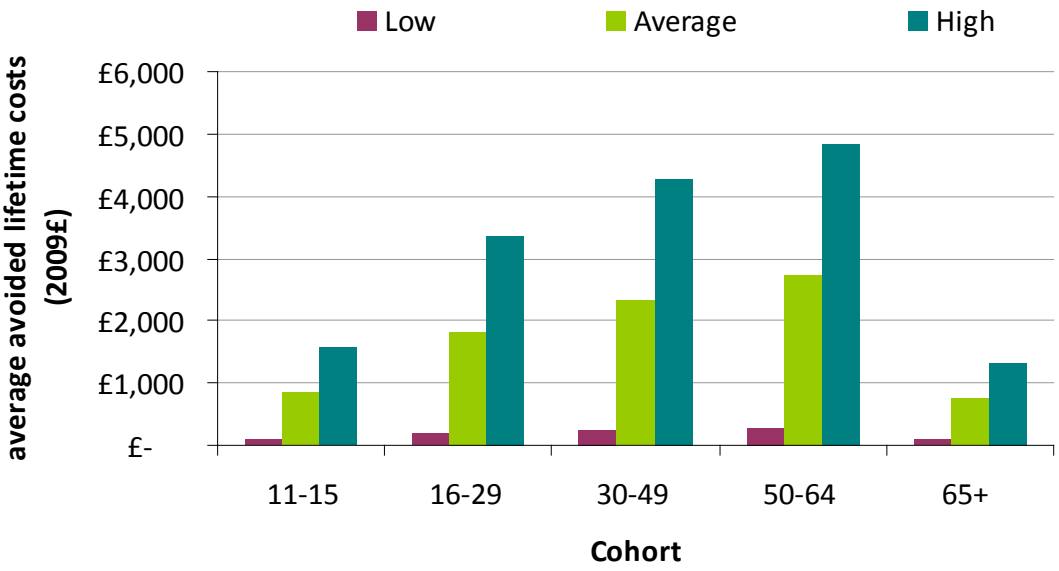
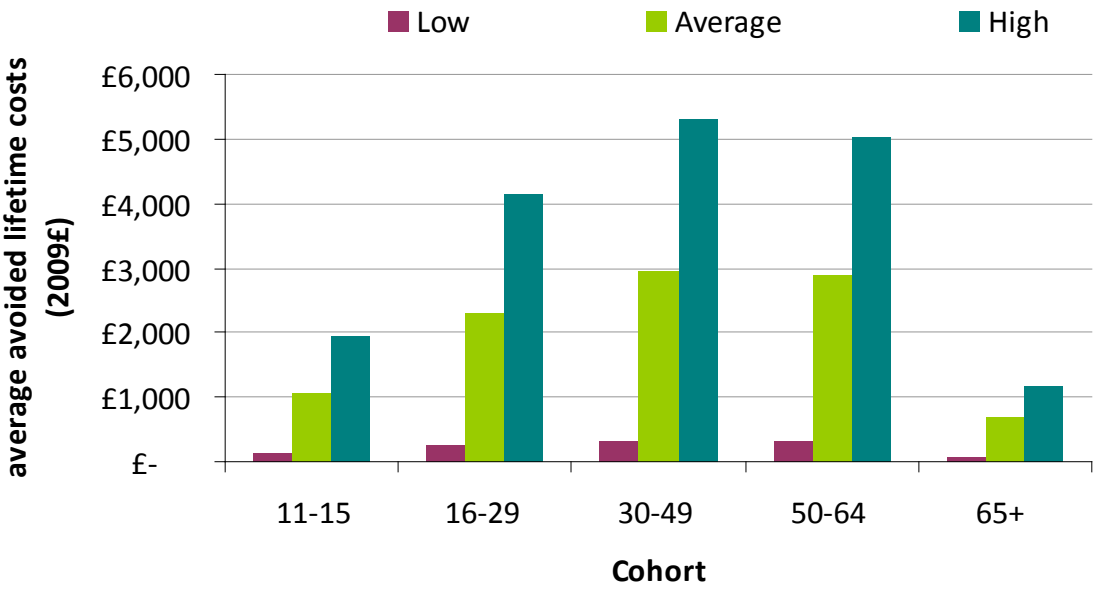


Figure 26: Health costs avoided due to avoided type 2 diabetes with vigorous physical activity



Figures 27 to 30 summarise the sensitivity the estimates of QALY gains to variations in the relative risk of experiencing health states with different activity levels.

Figure 27: Sensitivity of QALY gain to relative risk of experiencing health states with moderate activity (vs. no activity)

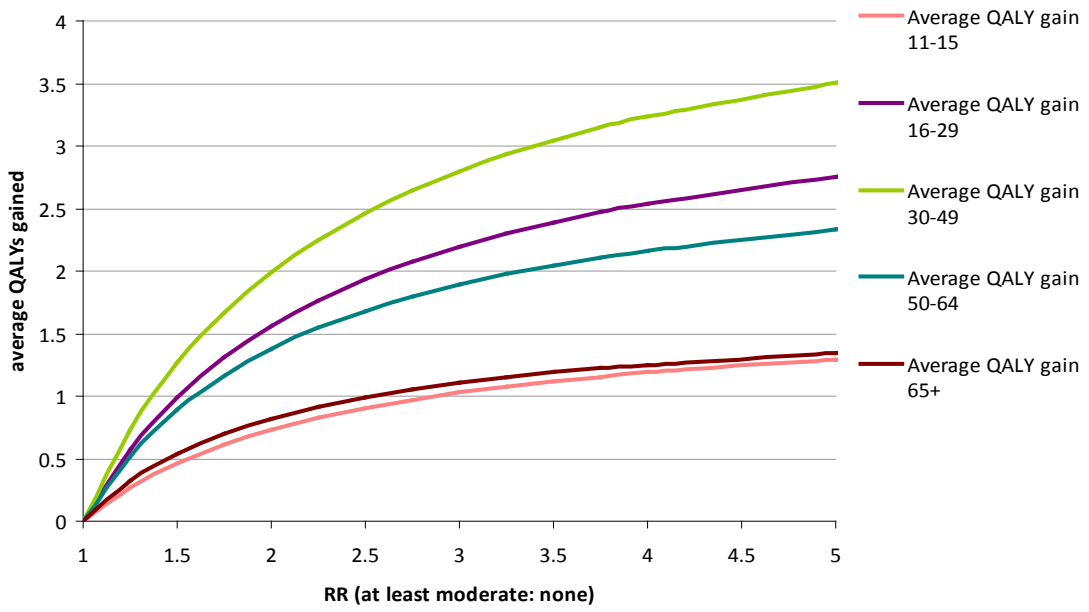


Figure 28: Sensitivity of QALY gain to relative risk of experiencing health states with vigorous activity (vs. no activity)

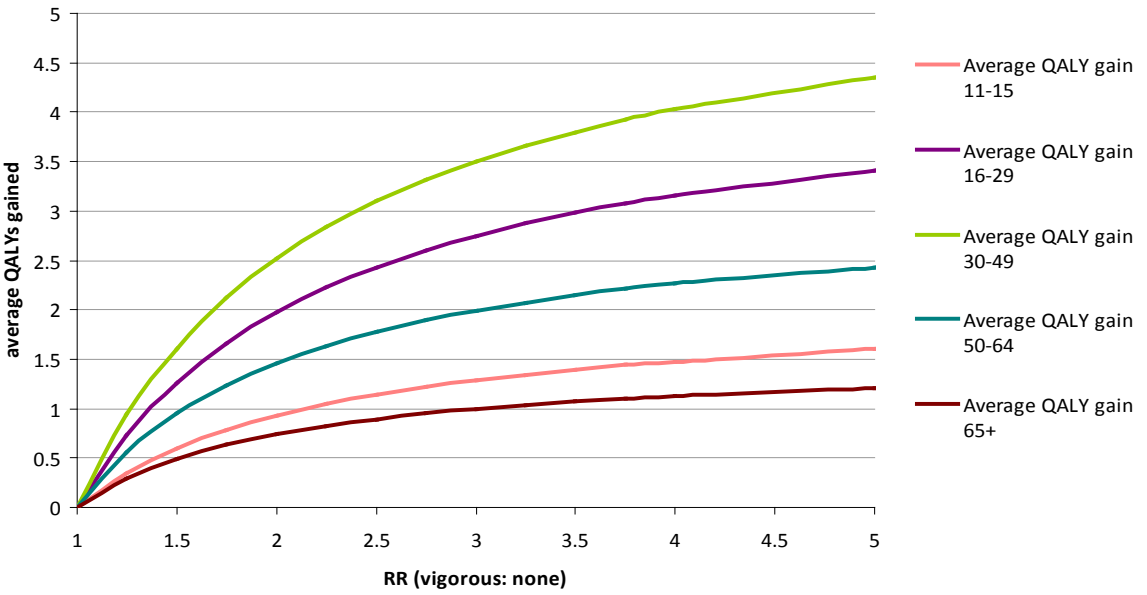


Figure 29: Sensitivity of health cost saved to relative risk of experiencing health states with moderate activity (vs. no activity)

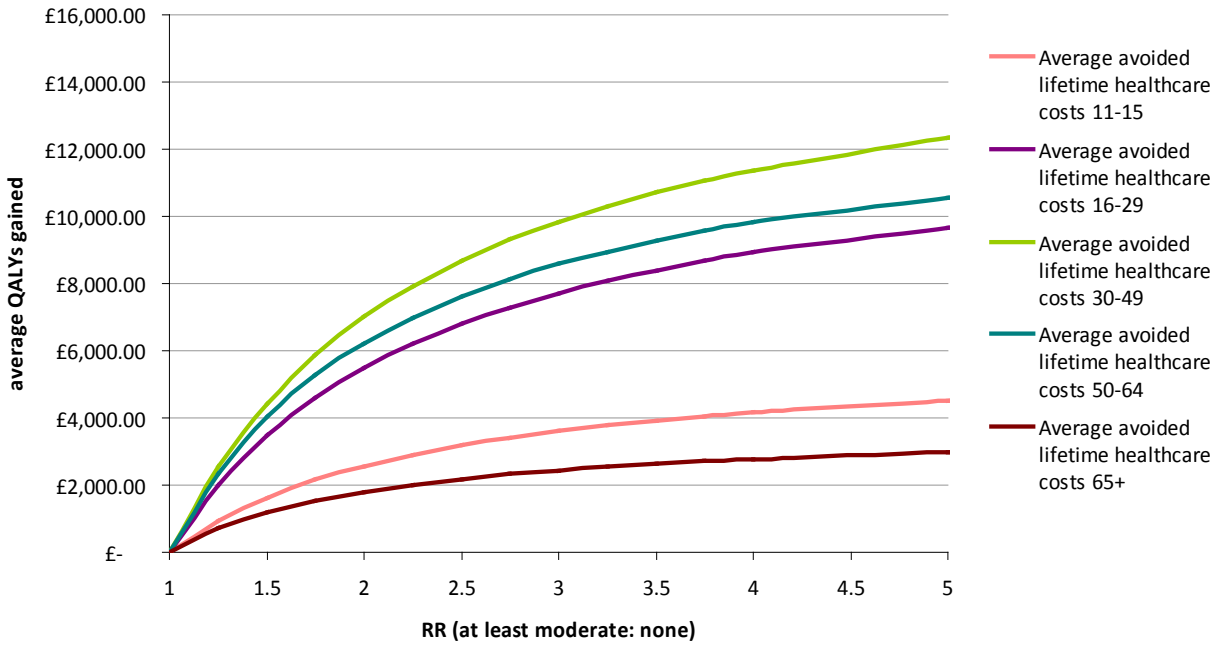


Figure 30: Sensitivity of health cost saved to relative risk of experiencing health states with vigorous activity (vs. no activity)