PLUREL

Sustainability
Impact Assessment

Module 4

July 2008

PERI-URBAN LAND USE RELATIONSHIPS – STRATEGIES AND SUSTAINABILITY ASSESSMENT TOOLS FOR URBAN-RURAL LINKAGES, INTEGRATED PROJECT, CONTRACT NO. 036921

D4.4.1b

Report on the monetary valuation of the urban, peri-urban and rural service supply

Part B: Monetary valuation of odour, brownfields, and cultural heritage externalities

Alberto Longo*, Andrew Hughes (QUB)

*Responsible partner and corresponding author
Tel: +44 (0)28 9097 2063; Email: a.longo@qub.ac.uk

Document status:

Draft:	completed
Submitted for internal review:	completed
Revised based on comments given by internal reviewers:	completed
Final, submitted to EC:	completed

SIXTH FRAMEWORK PROGRAMME

Contents

1. Abstract

In this deliverable we report a review of the economic literature assessing the monetary values of the external costs and benefits caused by the presence of odour, brownfields, and cultural heritage in urban, peri-urban and rural areas. Whilst the presence of brownfields and unpleasant odours give rise to negative externalities, the cultural heritage studies provide an assessment of the monetary benefits given by the presence of cultural monuments on the welfare of visitors and non visitors as well.

The studies reviewed in this report focus on works that have employed non-market valuation techniques to assess the external costs of odour, brownfields and cultural heritage. The focus of the literature review has mainly been peer-reviewed journal articles. This review provides an overview of the most important studies in the area and aims at summarizing the results from previous studies on the monetary values of brownfields, cultural heritage and odour.

We find that the affected population has different willingness to pay according to how serious the externality is, and how important the cultural heritage monument is. Willingness to pay is highly site specific for these externalities. We suggest caution in transferring the benefit from original studies to policy studies.

2. Introduction

In this report we investigate, through an extensive literature review, the monetary valuations of the externalities associated with three land use activities that have an impact on the welfare of the public: the production of odour, the presence of brownfield land, and the presence of cultural heritage monuments. The assessment of the costs and benefits provided by these activities in terms of welfare change of citizens provide useful information to the policy maker to make decisions on land use in a better informed way. For example, understanding how much residents are affected by odour externalities provides a useful information to a policy maker willing to regulate the external cost caused by odour by imposing a tax on the polluter, or establishing an emission limit, or by compensating those living near the odour externality facility. In similar way, knowledge on the external costs caused by the presence of brownfields can encourage the policy maker to carry out better informed decisions on the reuse of previously used land, by understanding the welfare change that a reuse of a brownfield might bring to local populations. Finally, assessing the monetary value of the presence of cultural monuments provides the policy maker with important information on how much citizens value the presence of cultural landmarks. These cost-benefit analyses may support the policy makers in allocating public funds for conservation of cultural monuments.

In this document we review studies of stated preferences and revealed preferences assessing the externalities in the three areas of cultural heritage, odour and brownfields. Our interest focuses on citizens' willingness to pay to regulate the external costs for brownfields and odour, or to maintain the external benefits in the case of cultural heritage.

The rest of this document is divided into three parts to separately address the externalities from odour, brownfields and cultural heritage. Each chapter describes the externalities measured using stated preference methods, such as the contingent valuation method and choice experiments, and revealed preference methods, such as the travel cost method and the hedonic pricing method. Each chapter ends with concluding remarks obtained by surveying the literature. At the end of each chapter we provide a table that divides the studies into urban, peri-urban and rural studies when possible. Appendixes collect useful information for selected studies. Among other things, they provide the monetary valuations, expressed in 2007 Euros, for the externalities.

This analysis provides a useful background for the monetary valuation exercises to be carried out later on in the project when we will focus on the land use externalities in one or more case studies of the project.

3. Odour Externalities

3.1 Introduction

In this section we review the studies on the external costs of odour. A detailed summary of all studies on odour exernalities is reported in the appendix where external costs are expressed in 2007 EURO (€). Most studies reviewed in this section are based on the hedonic pricing methods, on stated preferences and on cost based approaches.
One of the problems researchers have faced in valuing odour externalities is the difficulty in disentangling the odour externality from other externalities, such as air pollution, soil contamination, health effects, visual intrusion, windblown dust, litter and debris, noise , vibration. The majority of research into odour externalities has been conducted in rural areas. This is due to the fact that many hog farms and feedlots locate in rural areas, and it is these facilities which produce strong smelling odours that can be easily detected from the surrounding neighbourhood. Also, hog farms and feedlots are activities that have better allowed researchers to disentangle odour externalities from other external costs.
The fact that most studies are in rural areas makes it difficult to identify studies on odour external costs in urban and peri-urban areas. In urban or even peri-urban areas there will most likely be a variety of strong odour sources, making it difficult to identify just one source and place the blame on just one odour source. Perhaps if new technologies, such as electronic noses used in Nimmermark (2001), were developed and used, this would help in odour external costs studies of urban and peri-urban areas.
From the tables in the appendix we calculated that the external costs of odour are substantial and account for an average loss in property values of about €3,000 – €10,000, or about 3% - 10% on the value of a property. Stated preference studies report WTP figures that range from few cents to more than €80 per household per year.

3.2 Stated Preference Studies on Odour Externalities

Even though most studies have used the hedonic pricing method and cost based approaches, a number of researchers have used stated preference techniques to place monetary values on odour externalities.

Using the contingent ranking technique, Lareau and Rae (1989) value the willingness to pay (WTP) for diesel odour reductions. The sample was a diesel odour survey of 140 respondents in Philadelphia, conducted in 1984, from which Lareau and Rae estimate the WTP for reduced exposure to vehicle diesel odours. The survey required each respondent to smell two odours; ODOUR A (mild diesel smell) and ODOR B (more intense). Respondents then proceeded to a ranking procedure. Monitors presented respondents with a card set with four different alternatives. Each alternative showed the number of weekly exposures to the two odours and the associated increased annual transportation cost required to reduce particulate emissions. Odour exposures were defined over three ranges, while annual costs were grouped into four sets. No clearly dominant choice was available in any one deck. Twelve different card decks were used, which permitted a broad range of potential willingness to pay reponses without overly burdening any one respondent. The survey also asked respondents to specify the categories in their budgets that would be decreased to pay for their highest ranked alternative. In addition, the survey questioned respondents about their willingness to support public types of goods and public causes, such as public TV. Lareau and Rae estimate the WTP to be quite stable across different specifications of the indirect utility function. They find the average annual willingness to pay per household in Philadelphia metropolitan area to be $75 to avoid completely all diesel odour exposures. They find that this diesel odour control would be worthwhile, as the US EPA estimate that control of diesel particles from heavy duty trucks would cost around $300 million per year, or about $3.60 per urban household. So if the

willingness to pay and the number of odour exposures were comparable in other cities to the estimated values in Philadelphia, vehicle control of diesel particle emissions and associated odour would be worthwhile.

Muller and Deiner (1997) attempt to ascertain both the relative importance placed by the residents of Hamilton-Wentworth on four specific attributes of air quality; health effects, bad odour, black fallout and poor visibility. They also assess residents' willingness to pay for changes in these attributes. They use the choice experiment method to survey respondents. In February 1997 the final survey was administered by mail to households throughout the Regional Municipality of Hamilton-Wentworth, and asked respondents to rank well-defined alternative scenarios involving air quality and a payment vehicle. A total of 515 completed surveys were returned, resulting in a response rate of 31%, however, of this, 99 did not complete section B of the questionnaire. Muller and Deiner find that 81.2% of respondents were very or extremely concerned. Most respondents stated that the air quality issue was more important than the level of taxes and snow clearing, but not as serious an issue as crime levels, the quality of the educational system or unemployment levels. It was also found that respondents were willing to pay approximately $58/month to decrease the number of hospital admissions for cardio-respiratory diseases from 18 to 12/month and decrease the number of extra deaths from 2/month to 1/month. Respondents were also willing to pay $23/month to decrease the number of days with black fallout per month from 3 to 2, $19/month to decrease the number of monthly bad odour days from 4 to 3, and $14 in order to lower the number of monthly poor visibility days from 3 to 2 per month. Generally, respondents appeared to be willing to pay between $50 and $13 for a one third improvement in each of the attributes.

Garrod and Willis (1998) examine the impacts that the Crawcrook Quarry and Landfill Site at Crawcrook near Gateshead have on the people who live around it. They use a stated preference choice experiment to estimate the magnitude of these impacts in monetary terms. Included were questions concerning household waste, waste disposal issues, opinions about the landfill site, and household details. There 73 respondents, each making four choices, thus providing 292 observations. Garrod and Willis find that the overall WTP for 50 fewer days with smells from the site and 50 fewer days with windblown litter from the site could be €17, with the majority of people willing to pay relatively small amounts. Garrod and Willis explain that a low WTP may be due to the fact that people have learned to accept disamenity levels and so had little incentive to pay to reduce these levels. They suggest that local residents' familiarity with long-established waste disposal sites mitigates against much of the disamenity associated with their operation.

Hurlimann and McKay (2007) examine the attitudes of an urban Australian community living at Mawson Lakes in South Australia (12km north of the Adelaide central business district), to using recycled water for non-potable domestic purposes. They chose conjoint analysis as their method of study, as they explain that it can be used to evaluate the introduction of a new product (such as recycled water) with both private and public implications. They include price as a variable in the conjoint analysis as it allows willingness to pay estimations to be calculated for increases in quality of the attributes tested. Their sample includes 136 Mawson Lakes households, which were randomly selected to take part in a telephone interview that would last on average 30mins. Respondents were asked to consider a range of scenarios (such as garden watering, clothes washing, toilet flushing) and rate their preference for each scenario, for each use, on a scale of 0-10, were 0=very low preference and 10=very high preference. This scale method was similar to that of (Juster) 1966. Hurlimann and Mckay found that an increase in recycled water quality from having odour at times to being completely odourless increased the preference score by 1.643. They present a figure showing importance scores for each attribute use combination. Odour was most important for toilet flushing. They find the average willingness to pay for recycled water to be €0.29/m³. They explain that their results show that to be most acceptable to the community, recycled water should be

low in salt, colourless and odourless, while low in price. They also found that respondents were found to be most willing to pay for an increase in recycled water quality for clothes washing.

3.3 Hedonics Studies on Odour Externalities

Hedonic studies have been widely used for assessing odour externalities. In this section we review the most interesting studies.

Externe (1995) contains a hedonic property price study of the Cerro Maggiore landfill site in a sub-urban area north east of Milan, Italy. Data on 289 property sales over the period 1993 to 1995, obtained from a major estate agent in the area, were used to estimate disamenity (odour) costs (in million lira per m2) as a linear function of distance from the landfill site. An 'odour exposure index', which took account of both the intensity and duration of exposure above a specified threshold, was created to assess the impact of odour emissions from the site. The index was evaluated at each property surrounding the site using an emissions dispersion model, and the results integrated into the original hedonic property price function. Assuming that the sample used is representative of the region from which the sample was drawn, the average price change due to the odour disamenity was estimated at 2.8%. However, the relevance of this study is limited by the focus on odour, thus ignoring other sources of disamenity, such as visual intrusion, windblown litter and debris, the presence of pests, noise and vibration. It is therefore possible that the 2.8% price effect represents not only an odour externality, but also other disamenities. In addition, the price data were drawn from a single real estate agent only, in contrast to US studies that typically base samples on housing transactions sourced from many different agents, allowing a more broad-based sample to be employed.

Taff et al (1996) conducted research in the effects feedlots have on the value of nearby properties. They begin by looking at previous studies into the impacts of hog industries on local property sales. From the literature they calculate that a house price will drop by 4.75% if a feedlot is built 0.5 miles away, but will only drop by 0.56% if the same feedlot is built 2 miles away. Taff et al consider 292 rural residential property sales in 1993-1994 for two Minnesota counties for which data are available, plus all larger nearby feedlots (those with more than 500 animal units). They model the sale prices solely as a function of characteristics of the house, such as size and location, without considering any feedlot characteristics. Housing data in the study came from county assessor records and state Department of Revenue sales reports. They then compute the prediction errors i.e. the differences between the observed sale price and the predicted price from the property model. To their surprise, they find that nearby feedlots appear to positively influence property values in Minnesota.

Palmquist et al (1997) conducted a hedonic study of 237 rural residential house sales in 9 counties in south eastern North Carolina that occurred between January 1992 and July 1993. This was in order to determine the effect of large scale hog operations on surrounding property values. For each sale, data were collected on house characteristics, general neighbourhood indicators, and swine population statistics. They found that the predicted price falls from $63,272 to $57,266, or a statistically significant 9% reduction depending upon the number of hogs and their distance from the house. Furthermore, they find that odor associated with swine production has caused conflicts between neighbouring landowners, and that expansion of swine production in areas where hog concentration is already high will have smaller negative effects on surrounding property values than when expansion occurs in low hog density areas.

Gomez and Zhang (2000) examine the case of Illinois' hog farm sector to assess the impacts of increasing concentration in food and fibre production. They develop an econometric model to estimate the impact of large hog farms on the economic vitality of rural communities in Illinois and reach beyond qualitative appraisals common in the

assessment of large swine farms on rural communities. The model uses data, such as sales-tax receipts, for 1106 towns and cities in Illinois covering a period 1981-1997. They also review the current issues associated with structural changes in agriculture and livestock production, including higher unemployment for local residents, losses on property values, water contamination, profits flying away from the community, high human costs, and negative impacts of the environment such as odour and water contamination. Gomez and Zhang find an inverse relationship between hog production concentration and retail spending. They find that, contrary to their hypothesis, the several models developed consistently indicate that large hog farms tend to hinder economic growth in local communities. In conclusion they ask readers to consider two different policy objectives; 'no intervention' (acceptance of decline of rural communities as an inevitable outcome of economic growth); and 'intervention' (the necessity to protect and preserve economic vitality of rural economies).

To better understand the scale of the effects of livestock feeding operations on residential property values, Herriges et al (2003) have constructed a dataset that merges data on home sales with that on the location and size of livestock feeding operations in five rural counties of Iowa; Franklin, Hamilton, Hardin, Humboldt and Webster. Information on each of the 550 studied livestock facilities was obtained from the IDNR, with available data including the GIS files on the location of the operations as well as the live weight and animal type in production. Manure production was considered as an alternative measure of the size in their hedonic analysis. Data on home sales were restricted to 'arms length' sales between 1992 and 2002, this information being obtained from each county assessor's office. The variables used in the hedonic regression fall into three broad categories; physical attributes (square footage etc.); surrounding community attributes; and livestock facility attributes close to homes. Herriges et al then investigated four broad classes of models in hedonic pricing. They find that livestock operations have an overall negative effect on property values, which are largest for properties which are downwind and close to livestock operations. Furthermore, moderately sized feeding operations have more impact than large-scale operations, possibly due to age, type and management practices of medium sized operations. They agree that more precise estimates of the effects of feeding operations on property values could be obtained by gathering more data about the attributes of the operations.

Milla et al (2005) examine the applicability of GIS-based hedonic price modelling for evaluating impacts to residential property values from feeding operations, particularly hog operations. They also consider the effects of distances to other features such as schools, vacant lots, highways, sewage treatment, veterinary clinics, gas and oil storage, police and fire protection, banks, restaurants, golf courses, hospitals, retail food stores, lumberyards, trucking terminals, service gas station, night clubs, marinas, mining and quarrying, manufacturing and processing and agricultural fields. They find that a hog density/distance variable of 1% results in a -0.03113% change in the value of a property. They suggest the establishment of buffer zones to avoid impact to property values, but concede that these buffer zones may need to be too large to be realistic. They conclude that attribute data derived from a GIS parcel management system can be used for successful hedonic modelling of damages to property values associated with proximity to livestock production facilities.

Batalhone et al (2002) apply the hedonic price method in order to estimate the social cost of air pollution and economic impact of a strong smell organised from the ETE/North Sewage Treatment Plant upon residential properties located nearby in the north portion of the city of Brasilia, Brazil. Property values were obtained from two sources; the value of the urban territorial tax (IPTU/GDF/2000); and an evaluation made by the Urban Development Managing Support Unit (GIDUR/BR) of the Caixa Economica Federal bank. Four models of hedonic pricing are used and reviewed; 1) HD as a value of the Urban Territorial Tax – IPTU/GDF 2000; 2) HD as a value of the Evaluation of GIDUR/BR/CEF expressed in Current American Dollars; 3) HD as the Evaluation of GIDUR/BR/CEF, corrected by the Brasilia Construction Index – ICC/BSB from the Getulio Vargas

Foundation; 4) and Price as a value of Evaluation of GIDUR/BR/CEF, corrected b the Exchange Rate Index of the Central Bank. Different sample sizes were used for the various models, with a sample of 959 apartments being used for models 2 and 4, while 9522 were used in model 1. The economic analysis revealed a number of coefficients; air quality from ETE/North negatively influences the value of apartments; buildings with garage and elevators are more valuable than those without; proximity to drugstores, bakeries, bookstores and restaurants appear to contribute to the reduction of apartment values; and apartments suffer a devaluation in their prices when located in residential blocks nearby bars with music. They find that the presence of smell has an impact on the house value of €3664.50-€7851.29, but no information is provided on the average house value. The findings confirm the hypothesis made by Batalhone et al; the quality of air has influence on the apartment value. Apartments located in the proximities of that sewage treatment station have relatively smaller prices, in relation to similar ones located in more distant areas.

Anstine (2003) examines how the presence of dual, disparate environmental disamenities located near each other impact property values in a semi rural area. He uses two facilities (a heavy metal facility and a rubber compounding manufacturer) located within two and a half miles of each other, and a few miles from the downtown area of Jonesborough, Tennessee. Housing data are gained from the Washington County Tax Assessor's Office. Using hedonic pricing, he examines the impact of the use of an imperceptible hazardous material in the production of goods on the housing prices in the community when the other noxious facility is present. He first examines relevant previous studies, which he finds have focussed on a single unpleasant facilty in a community e.g. a toxic waste site or landfill. Anstine finds that where people can see or smell the pollution from a facility such as the rubber compounding factory, the presence of the disamenity affects assessed values of the homes, while facilities less visible and with less available information, such as the heavy metal facility, do not affect the values. The marginal price of a location near the rubber compounding plant, evaluated at the means, is €5050.80 less than those located further away. Anstine suggests that cleaner plants will have smaller impacts on housing values in low populated areas.

Using the hedonic pricing method, Ready (2005) estimates the marginal implicit prices for proximity to three landfill sites in Berks County PA, USA; the Western Berks Landfill which is small 65 acre site which accepts 300-400 tons of waste per day and is difficult to see from off the actual property; Rolling Hills Landfill which is a 120 acres site that accepts 2400 tons per day and is visible in some directions from over a mile away; and Pioneer Crossing Landfill which, at the time of study had 92.5 acres, accepted 1000 tons per day, and is a prominent feature in the landscape (it has since been granted a new permit allowing for 1550 tons to be accepted per day. A database on residential sales between 1998 and 2002 (11,090 in total) was constructed from the 2002 digitized parcel map of Berks County maintained by the Berks County Office of Assessment. Information on structural characteristics (age, square footage, lot size etc), locational characteristics (house location, distance between landfills, and distance from towns) came from the assessor's database. A county-wide map was developed showing the location of all industrial land. A meta-analysis of all available hedonic regressions showed that the average landfill reduces nearby property prices by 4.12% (€3989.83) per mile of distance, but the impact varies among landfills; a house located adjacent a landfill may decrease in price by 9.21%, while an estimated 5-8% of landfills have no impact at all on nearby property values.

Ready and Abdalla (2005) use a GIS-based hedonic pricing model to show how agricultural land uses impact nearby residents. They study the area of Berks County which is northwest of Philadelphia PA. The sample was of 8090 single family detached residential properties that were sold between 1998 and 2002. Data on house sales and structural characteristics were obtained from a county wide parcel map maintained by the Berks County Office of Assessment. From the parcel map, a land use map was constructed. The four categories of land use labelled were; open space; commercial;

industrial; and residential (of which there were five subcategories; small lot single family (less than 0.2 acres); medium lot single family (0.2-0.5 acres); large lot single family (0.5-1.5 acres); very large lot single family (over 1.5 acres); and other residential (which includes duplexes, row homes and mobile homes). He implicit house price function was estimated using an instrumental variable (IV) approach similar to that used by Irwin. The IV regression uses as explanatory variables: land use, high traffic roads, sewage treatment plants, airports, landfills, mushroom production and animal production facilities. Ready and Abdalla find that agricultural open space increases residential house prices within 400m. However, larger scale animal operations and mushroom production have negative impacts on house prices within 1600m; they find a single animal production facility decreases nearby property values by up to 6.4%

3.4 Other Study Methods on Odour Externalities

A group of studies has used cost based methods to assess the external costs of odour disamenities.

Taylor (1999) reports on issues arising over the exposure of some US residents to odours from animal waste. He reports the story of a man in Faison, North Carolina, whose house is surrounded by 21 hog barns, the odour from which cannot even be drowned out by closed windows, air conditioning and incense. He continues to describe how intense odours can cause mood swings, irritate eyes and even cause neurochemical changes, affecting health. Taylor describes different methods of odour measurement, starting by mentioning the popularity of the scentometer in 1970s North Dakota and also mentioning mass spectroscopy. He describes the issues which arose with the establishment of EnviroPork hog facility in North Dakota and how for it to abate odour with the installation of a lagoon (including material, labour and equipment rental) may cost over $11,500. Taylor looks at the continued expansion of the hog industry, despite the falling prices of exports, and the development of the Ekokan upflow biofilter which can help with odour problems but may cost around $50,000 for a facility of 800-1200 hogs.

Sang Jin Park reviews the status and management of odour in Korea and introduces three measurements applied in the country. He reports that more than 2760 civil petition cases among 1626 manufacturing plants have been filed. He presents a table showing the analysis and permission levels of odours in Korea, while also describing the legislation of the odour prevention law and bills due to be enacted.

Nicolai and Janni (1997) recognise that odour sources on livestock facilities include buildings, manure storages and land application of manure. They report on the construction, performance, and management of a low cost biofilter used to treat air from a continuously running pit fan on a swine farrowing barn. The biofilter (installed in October 1996) treats exhaust air from four pit fans in a 36 crate farrowing barn. One of the fans operates continuously at maximum speed with a flow rate of 2200 cubic feet per minute at 0.25 in of H20 static pressure. A water sprinkler was added to the filter in May 1997. A handheld temperature probe was used to measure ambient tempeature and biofilter bed temperature once a month from October to March. In April a monitoring system was installed to measure biofilter bed, inlet, exhaust and ambient air temperatures, with recordings being taken every five minutes and averaged hourly. Air samples from beneath the bed were obtained by placing the collection hose near the connection of the vertical duct and plenum beneath the bed. The odour threshold is expressed in odour units, which is defined as the lowest volumetric concentration ratio of the total sample. Odour detection thresholds inside the barn were between 120 and 854 odour units. Odour levels in the treated air leaving the biofilter ranged from 20 to 208 odour units. Odour was reduced an average of 78% ranging from 29% in April to 96% in July. The biofilter cost approximately $75 for materials to construct because many of the components were readily available from the producer and therefore not directly purchased. Nicolai and Janni estimate a biofilter constructed similarly from new

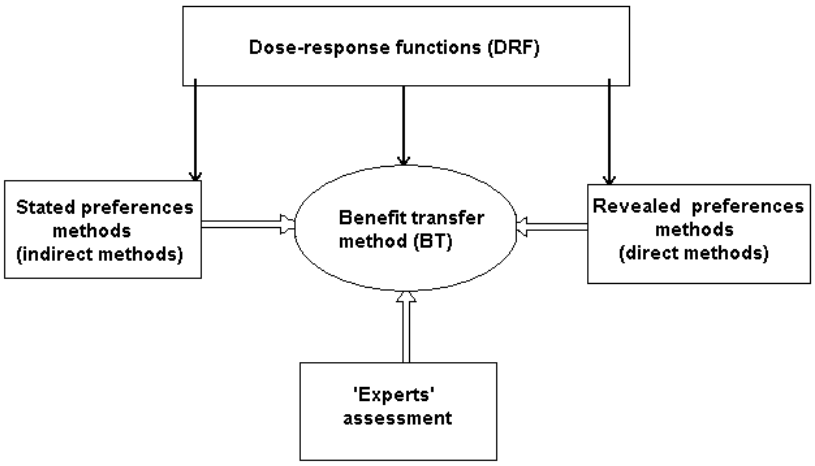
materials to cost $500, meaning the construction and operating cost would be $0.28 per piglet produced. They conclude that a low cost biofilter using compost and kidney bean straw was very effective reducing odour threshold levels and removing hydrogen sulphide and ammonia from air from a manure storage pit below a swine farrowing barn.

Fleming (1999) evaluates how much longer the setback length for surface application must be to encourage soil incorporation of swine manure. Generally, setback provisions require that swine production facilities are located a specified distance away from neighbours; these may vary according to category. The empirical focus of this investigation is a large swine producer who is investigating the costs associated with locating in western Kentucky. The producer is not currently producing crops or other agricultural commodities in the state. Fleming finds that at 420000 pounds of production and with manure applications to soybeans, if the setback length for incorporation is 0, then setback length for application must be 1679 feet for the producer to be indifferent between the two application methods (the marginal cost of the two application methods is the same). Therefore, at 5.04 million pounds of production with manure applications to corn, soybeans, wheat and Bermuda grass in rotation, if incorporation is 500 feet, then surface application must exceed 8393 feet for incorporation to be the preferred and least-cost manure management strategy. Fleming explains that incorporating swine manure into crop acreage is expensive relative to surface application. The unit cost of incorporation is higher and injection requires more crop acreage for land application; the higher costs require large differences in setback lengths if provisions. Fleming concludes that other economic incentives that encourage incorporation of swine manure should be explored.

Beloff et al (2000) conduct research into 'harmless' odours, and aim to determine the cost impact of environmental effects resulting from management decisions. They construct a table showing the internal and external drivers for assessment of intangible costs, including external public reporting and non-domestic applications. Beloff et al then describe the methods and findings of a 1999 study by BRIDGES to Sustainability™ which aimed to identify societal costs associated with the industrial release of 'harmless' odours as a result of industrial and agricultural activity. In the study they would make use of the TCAce™ model (a workable total cost assessment model that meets the needs of a broad range of industrial sectors, established by the Center for Waste Reduction Technologies). The term 'harmless odour' used by Beloff et al is defined as ''harmless' if the substance causing them does not appear on the Toxic Release Inventory or the Resource Conservation and recovery Act (RCRA) hazardous material list.' They undertake research on a number of sites, including; the DuPont facility in La Porte, Texas; a paper mill in North Carolina; and EnviroChem and Monsanto in St Louis, Missouri. They identify a number of societal costs associated with hazardous odours, including medical costs, individual's odour abatement costs, government costs, public interest group costs, legal costs, commercial costs and job loss costs. They find an average annual cost of €509.16 per affected household. In concluding they state that the presence of an odour in a community may create a number of impacts that lead to economic losses and costly actions on the part of citizens in the community. They also suggest that societal costs provide an imperfect estimate of the costs that a company is likely to bear as the result of emitting 'harmless' odours, and find that once a threshold of complaints from thirty people is crossed, the magnitude of company costs relative to social costs grows significantly; so estimation of potential societal costs as a function of the size of the affected population when making company decisions regarding issues having odour impacts.

Eshet et al (2005) study the environmental and social costs related to various pollutants and disamenities associated with landfills and incineration of municipal solid waste. The first step of their study was a comprehensive literature review of relevant studies, addressing existing estimates and implications from primary and secondary studies worldwide that have been conducted since 1990 (based on both real cases and theoretical models). Secondly, they mapped and gathered different values for externalities associated

with various types of related pollution and disamenity, summarizing findings in a table. Thirdly, they analysed and compared reviewed values. Eshet et al review a wide range of valuation methods, including; dose response function; direct methods (contingent valuation and choice modelling); indirect methods (hedonic pricing, averting behaviour, cost of illness, health production, travel cost and complaint assessment); expert assessment of damage costs (control cost, cleanup cost and replacement cost); and benefit transfer. They present these methods as a simple diagram as shown below.



Eshet et al draw up a number of observations from their research; recommending a single 'best value' for each externality as well as for the total external cost of land filling and incineration is not feasible due to a high level of uncertainty; economic methods are favoured because they consider the preferences of people and hence provide the true external cost; studies that include externalities generated by waste transportation differ largely in their total estimates in comparison with other studies that do not; given that many of the estimates have been derived from primary studies via the practice of the BT method, the potential for additional uncertainty of the secondary values should be taken into account; there is plenty of room for improvement in the valuation of pollutants associated with landfilling and incineration of waste, especially with respect to pollution to water and soil; and the field of disamenities valuations is relatively neglected, especially with regard to incinerators. They conclude by stating that valuations should be continually investigated and updated consideration should be given to various changes and developments in the environmental field in general and in waste management.

Table 3.1 Urban, peri-urban, and rural studies on external costs of odour externalities

Urban Studies	Peri-urban studies	Rural studies
Batalhone et al (2002)	Anstine (2003)	Fleming (1999)
Beloff et al (2000)	ExternE(1995)	Garrod and Willis (1998)
Hurlimann and Mckay (2007)	Ready(2005)	Gomez and Zhang (2000)
Lareau and Rae (1989)		Herriges et al (2003)
Muller and Deiner (1997)		Milla et al (2005)

		Nicolai and Janni (1997)
		Palmquist et al (1997)
		Ready and Abdalla (2005)
		Taff et al (1996)
		Taylor (1999)

3.5 Conclusions

In this section we have looked at studies on the external costs of odour. One of the problems researchers have faced in valuing odour externalities is the difficulty in disentangling the odour externality from other externalities, such as air pollution, soil contamination, health effects, visual intrusion, windblown dust, litter and debris, noise , vibration. Hedonic studies on hog and feedlots activities in rural areas are perhaps the best studies that allow researchers to well measure odour externalities as these activities minimise the risk of including other external costs in the measure of the disamenity.
From the tables in the appendix we calculated that the external costs of odour. A first result is that it is difficult to provide a unique value for the disamenity caused by odour presence. Hedonic price studies, mostly based on disamenities caused by farm activities, have found that the losses vary between 0 and 30% of the value of the average houses, depending on the size of the farm, wind direction, distance from the farm. On average, houses located within 1 mile from the closest farm suffer a loss of about 3,000-4,000€ (2007). Stated preference studies on odour externalities show large differences: the WTP for one extra day without bad smell varies between 0.11€ and 17€ (2007). However, these stated preference studies suffer from difficulties in disentangling odour externalities from other externalities and it appears that hedonic studies seem to provide more sound methodological approaches for valuing odour external costs. Finally, studies employing cost based approaches have found that the costs of removing odour externalities vary between 0.26€ and 47€ per piglet in hog farms, depending on the technology used.
In conclusion, it appears quite a difficult task to identify a single estimate for odour externality from previous studies because of 1) difficulties in disentangling odour from other externalities; and 2) comparability of different studies of odour. Researchers have tried to overcome these problems by focusing on hog farm activities. However, even among these studies we have found that external costs vary by about two orders of magnitude.
When we consider external costs of odour in rural, peri-urban and urban areas, it appears that the majority of research has been conducted in rural areas, suggesting that if researchers aim at addressing odour externalities in urban areas new methodologies have to be developed. One of the biggest problems in urban odour studies is disentangling odour external costs from other external costs, mostly health related. Hedonic pricing studies on agricultural activities probably provide the most reliable assessments of the external costs because they can more easily disentangle odour externalities from other air pollution or soil contamination externalities. Perhaps if new technology, such as electronic noses used in Nimmermark (2001), were developed and used, this would help in odour studies of urban and peri-urban areas.
The monetary values of the external cost from odour emissions are quite different in different studies. Stated preference studies report WTP figures ranging from as little as few cents (Hurlimann and McKay, 2007) to as high as €87 per household per year (Lareau and Rae, 1989). The latter figure, however, may be misleading as the study reporting this result focused on the valuation of odour exposure from diesel emissions. In particular, we find it difficult to believe that respondents did not consider other health related externalities when answering the WTP questions. All the stated preference studies are based on small samples, except the study by Muller and Deiner (1997), which however uses the contingent ranking method which is not usually recommended for the high

cognitive burden imposed to respondents when asked to rank different options in a choice set. We conclude that stated preference studies on odour externalities are in their infancy, and more research is needed to provide more convincing external costs estimates. In particular, new studies should increase the sample size and find more robust methodologies to disentangle odour from other externalities.

Revealed preferences studies assessing the external costs caused by proximity to an odour emission source provide estimates ranging from about 3% to about 10% of the value of real estate properties. This is approximately equal to an average loss in property prices of about €3,000 - €10,000 per property. Most studies have been conducted in the US, with only a couple been done in Europe. These European studies, however, are not as methodologically convincing as the American studies as they have not been published in peer-reviewed journals.

4. Brownfields Externalities

4.1 Introduction

This section examines the external costs of brownfields. Research methods have mostly taken the form of hedonic analysis, with a limited amount of papers using stated preferences approaches. Section 2 reviews stated preference studies; section 3 looks at hedonic pricing studies; section 4 summarizes other valuation studies; section 5 summarizes a number of interesting studies that look at brownfields externalities but do not provide monetary values for the presence of brownfields; section 6 summarizes the results from the review. The reader only interested in valuation studies may skip section 5.

4.2 Stated Preferences Valuation Studies on Brownfield Externalities

Not many studies have been conducted to assess the WTP to redevelop brownfield sites using stated preferences. In this section we summarize the most relevant ones.

Alberini et al (2005) examined market-based incentives which were intended to promote brownfield reuse and remediation. A conjoint choice survey was distributed 293 developers at MIPIM, Europe's largest international commercial property conference, in Cannes, France, on March 12-15, 2002. The survey was carried out in order to see developers' responses to these market-based incentives. It was found that developers who have previously received incentives from the government are more responsive to the incentives posed in the survey. The results also suggest that liability experience is more important than subsidies for developers with no previous contamination experience. Furthermore, Alberini et al conclude that contaminated sites are less desirable, with developers experienced in contaminated sites being more responsive to financial assistance than others. It was calculated that for a project worth €7.77million developers need to be compensated €2.77million for them to accept a contaminated site and are willing to give up €1.66million to secure a certificate of exemption from future liability.

Del Saz Salazar and Garcia-Menendez (2003) use the contingent valuation method to study the WTP for regenerating the harbour of Castellón in Spain. Using a voluntary payment vehicle, they interviewed 700 inhabitants within the metropolitan region of Castellón, through in-person interviews. They find that the mean WTP is € 55.90 per person per each of the three years the payment was asked for.

Alberini et al (2006) use a computer based-questionnaire to survey 508 users of a multimedia library in Venice to elicit their preferences for the reuse of the Arsenale area, the former historical shipyard of Venice. Using choice experiments, they find that respondents are on average willing to pay €46 for extra moorings and €143 for fast transportation services.

Alberini et al (2007) use conjoint choice questions to investigate the preferences of people in four cities in Italy (Venice, Milan, Bari and Naples) for income and future/permanent mortality risk reductions delivered by contaminated site remediation policies. They survey 804 people using a computer based questionnaire. The payment vehicle used is a one-off additional tax. The value of a statistical life they find is €5.94 million for an immediate risk reduction. If the risk reduction takes place 20 years from now, the implied value of a statistical life is €1.34 million.

Wernstedt et al (2004) provide an overview and discussion of brownfields and their redevelopment. They commence by describing brownfields and their drivers. They then present findings from a recent study. The study was a mail survey of real estate developers; the 300 respondents were given a series of background questions and choice

experiments in which to participate. The choice questions gave a choice of different incentives regarding redevelopment projects. By analysing the choices of the respondents, Wernstedt et al were able to estimate the relative value of the different incentives (including having public hearing, eliminating cleanup cost risk, and eliminating 3rd party liability risk). The results showed that elimination of all cleanup cost risks and of 3rd party liability were very highly valued, at $702,000 and $969,000 respectively, whereas a public hearing requirement was actually negatively valued (-$212,000) as this would impose a dollar cost. Wernstedt et al summarise some of the problems with brownfield redevelopment and propose an approach to highlight the wider societal benefits of brownfield redevelopment. However, they agree that more public resources must become available to aid the assessment, cleanup and redevelopment of brownfields in communities.

In an experiment using conjoint choice analysis, Wernstedt, Meyer and Alberini (2006) carried out a mail survey of developers; members of the Urban Land Institute, in the USA. The survey was carried out in late fall 2003 and produced 313 usable responses. The questionnaire presented respondents with a hypothetical townhouse development project on a contaminated site, and provided details of two hypothetical policy packages, which each offering the respondent something slightly different in terms of incentives. For example a policy may offer site cleanup, protection from third party liability claims, protection from cleanup liability and so on. Respondents could choose which package they found most attractive, while also being able to select neither if they wanted. Three of the four policy attributes (protection from cleanup liability, protection from third party liability and cleanup/construction subsidies) have positive coefficients, suggesting these are of greater value to respondents. Wernstedt, Meyer and Alberini (2006) found respondents would generally choose to develop if the right configuration of policy incentives were present. They also found that third party liability protection is particularly attractive. So it seems that incentives such as liability relief would work well in stimulating brownfield redevelopment.

4.3 Hedonic Pricing Valuation Studies on Brownfield Externalities

A number of hedonic pricing studies have looked at the impacts on property values caused by the proximity to brownfield sites. We review here this group of studies.

Alberini (2007) investigated the impact of participation in voluntary cleanup programs (VCPs) upon property values. A number of Colorado based sites were pooled from the CERCLA Information System database. In total 432 eligible sites were obtained. There was a presence of contamination at 31.5% of the sites. Alberini, identified a total of 245 site sales that took place between 1974 and 2002, from which there was found to be an average sale price of $854,116 (1988 US dollar), ranging from $5326 - $6.5million. As with Meyer and Lyons (2000), Alberini finds the size of a site is an important factor, and it is associated with participation. However, it is uncertain whether VCP is actually obtaining its original environmental goals; the case may be that it is driven solely by the desire to rid the site of any stigma.

Gawande and Jenkins-Smith (2001) use data on 9432 real estate transactions in three South Carolina counties (Aiken, Berkeley, Charleston) to model the effects of a series of highly publicised shipments of spent nuclear fuel to storage facility at the Department of Energy's Savannah River site. They find a price increase of €403.09 with every mile from the rail route, and that property values in areas with lower risk perception and more experience with nuclear activity are not affected, whereas the property values of more populous urban areas appear to have been lowered substantially. Gawande and Jenkins-Smith agree that the findings reveal whether shipments of hazardous nuclear materials are in the public interest.

Guntermann (1995) applies the hedonic pricing model to estimate the impacts of proximity to landfills on a sample of 153 industrial parcels sold in Phoenix, Arizona, from 1984 to 1994. The results of the study indicate that the value of industrial properties around open landfills is reduced by proximity to the landfill, while the value of industrial properties around closed landfills is not reduced.

Howland (2000) studies the impact of contamination on demand for and supply of industrial land in Baltimore City. Based on a survey that covers 69 percent of the industrial area, she concludes that documented land contamination is not deterring buyers from purchasing land in the Canton/Southeast area of Baltimore City. Land purchases and redevelopment are occurring on larger parcels, where sellers are willing to lower their price to compensate for the risks and costs associated with owning a site with a history of contamination. In the period between September 1995 and September 1996, brownfield sites sold for 55 percent of the price per acre of clean sites, and among brownfield sites, those that were truly contaminated were sold at prices that were, on average, 75% of the asking price. She finds the average sale price of nine contaiminated parcels to be equivalent to €124115.41. The author finds some evidence that business and land owners are reluctant to put parcels on the market, but the problem does not appear widespread. Surprisingly, the city of Baltimore appears to be more reluctant to redevelop contaminated parcels than does the private sector. This analysis was conducted prior to the passage of Maryland's 1997 Voluntary Cleanup Law that limits an owner's legal liability for future cleanup costs, once the site has been cleaned up following prescribed standards, and cannot assess whether the VCP has had an influence on the real estate market.

Howland (2002) studies another area in Baltimore City, focusing this time on the industrial district known as Carroll Camden, situated in southwest Baltimore. In this analysis, the author looks at how contamination has influenced transactions at 740 industrial sites in the period 1990-2000. The 144 transactions she considers show that parcels with known contamination sold at 67% discount, parcels with historical reasons to suspect contamination sold at an average 65% discount. She also finds that the coefficient of a dummy variable that takes on a value of one if a site is adjacent to a (potentially) contaminated site and zero otherwise is negative, but not significantly different from zero. She concludes that contamination does not deter the sale of a parcel, but does reduce property value, finding that parcels sold within one year had an average sale price of €260,244.26. Based on interviews with real estate agents, Howland suggests that more important barriers to the revitalization of brownfields in Baltimore City are incompatible land uses, obsolescent road patterns, inadequate water, sewer and telecommunications infrastructure, and obsolete buildings.

Ihlanfeldt and Taylor (2004) study the effects of proximity to hazardous waste sites on commercial and industrial properties. Using sales data for the period 1981-1998 in Fulton County, Atlanta, Georgia, they estimate separate property price gradients for proximity to hazardous waste sites both before and after the sites were listed on the Georgia Environmental Protection Division's Hazardous Site Inventory (HSI) or on the CERCLIS database. They find that the total estimated property value loss in Fulton County due to contamination is at least €58.94million for industrial and a maximum of €411.48million. They find that the announcement of contamination status generates significant negative externality effects on the values of nearby properties. In contrast, prior to discovery of contamination, proximity to such sites has no influence on the price of surrounding properties. In all cases, the post-announcement gradient is steeper than the pre-announcement gradient. They also find that the value of office buildings is more negatively influenced than industrial sites by the proximity to contaminated areas. They find no "density" effect, i.e. no relationship between the value of a property and the number of contaminated sites next to this property. The authors use the price gradients to examine tax-increment financing as an option for funding the cleanup of contaminated sites. Estimates of the total value losses caused by many of the sites are sufficiently large relative to the cost of remediation to justify tax-increment financing as a clean-up option. In their study, Ihlanfeldt and Taylor do not control the impact of other economic policies

(such as direct financial incentives that are given to firms located in less economically advantaged areas of Atlanta) on the value of industrial and commercial properties.

In one analysis, Jackson (2001) found that the prices of previously contaminated industrial properties in California were not adversely impacted relative to comparable but uncontaminated properties. In another, which covered 140 industrial property sales in Southern California in the period 1995 –1999, Jackson (2002) found that industrial contaminated properties sold at prices approximately 30% less than unimpaired levels. After the clean-up had occurred, prices recovered to be indistinguishable from comparable uncontaminated properties.

Longo and Alberini (2006) analyse brownfields externalities in Baltimore city. They use a similar analysis to the one employed by Ihlanfeldt and Taylor in Atlanta to assess the external costs caused by the presence of sites listed on contaminated sites registries to surrounding commercial and industrial properties. They find that in Baltimore industrial properties are virtually unaffected by proximity to a site with a history of contamination, while commercial properties do suffer an external cost due to the proximity to a contaminated site. This external cost is not cleared once the site has been cleaned up or has been pronounced to be harmless.

The existence and duration of stigma were examined by McClusky and Rausser (2003). Hedonic pricing was used, with the data set including 205,397 observations with variables describing price and attribute of all single-family detached homes sold between 1979 and 1995 in Dallas County, Texas. Using a Geographic Information Systems database, each house could be coordinated, along with hazardous waste sights. The distance was then calculated between points. Findings suggest that stigma remains with a within a very limited (no greater than 1.2miles) sphere of influence around the site even after cleanup of the site has taken place. In the years following a cleanup, properties within 1.2 miles of the RSR lead smelter sold at significantly lower prices than those further away.

McGrath (2000) obtained information on 195 industrial properties that were sold within Chicago between August 1983 and November 1993. Of these, 95 were parcels that were sold for redevelopment. McGrath finds that the median land demolition or contamination discount is approximately $1.9million per parcel. The results suggest that contamination risk is not necessarily a detriment to redevelopment. McGrath explains, from the evidence that investors in Chicago could expect to recoup the expenditures required to remove contamination liability through an increase in land value after site remediation.

Munneke (1996) examines the determinants of redeveloping decisions for commercial and industrial properties in the city of Chicago during the period 1987-1990. The probability of a commercial or industrial property being redeveloped is predicted using the difference in the estimated value of a parcel in its redeveloped state and its current use, correcting for sample selection bias. The empirical results support the hypothesis that land is redeveloped when its value in the redeveloped state is higher relative to its value in the current use. He also identifies proximity to the central business district, acreage, and location in the northern region as determinants of site value, and finds that the location in the northern region and smaller amounts of capital make a property a candidate for redevelopment.

Schoenbaum (2002) examines the validity of the assumption underlying brownfields legislation that real or potential environmental contamination systematically affects land use and economic development. Using data for non residential parcels during the period 1963-1999 for Fairfield, a two square mile industrial area in Baltimore City, she compares brownfields to non-brownfield properties to identify variations in assessed land value, vacancy, property turnover, and redevelopment. She does not find any evidence of a systematic relationship between brownfields status and the above variables.

4.4 Other Valuation Studies on Brownfield Externalities

A few studies have used other valuation techniques to estimate of the external costs caused by the presence of brownfields. Most of these studies use statistics and econometrics to compare brownfields to non brownfields.

De Sousa (2003) looks at the issues, obstacles and benefits of the remediation of brownfield sites and their conversion into green spaces in Toronto, Canada. The data for the study was collected through a review of ten relevant greening projects and personal interviews with twelve relevant stake holders (not random, but chosen to be representatives), with the objective of shedding light on how greening projects can be implemented and how they can improve environmental quality and play a role in revitalizing cities. Overall, it was found that the greening projects generated 1520 acres of green space in Toronto. Redevelopment projects involved former industrial land, former railway corridors, and sites of former landfills or waste disposal activities. Reasons for redevelopment differed, with the majority of respondents stating that ecological restoration was the primary purpose. These are also seen as the benefits after completion of a project. Others named the provision of recreational opportunities for under serviced communities as significant, with the average capital for the projects examined reaching €52231.52 per acre. However, obstacles to greening also exist, with respondents stating the most important factor was a lack of financial resources for planning, coordinating and undertaking remediation and redevelopment. Interestingly, this differs from an earlier study by De Sousa (2000), where he finds that liability is considered the most significant. Other concerns included the fear of damaging the health of children and animals. De Sousa explains that greening projects such as this Toronto example provide opportunity for improving soil quality, creating habitats, enhancing recreation opportunity and revitalizing neighbourhood economy. He also explains that these projects require a concerted effort among people from both planning agencies to community groups if the quality of life in urban centres is to be maintained or improved.

De Sousa (2004) studies the implementation and impacts of twenty projects involving the greening of brownfield sites in US cities. The data were collected between Spring and Fall 2003 from sources such as the EPA and Trust for Public Land. Surveys were mailed to the managers of the 70 greening projects, of which 20 responded. The survey asked 20 questions about such subjects as the history of a site, planning processes, remediation activities and project impacts. It was found that 13 of the 20 cities had an above average percentage of park and open space areas that was greater than or equal to the US average, suggesting higher priority has been given to parks and open space planning in these cities. This was conclusive when respondents were asked what the primary objective of the project was, to which 12 stated recreational spaces. The mean size of projects was 57 acres, with the average cost for a greening project coming to €4.69million. It was found that respondents believe government support for projects is essential for planning and financing greening projects. De Sousa concludes that greening project are beneficial in that they tend to 'fulfil community desires, revitalize neighbourhoods and enhance economic and aesthetic appeal of inner cities.'

Myer and Lyons (2000) conducted phone interviews with 13 developers specialized in brownfields redevelopment, also called Environmental Merchant Bankers (EMB).

Simons & Sementelli (1997) compared sale prices of commercial properties with leaking underground storage tanks (LUSTs), properties with non-leaking tanks registered with the State of Ohio (RUSTs) and other commercial properties (baseline) in Cleveland for the years 1989 – 92. Both LUST sites and RUST sites transact at significantly lower rates than the baseline commercial properties, but the prices of RUST and LUST sites are not significantly different. Sementelli & Simons (1997) further found that removing a LUST from the registry of contaminated properties after remediation accompanied by a 'no further action' letter from the State of Ohio does not improve transaction rates. Only 0.2% of the LUST sites sold after receiving the 'no further action' letter. This is much lower than

the 10% transaction rate for non-tank commercial properties over the same period and the 4% rate for the LUST sites that did not receive a 'no further action' letter.

Simons et al. (1999) compared transaction rates of commercial properties near LUST sites with other commercial properties in Cleveland. They found that for properties adjacent to LUST sites the transaction rate was 2.7% per year versus 4.0% per year for all other properties, the difference being statistically significant. Next, they compared the incidence of seller financing, which was indeed higher for properties adjacent to LUST sites than for other properties. Finally, they looked at sites with sales before and after the discovery of contamination. Based on an analysis of six such sales, Simons et al. (1999) concluded that the average decline in value due to the contamination was from 28% to 42%.

4.5 Other Studies on Brownfield Externalities

Some relevant studies on brownfields externalities do not provide monetary estimates of the externalities. These studies are nevertheless interesting because they provide an important description of the characteristics of the externalities caused by brownfields. We therefore present in this section some of these studies.

Adair et al (2003) links the concept of market failure and the rationale for redevelopment. They also examine policy responses from European, US and, notably, UK perspectives. They explain how a number of European countries and cities have adapted UK policy initiatives, for example Moscow has utilised UK delivery mechanisms but has applied them in a different policy context. They also describe how current (as of 2003) government policy in the UK is based on the principle that the delivery of urban regeneration strategies requires enhanced economic development and social cohesion through effective regional action and integrated local programmes, while targeting of public resources in urban regeneration (to maximise the leverage of private-sector investment) was strongly advocated in the final 1999 UK Urban Task Force report. According to them interest in the UK is gradually turning to the use of tax-based financing to encourage economic, physical and social development. They suggest that tax relief has the potential to facilitate greater involvement by key players in brownfield regeneration, thus encouraging movement away from sensitive greenfield areas. Other fiscal relief, such as capital allowances, stamp duty and VAT, can also facilitate this. However, they recognize the European situation has become increasingly clouded by the interpretation of State Aid rules and competition policy, the outcome of which has had an immediate impact in the UK in terms of gap funding.

Adams (2004) explores how far speculative house building will need to change to ensure the successful implementation of the government's brownfield housing target. The government target is that "by 2008, 60% of additional housing should be provided on previously-developed land and through the conversion of existing buildings" (DETR, 2000a, paragraph 23). Adams explains that at the time of research, 53% of new dwellings were developed on already used land; however a significant percentage of this was in rural areas. He suggests some of the challenges which house builders face in the regulatory change from greenfield to brownfield development, such as the requirements of new competencies and strategies, while partnerships with planning authorities and local communities must 'become the norm rather than exception.' He concludes that some house builders will (and have already begun to) chart new business strategies to manage with emerging brownfield development opportunities, while others that continue to rely on past practices and technology will struggle in future times when Greenfield development opportunities diminish.

In a Policy Review Section Issue, Adams and Hutchison (2000) address the question of supply of brownfield sites in urban regeneration. The research was based on an earlier study by Adams et al (2000), in which four British cities in 1995 were studied (Aberdeen,

Dundee, Stoke-on-Trent and Nottingham). They seek to define and classify ownership constraints to development and measure their recent impact upon the cities mentioned. This was in order to illuminate the policy debate which arose from the failures of the Urban Task Force 1999 to take any real account of the impact of ownership or other constraints on the availability of brownfields. As with Adams et al (2000), the five major constraints to redevelopment are described and explained, then Adams and Hutchison provide a table showing the resolution of ownership constraints by 1998. They find that the problems of unknown or unclear ownership and divided ownership rights are easy to resolve, whereas owners willing to sell but not on terms acceptable to potential purchasers proved more difficult to overcome. They conclude that such constraints can disrupt or even halt brownfield redevelopment processes, and that more imaginative institutional mechanisms to supplement compulsory purchase will be essential, if much greater brownfield redevelopment is ever to be delivered and sustained.

Adams et al (1988) examined how certain potential redevelopment sites appear to move through the development process freely, while the development of others is delayed by the existence of market constraints. They conduct their study in Manchester, a city which they claim to be an excellent study environment. This is due to the city being a formerly thriving industrial and commercial centre which has since seen much industrial decline, resulting in substantial falls in employment, especially in manufacturing. The study took place over a period of six years. Adams et al compare the case of Manchester with a number of earlier case studies to gain a wider scope into their research. They found the extent of vacant land fell from 695ha in 1978 to 609ha in 1980 and further to 530ha in 1984, the fall being attributed almost entirely to a reduction in publicly owned land as a result of environmental improvement and creating permanent public open space under the Inter City Partnership. Information was also collected on ownership, size, planning status, development constraints, sales, last known use and any temporary uses for all 384 sites studied. In order to obtain more detailed information on these issues, 50 sites were chosen from the 384 by structured sampling. Adams et al find a number of constraints to development, including ownership constraints (multiple ownership, unacceptable land valuation by owners, unacceptable terms and conditions, large scale passive ownership), planning constraints (planning permission, availability), physical constraints (ground conditions, buildings presence, endogenous and exogenous access, adjacent uses, size/shape, services), and price constraints (falling levels of employment and industry were in decline in Manchester but land values did not decline so rapidly). They conclude that local land policies need to develop a resolute approach to deal with constraints if the inner city of Manchester is to contend with the urban periphery for new development.

In their research paper in 2000, Adams et al aim to find out how effective fiscal measures are in stimulating brownfield land regeneration, and which fiscal measure (taxes or subsidies) is the most effective. Research is based on a three year study of 80 brownfield sites across four British cities (Aberdeen, Dundee, Stoke-on-Trent and Nottingham). Interviews were conducted with 140 landowners and 36 organisations that had valuable experience of planning and development. Results showed that if holding costs are perceived low, the land owner is able to hold a site without financial penalty, and speculation over future uplift in capital value is encouraged. Also, 45% of respondents felt a vancant land tax policy would have no impact on redevelopment of a site, while 39% felt that the introduction of a greenfield tax would hasten or delay site redevelopment. 52% thought that a site preparation grant would either slightly or significantly hasten redevelopment, while it was revealed that development prospects for 21 of the 80 research sites hinged on the availability of development grants or subsidies.
Adams et al found that response to the various fiscal measures was mixed; in areas of weak demand (such as Dundee and Stoke-on-Trent) tax penalties may be inappropriate, whereas in areas with stronger demand (such as Aberdeen and Nottingham) it may be feasible to design a tax penalty which meets aims and find favour with successive governments while not producing unwarranted side effects.

In a study by Adams et al (2001), the nature and significance of ownership constraints within the urban redevelopment process is examined. The study was based on research in two Scottish (Aberdeen and Dundee) and two English cities (Nottingham and Stoke). In each of the cities, local authorities, prominent chartered surveyors, Chambers of Commerce, (and local enterprise companies in Scotland) were first contacted to identify all potential redevelopment sites which were of at least 2 ha in area or on which were at least 5000m of gross floorspace. These sizes were focussed on because the researchers agreed that the more significant redevelopment is, the greater the number of existing owners likely to be affected and the more complex the process of negotiation with each one. 88 potential redevelopment sites of the required size could be identified across the four cities at the time of study (31st December 1995). Five types of constraint to brownfield development are identified; including the ownership of land being unclear; ownership rights of land being divided (e.g. land being held in a trust or subject to mortgage); ownership assembly being required for development (e.g. ransom strips or multiple ownership of land); the owner may be unwilling to sell; or the owner may be willing to sell but may have unrealistic terms or valuation. So Adams et al conclude that constraints to brownfield development may arise due to deficiencies or limitations to the extent of ownership rights in potential development land or as a result of strategies, interests and actions of those who hold rights. They conclude that even if ownership constraints to brownfield redevelopment are resolved, the time and resources this process consumes may generate a negative reputation for brownfield sites.

Armstrong et al (2002) examine existing monitoring and evaluation procedures for community economic development (CED). They describe four CED case studies examine the problems with applying traditional methodology. One of these case studies, undertaken by the City Council, was located in the north-west inner-city area (NWICA) of Sheffield. The project concerned a series of environmental improvements on council-owned land in and around the housing area. An analysis was conducted with the use of semi-structured interviews with those involved, a review of documentation (URBAN and SRB programmes), focus with local residents (to monitor community involvement) and a series of pilot surveys of local residents, businesses and property agents. Formal questionnaires were conducted with beneficiaries (residents and local businesses). The case study showed that the four major characteristics which are the greatest challenge for traditional evaluators are present in the Sheffield case study as well as the three others. These challenges include multiple objectives, multiple beneficiary groups, capacity building and interlocking initiatives. Armstrong et al conclude by discussing possible methods that would ensure that more effective monitoring and evaluation would be undertaken.

Asabere and Huffman (1991) examine the market effects of zoning on industrial and residential properties in Philadelphia in the years from 1986 to 1989. Using the hedonic framework, they find that lots zoned for industrial use are associated with a 58% price discount when they are sold at foreclosure auctions compared to normal transactions. They also show that as the demand for industrial land in Philadelphia declined (resulting in vacancies), prices fell, but zoning was slow to adjust, therefore land conversion did not occur to re-equilibriate.

Bartsch and Collaton (1997) investigated brownfield redevelopment in their book “Brownfields: Cleaning and Reusing Contaminated Properties”. They explain how many cities in the USA’s older industrial regions, regardless of its size, grapples with the challenge of unused or abandoned manufacturing facilities and other industrial sites. Local public officials, economic development practitioners, and site owners who have sought to revitalize fallow industrial properties face daunting challenges: contamination of the buildings, equipment, and surrounding land and water. Public concern about health effects from hazardous chemicals, changing environmental law, and evolving private sector development and financing priorities have made it increasingly difficult for communities to restore and reuse former manufacturing sites. This study, sponsored by

the Northeast-Midwest Institute, offers analysis and practical guidance on how these blighted areas--brownfields--have been and can be brought back to life.

Bardos et al (2000) consider the qualitative and quantitative approaches for assessing the wider environmental value of remediating land contamination. They held a workshop with a group of UK stakeholders, in which they discussed views on what was the best way forward for considering the "wider environmental value" assessment of remediation. The workshop concluded that qualitative assessments were better than quantitative assessments; however they offer that quantitative assessment could have a role to play when specific decision making was difficult. Using the qualitative assessment approach, Bardos et al identify a number of essential components and boundaries within the scope of "wider environmental value" in order for it to be a useful tool in refining a shortlist of potential remedial options. They explain that components may include water function, legacy, resource and energy use, while an example of a boundary may be the practicality of assessment or defining the environmental system under study.

Barlow (1999) investigates the extent to which new methods for improving housing and reducing construction costs may be implemented by housebuilders. Barlow explains how, to date, innovation has been a secondary factor in competitive strategies for the British housing industry, with firms traditionally focussed upon optimizing heir land holdings and timing the sale of their properties to benefit from house price inflation. He describes the issues of the changing housebuilding environment in the UK and how the impacts of these changes upon housebuilders, for example planning policies, construction costs, and the levels of environmental standards (e.g. thermal standards in dwellings). He also identifies three major barriers to the emergence of a more innovative housebuilding industry in the UK, including a lack of competition, previously successful behaviour/lack of strategy, and a fear of change. He concludes that limited market knowledge remains a problem, and the responsibility remains with the industry to acquire this in order to help form effective relationships with its customers. Barlow also declares that firms which stick to traditional competitive strategies are likely to leave the market or be taken over, while the most adaptable firms will survive without difficulty.

Bond and Kennedy (2000) compare results from two surveys of practice in the valuation of sites affected by contamination; one in the UK (Kennedy 1997) and one in New Zealand (Bond 1998). The aim was to address the lack of systematic research on the valuation methodology for investment on contaminated land that has led to financial loss, negative impacts on property value and other risks. They find the majority of land contamination is related to industrial activity. As part of the study, a summary of previous research to date is presented, much of which is from the USA and so may not be relevant to our research. Bond and Kennedy question the information within each country's guidance, which allows valuers the discretion to decide the most appropriate method to adopt for the valuation task at hand. They agree the guidance available is of value but a lack of recommended methodology has contributed to inconsistencies with techniques used in practice. With regards to the surveys, they adopted a targeted approach to respondent selection so to attract respondents with experience in the valuation of contaminated sites. The UK survey contained 54 valid respondents, with only 7 from New Zealand. They found over half the respondents (UK 55.5%, NZ 57%) reported using more than one valuation method, which could mean that their methods differed between sites, or they may use more than one method for a single site. Both countries use discounted cash flow (DCF) techniques. The majority of respondents (UK 42.6%, NZ 57%) use a capital deduction of the total value, which Bond and Kennedy describe as a 'concern' as this is likely to produce a lower value than if the present value of costs were deducted. To incorporate perceived financial risks in value estimates, over 80% of respondents in both countries use a discount rate adjustment. Bond and Kennedy conclude that there are similarities between the two countries in terms of approach, but also in terms of problems; something needed in particular is that of a more analytical and quantitative approach to calculations to solve the problem of simplistic valuation techniques.

Braswell (1999) examines a project that is implementing a brownfield redevelopment. The project is the Woonasquatucket River Greenway Project, a partnership between the state of Rhode Island and the city of Providence, and is one of the 16 Brownfields Showcase Communities projects. Proposed in 1994, it is a non-profit project involved with two brownfield sites; Riverside Mills, and the Lincoln Lace and Braid Mill. Braswell looks at the early development and economic history of Providence in order to grasp a better understanding of the importance of this project to riverside communities. One aspect of the project is reclamation of the old railway, which has been abandoned since 1856, and transforming it into a bikeway.
Braswell finds that the project has had many benefits for the communities involved. It has brought both local and national attention, has helped generate private investment and has served as a platform from which to apply for remediation grants. With further support from public, private and non-profit organizations, the outlook for the area is bright with plans to 'revitalize the river corridor, return the river as a positive asset, improve quality of life, and bring back pride to the neighbourhoods.'

Cozens et al (1999) discuss the crime-specific problems that may arise with regard to potential solutions that have been provided to achieve the projected housing need of 4.4 million new homes by 2016. The development of "brownfield" land in this regard is briefly discussed. They find that most brownfield land available for development is found in existing highly urbanised areas, which already experience high crime rates, while brownfields in rural areas experience much lower crime rates; this is pushing developers toward the less criminogenic and potentially more 'sustainable' rural neighbourhoods.

Dair and Williams (2006) research urban brownfield redevelopments in England to establish whether the sites are being developed to achieve sustainable outcomes. To show this, evidence was required of stakeholders' actions in brownfield redevelopment projects, and the reasons for such actions. A pilot study was undertaken, which concluded that the best data collection method would be that of a qualitative case study. This would allow the researcher to extrapolate from individual cases to the implementation process in general. Five recently completed brownfield developments were chosen as case studies, and information on stakeholder roles was collected by thoroughly examining the documentation of local planning authorities, while also holding interviews with stakeholders. Most interview questions relating to stakeholder actions were very specific, with open questions used for them to give reasons. Findings were analysed by coding the data. Three general types of stakeholder were found; those involved in land-use planning and regulation; those involved in development and construction; and those involved in end use. Not all stakeholder types were actually involved in the case study developments e.g. clients of developers. Research showed that the achievement of sustainability was mixed; the protection of biodiversity and minimising pollution were regarded by stakeholders as important issues, but use of sustainable technology and buildings were almost wholly ignored. Dair and Williams identify five reasons for this variation. 1) If different stakeholder types are included or excluded from development projects, this is likely to cause variations in the sustainability of completed schemes. 2) Opportunities to introduce sustainability objectives may be limited to specific time periods. 3) There may be an absence of power to enforce the use of sustainable options. 4) Attitude of stakeholders toward sustainable technologies. 5) Stakeholder attitudes towards and knowledge of sustainability issues, when their aim is to be successful regardless of sustainability.

Dennison (1998) explains that cleaning up and redeveloping environmentally contaminated real estate, also knows as brownfields, can be extremely lucrative. This book is a comprehensive guide to the issues surrounding brownfields initiatives. It examines success stories of state and federal brownfields programs; the legal implications of purchasing, improving, redeveloping, and revitalizing these sites; incentives available; and strategies for undertaking these projects. Special features include checklists, cost estimates for sample projects, and tables listing features of individual programs and lists of resources.

De Sousa (2000) examines the nature of the economic costs and risks involved in brownfield redevelopment in comparison with greenfield redevelopment in the Greater Toronto Area. Analysis is done by way of interviews, case studies and an analysis of hypothetical scenarios. Interviews were held with only 18 respondents, but De Sousa ensures that these respondents represent key stakeholders involved in brownfield redevelopment in the GTA and Ontario. De Sousa tries to answer questions regarding how cost effective brownfield redevelopment is for developers, how these costs differ from the perceived costs, and which policies/programs are best able to mitigate the costs and risks. It was found that the main driver behind deciding to invest in brownfield redevelopment is economic profit, with liability being perceived as the most severe obstacle, as it adds to project costs. The majority of developers agreed that brownfield redevelopment is less cost effective and entails greater risk than Greenfield development, however De Sousa finds this view may only apply to industrial brownfield redevelopment. Residential brownfield redevelopment may be more profitable due to high real estate values and high costs of servicing Greenfield municipalities. He suggests that minor changes to existing policies and programmes would make residential brownfield projects more attractive, for example by streaming the approvals process and providing technical assistance.

De Sousa (2001) examines the types of policy-making measures that are currently being taken in Canada to overcome obstacles of brownfield remediation, obstacles which include regulatory processes, lack of information on soil quality and fear of liability. He compares these policy-making measures to those being taken in USA and Europe. The study gathers information from relevant literature and legislation, as well as 18 phone call interviews with policy-makers and researchers across Canada, the USA and Europe. The aim was to reveal the primary factors underlying the inconsistencies in policy-making practices and their perceived variability. De Sousa explains with some detail about issues surrounding American policy-making, such as regulatory jurisdictional issues and clean up criteria. He explains that the size and capacity of contaminated site policies in Europe make it impossible for any analysis to cover everything, so he simply describes policy actions being taken by Europe, and associated issues such as liability and funding.
De Sousa claims that policy-making in Canada is evolving more slowly than it is in the USA or Europe, but public and private sectors within Canada are calling for a convergence of policy-making with the USA and Europe in order to deal with the problems, while there are calls for Canadian researcher to play a larger role in international projects in this area.

Dixon and Doak (2005) present their paper to the SUBR:IM conference, describing actors and drivers that play roles brownfield regeneration. They also examine inter-linking relationships between actors and between actors and drivers. They identify a number of actors which they group and place in a simplified diagram (fig 1). These actors include investors, developers, utility companies and many more. Dixon and Doak explain how these actors influence, constrain and facilitate each other in various ways, and state that they are also influence by wider ‘driving forces’ that provide an important context for their actions (fig 2). They identify these ‘drivers’ and illustrate them diagrammatically, including factors such as economic (e.g. Market institutions), political (e.g. policy objectives) and cultural (e.g. language). They describe how these drivers are social constructs of actors, produced and changed as the brownfield process unfolds, and suggest that these drivers may be mutually reinforcing. Dixon and Doak stress that the development industry could be hindered in tackling contaminated sites by the EU Landfill Directive, with over two fifths of house builders likely to be discouraged following its implementation. However, they do agree that the directive has also stimulated some interest in exploring alternatives to landfill.

Fig 1: The simplified network of actors around brownfield regeneration (taken from Dixon and Doak 2005)

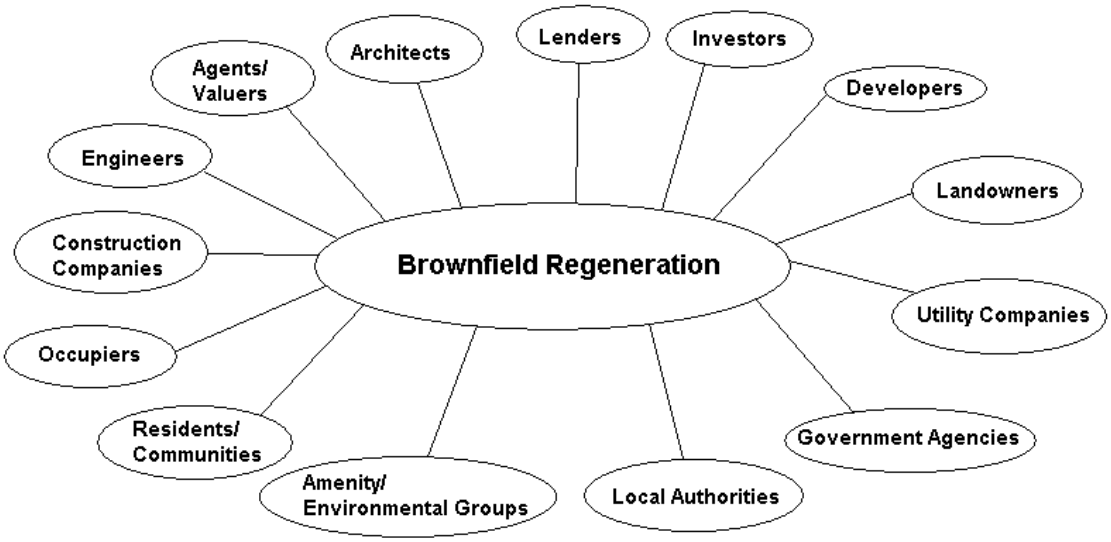
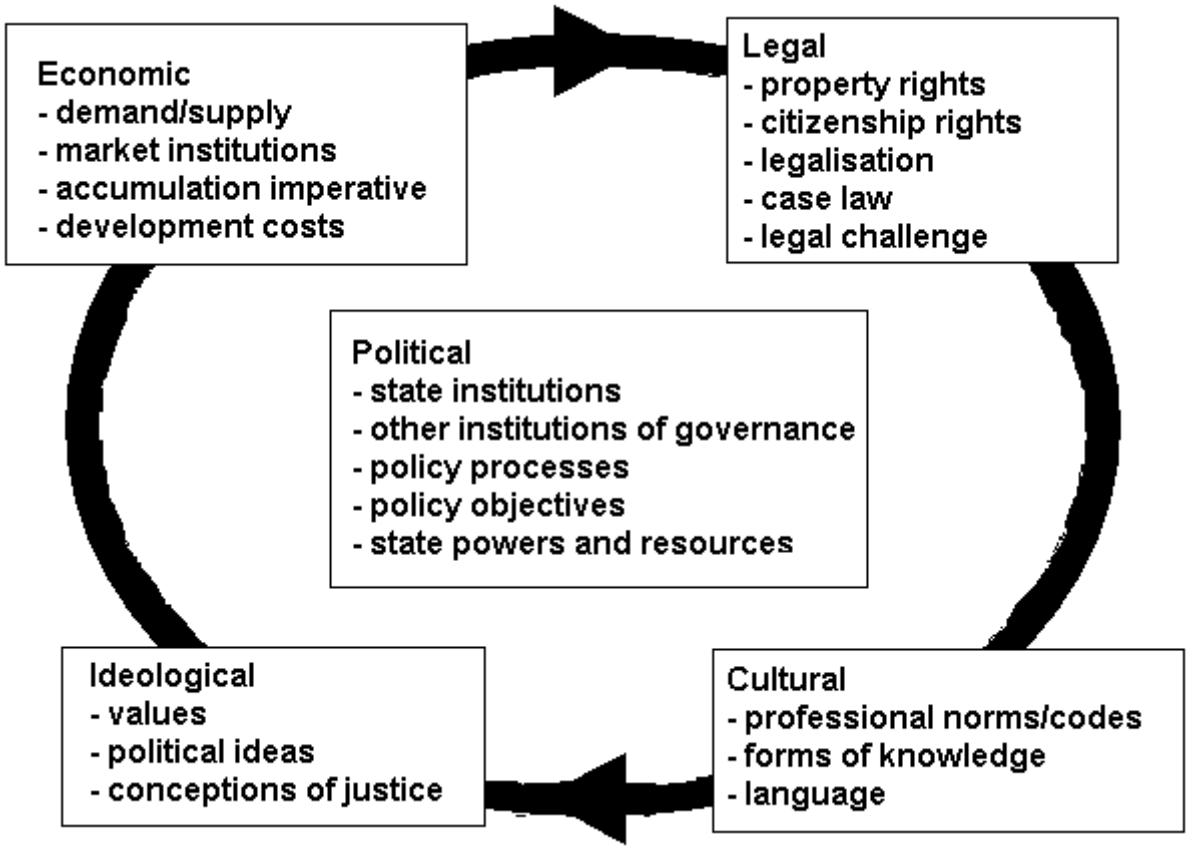


Fig 2: The main driving forces structuring the brownfield regeneration process (taken from Dixon and Doak 2005)



Dixon et al (2006) conduct a UK survey of developers to gather contextual data on their approach and opinions of brownfield development. The survey was in the form of a questionnaire which was posted to 987 commercial developers and house builders (with a ratio of 30:70 between the groups respectively). Only 158 companies filled in the questionnaire. The survey targeted named managing directors or other members of senior management as it required a response from an individual with an overview of company strategy. Dixon et al find that there is already a significant overlapping of groups, with over half of commercial property developers also building housing and vice versa. 80% of the respondents developed entirely on brownfields. They suggest that this increase has been driven primarily by changes in the availability of suitable land, supported by government policy. Other drivers include changes within a company's own policy, and the realisation of profit potential from development. One fifth of house builders also explained how non-brownfield land values were 'prohibitively high' which forced them to utilize brownfields.

Dobson and Goddard (1992) study the determinants of commercial and industrial prices and rents in four UK regions: (i) South East (including London), East Anglia; (ii) South West, West Midlands, East Midlands; (iii) Yorkshire and Humberside, North, North West, Wales; (iv) Scotland. They analyze sale prices and rents for industrial properties, offices and shops for the period 1972-1987. Ordinary least squares regressions show that employment in the area is an important influence on price, especially for industrial properties. In most cases, price and rent are also found to be sensitive to interest rates and residential property values in the neighbourhood.

Eisen (1999) explores the linkages between sustainable development and the proliferation of state and federal policies designed to combat the 'brownfields phenomenon'. He explains the concept of sustainable development and how brownfields initiatives have been designed to lessen the fear of liability under state and federal environmental laws. He identifies three core principles which should be possessed by any programme claiming to be a foundation of sustainable development law; including integration of economic and environmental goals; procedures designed to ensure sustainable urban futures; and attention to equity. Eisen concludes that attaining sustainable development requires institutions at all levels to 'implement strategies to ensure the economic development, social goals, and environmental regulation go hand in hand'.

Greenberg, M., Lee, C. and Powers, C. (1998) describe some of the problems of brownfield sites, such as them becoming dumping grounds for hazardous waste and their use as a centre for drug-related activities. These activities in turn lead to out-migration from the area, resulting in more property abandonment and brownfield formation. They iterate that local residents not only want brownfields remediated, but they want them replaced with uses that upgrade the quality of the neighbourhood. They say that close collaboration among city planners, civil engineers and public health officials is required. This collaboration should address a number of issues; hazards and risks of unwanted land use on old brownfield sites, the implications of alternative land uses, and the development of community leadership.

Greenberg and Lewis (2000) conducted a survey with 204 residents of the city of Perth Amboy (pop 41000), New Jersey in order to identify their preferences for brownfield redevelopment and the extent to which they would desire to participate in the redevelopment process. The study took place in 1992 and was conducted within census tract no.46 of Perth Amboy, which is located directly across from New York City and constitutes mostly people of Hispanic origin. The survey instrument contained almost 100 questions and was to be completed prior to the formal establishment of a process in the city so that the survey could inform that process but not interfere with the official community public involvement process. Respondents showed highest preference for community facilities, in particular parks and play areas. Preference was also shown in favour of community cultural facilities and health care facilities. Warehouses and stores were least favoured. Onethird of the participants spoke of their desire to be strongly

involved in any future decisions i.e. in future planning of brownfield sites in their neighbourhood. Greenberg and Lewis (2000) state that their research can act as a warning to government officials and businesses that they need to work as closely as possible with surrounding neighbourhoods in order to know what will be the most effective and appreciated use for brownfield sites if they are to be redeveloped.

Greenberg et al (2001) make an evaluation of brownfields redevelopment as a smart growth policy in the USA. They define smart growth as clustering 'people and their activities in central places and along corridors, filling in skipped over areas in cities and older suburbs, redeveloping already developed parcels, such as brownfields, and concentrating new generated development in clusters adjacent to existing infrastructure'. They compare this to five other smart growth policies; direct government purchase of land, restrictive development (of farms, forests and other greenfields), changing transportation policies, promotion of compact settlements and implementation of regional governments (including fair share housing agreements and tax collection and sharing). Impacts of the policies on such services as air, water, land and ecology are investigated. Greenberg et al (2001) also look into both the short and long term feasibility of brownfield redevelopment, investigating issues such as cost of sprawl, government reactions and pubic opinion. They conclude that brownfield redevelopment is the 'smartest smart growth option policy', with it having environmental, political and moral advantages that other policies cannot match. Greenberg et al (2001) also point out the major concerns of brownfield redevelopment; the need to determine demand for brownfield redevelopment, the need for more knowledge, the lack of communications related to brownfield sites, and the health concerns. They suggest that brownfield redevelopment and urban sprawl can work hand in hand to ensure city revitalization occurs and so that sufficient space will be available for affordable housing.

Grimski and Ferber (2001) describe the major findings of Working Group 1, a specific working group set up within the wider CLARINET project (which ran between 01/07/98 – 30/06/01). The working group was set up in response to growing awareness of the brownfield situation across European countries. They also outline some special programmes set up by various European countries, and the objectives that these programmes intend to meet. Also described is a checklist which was designed as a tool for project management, so that applying the checklist will enable the user to become aware of any complexities of any brownfield project and grasp an overview of all associated issues. Grimski and Ferber conclude that, although obstacles of brownfield redevelopment still exist (such as the inflexibility of policies and legislation), there are many benefits of redevelopment and efforts should be made to ensure brownfield sites are restored to improve the environment and attract new investment for jobs, housing and public facilities.

Harrison and Davies (2002) use in-depth interviews with conservation professionals and practices employed by ecological advisers employed by developers seeking to redevelop brownfields in London, UK. It makes reference to the London Biodiversity Action Plan which launched in 2001. This study is conducted in order to examine how conservation professionals in the private, public and voluntary sectors are responding to biodiversity loss and opportunities for habitat creation posed by redeveloping brownfield sites. All respondents of the survey believed that a scientific framework should be utilised when characterising sites, and several emphasized the importance of an 'experiential and experimental approach' to learning how urban ecosystems function. Harrison and Davies mention some unresolved issues that arose when analysing the tensions experienced by ecologists and conservations engaged in brownfield redevelopment. These include the requirement to mobilise diverse knowledge and collaborative networks, or the failure of amateur naturalists and enthusiasts to conform to scientific methods of recording and evaluation. They state that 'Formalising knowledge and co-operation networks to achieve more effective engagements with developers and the construction industry could consolidate ecological practices designed to conserve and re-create the biodiversity of wasteland habitats'.

Healey and Barrett (1990) review existing approaches to property development processes. They begin by reviewing research on the processes of production of the built environment, with the aim of drawing out theories being used and how the relations between structure and agency are established. Two approaches to economics that they investigate are neo-classical and Marxist, both of which they agree to be lacking the 'capability to address a fundamental dimension of our understanding the development process.' They conclude by suggesting four major intersecting themes which need to be addressed through further research; the relation between the financial system and investment in land/development processes; the way the resources and rules of economic organisation constitute the types and strategies of firms involved in land and property development processes; the way the state structures land and property development processes through contribution to the constitution of rules and resources; and the outcome of these processes.

Kaplan (2001) conducts a study into the effect of what people are able to view from their windows. She describes previous studies showing that well-being of residents can be improved by seeing 'nature' (i.e. trees and flowers) through their windows (Talbot and Kaplan 1991, Heerwagen and Orians 1986). Her literature research also finds that indoor nature such as pot plants does not fully compensate for outdoor views. The study was conducted at six low-rise apartment communities in Ann Arbor, Michigan. A mail survey with both verbal and visual material was used. The survey included a few open ended questions, but mostly involved respondents giving a rating of between 1 and 5 for the views that they saw from pictures. Kaplan finds that nature views play a substantial role in participants' satisfaction with their locale, with views of trees, gardens and flowers playing an important role in satisfaction. This may have important applications for what to do with brownfields sites in inner cities; the study could provide support in changing an abandoned site into a green park to improve the well-being of local residents.

Ketkar (1992) uses the hedonic pricing model to estimate the impact of hazardous waste upon the value of properties, and to therefore determine the economic feasibility of a partnership between polluters and property owners based on Coase's theorem. According to the theory, a partnership will not only ease financial burden but will also speed up the pace of cleanup.

Kowalski and Paraskevopoulos (1991) examine the impacts of spatial and time-related variables on the price of industrially zoned acreage in a suburban sub-market of Detroit. The time-related variable they use is the ratio of the distance to the northern boundary of the submarket and the number of years spent since the sale had occurred. They suggest that the impact of price of "where" a parcel is located will depend on "when" a fixed location's impact on price is measured, and vice versa. They find that as the sub-market they consider develops through time, there is a narrowing of price differentials between parcels because of locational differences.

A paper by McCarthy (2002) examines the progress by US local, state and federal agencies during the last decade in addressing a dual challenge in relation to brownfield redevelopment. The study is based on evidence from Toledo, Ohio. One side of the challenge is that facing government agencies to help reduce the barriers to private sector re-use by addressing four major issues of uncertainty; liability for contamination; uncertain cleanup standards; funding availability; and complex regulatory requirements. The other side of the challenge is that brownfields re-use must be connected to wider community efforts to achieve environmental protection, inner city revitalisation and reduce suburban sprawl. McCarthy observes that government efforts to reduce the impediments to brownfield redevelopment have focussed on the economics of re-use. She explains how difficult it is to connect brownfield redevelopment to broader community goals because it involves more than economic factors; social factors also play a role. She suggests that a common interest in brownfield redevelopment may generate the effort and resources/funding needed to make opportunity outweigh challenge.

McGreal et al (2002) assess the application and outcomes of tax-based incentives in urban regeration, focussing on the differing models represented by Dublin and Chicago. The urban policies of the UK, Ireland and USA are discussed, with McGreal et al describing the Irish model as 'one that illustrates the extensive use of fiscal incentives to encourage residential and commercial development in designated geographical areas.' The research methodology is qualitative, with the first stage of the survey in Dublin taking the form of structured interviews with 22 key actors from the public and private sectors. The second stage of the survey involved two focus groups, one with the public and the other with the private sector. These provided useful insights into a number of issues, including macro-economic factors, actor groups, institutional structures, targeting, dead weight and displacement. They conclude that their paper supports tax-based mechanisms as an instrument in the delivery of urban regeneration but stress that complementary structures are needed to fully exploit the incentives.

Meyer and Lyons (2000) explain how public sector planners may more effectively intervene to encourage the merchant banker approach (treating each trading voyage as a separate speculative venture in which they remain open to all opportunities), as it has positive implications for both environment and economy. They conducted a series of telephone interviews from July to September 1997 with firms involved in brownfield development. There were 13 firms (or 'environmental merchant bankers') studied, all of which were based from New York to California and engage in redevelopments throughout the country. 19 questions were posed in total, with not all respondents willing to provide details for all questions. The researchers found the field to be apparently dominated by new firms, with only one being actively engaged for over 5 years. The firms are also very small staffed and many are not yet engaged in full time brownfield redevelopment work. However, Meyer and Lyons report themselves that the research method may have overlooked strictly local firms operating with their own capital. They find that EMBs show preference for heavily contaminated, previously rejected sites, in major metropolitan areas with a minimum site size of 5 acres. Some firms also expressed interest in particular types of severe on-site pollution, such as those listed on the EPA National Priority List ("Superfund sites"). One firm admitted that the return on investment necessary to attract their attention was around 12.5%, which is a decline from former return targets of 25% 1996. Insurance availability was another major driver when selecting sites, and preference was also shown toward older industrial states with local governments that were more highly experienced in brownfield redevelopment. Sites may be unattractive due to competitive bidding, the stigma that comes from working with brownfield sites (which are usually situated in urban areas with high crime rates etc.) and restriction by local governments on what a site may be used for. So in conclusion Meyer and Lyons agree that EMBs and their practices provide a model to which private insurance carriers and some state governments are turning to for insights as to possible and desirable approaches to brownfield redevelopment.

Moore (2003), in her paper presented to the IUAV Conference, examines the links between brownfield redevelopment and the achievement of urban sustainable development, a stated goal of most national governments. She explains, how, currently, the ecological footprint of Ireland is four times its ideal size, while Dublin's is 77 its size (compare this with London which is said to have one 125 times its size), so Dublin City ranks poorly in terms of urban sustainability. Moore suggests that one of the ways to improve this is promotion of mixed development, for example having apartment housing over the main floor commercial premises, termed 'living over the shop'. Brownfield redevelopment should also play a major role, as she points out that 'infilling, rather than decentralisation, has the potential to reduce commuting and thus energy consumption.' Redeveloping brownfields in Dublin could, as has been done in many other European cities, reduce waste, noise, water and air pollution, traffic congestion; and reduce the loss of open space. Moore continues to explain how bringing brownfields to productive uses would increase the availability of land, therefore easing pressure on residentially zoned land, contribute to improving access to affordable housing, and therefore minimise the

destruction of the natural environment. However, she states that there is no comprehensive survey of the number of brownfield sites in Dublin or Ireland, and that a clearer definition of what constitutes a brownfield must be rectified before undertaking any such survey. She identifies the major opportunities (such as improving the environment, contribute to city densification/consolidation, contribute to economic development, involvement of stakeholders) and challenges (costs, liability, confusion over required remediation levels, struggle for social equity) of the redevelopment of the Grand Canal Dock in Dublin. Moore then examines the legal, political and environmental obstacles to redevelopment in Dublin. She concludes by suggesting a major sea-change in attitudes, perceptions and ethics is required for brownfield redevelopment to gain the interest and resources that would yield significant benefits. She states that the areas should be re-valued as potentially profitable areas, not just in an economic sense, but also in terms of the potential to contribute to the social, cultural and heritage development of Dublin.

Mundy, in his 1992 paper 'Stigma and Value', discusses the causes of stigma and how it may explain market uncertainty. He gives a summarised account of the characteristics of social stigma, and lists seven criteria that may be used to evaluate and determine the degree of stigmatised land. These include disruption of day-to-day behaviour, concealability, aesthetic effect, responsibility/accountability of liable individual, prognosis of contamination, degree of peril, and level of fear association with a particular site. He explains how stigma can be caused by high levels of uncertainty or lack of knowledge in accordance with the level of familiarity with an issue. He also explains how stigma and risk perception can be amplified by the media; with the example of the Exxon oil spill in the Prince William Sound. He describes how, in a perfect world, stigma would be quantified on a direct basis, using variables such as property rental, marketing expenses and loan interest rates, but in our imperfect world we are left to use indirect methods such as contingent valuation and conjoint analysis.

Nelson (2001) reviews the growing body of European literature exploring the nature of contemporary partnerships in Urban Renewal. Her case studies are of Bercy in eastern Paris, and the Surrey Docks in London. Nelson describes the relationships between organisations involved in the process of redevelopment in these areas. She finds a complex of interrelationships in the Paris case between companies Mairie de Paris, SEMAEST, APUR and ZEUS, between all of which there is continuing dialogue but not necessarily a contractual relationship, which gives the larger authority Mairie de Paris the opportunity to distance itself from having any dealings with all others, should any issues arise. In London there was found to be much less stability in terms of the organisations involved and the relationships between them. An organisation, the Docklands Joint Committee was set up in 1974 to plan and coordinate redevelopment of the site. This organisation included the DOE, Greater London Council, Docklands boroughs, Port of London Authority and Docklands Forum. Nelson describes examples of how redevelopment was delayed or stopped, including the plan to lease one third of the land to American developer Trammell Crow during the 1970s. The plan was to develop a wholesale Trade Mart, but the worsening economic climate and the refusal of the government to guarantee the bulk of loans for development led to the decline of the project. Nelson continues to describe the implementation of redevelopment at the sites and concludes by identifying some features found in the case studies which may be common to different national contexts and some which may vary according to context.

Nijkamp et al (2002) aim to identify the factors that improve success in effective remediation of brownfields. They have created a qualitative impact assessment model; a comprehensive flow diagram, which is an expert system for brownfield redevelopment. Each of the 18 Netherlands case studies used had to be able to pass through the system, and in doing so show up the most important aspects of the cleaning up process. Nijkamp et al use a meta-analysis to identify and illustrate the bottlenecks and success factors of clean-up operations. They find four main positive factors that may be the explanation for soil sanitation in an area; accountability of the current owner; costs; potential use of site

after clean-up; and if the current owner is the cause of contamination. They find no single dominating factor, and find that the data suggest a number of factors that cause stagnation of redevelopment projects; including problems with balancing finances, accountability, responsibilities of the current owner, formal procedures and legal regulations.

Pauleit et al (2005) investigates the changes in land use cover of 11 areas in Merseyside, UK using aerial photographs taken between 1975 and 2000. They modelled changes in land use and how they affect three environmental parameters; surface temperature, surface runoff and greenspace diversity. A loss of greenspace (especially loss in tree cover) was discovered in all 11 sites. This was found to be related to socio-economic status. Pauleit et al show concern about the removal of old stands of trees because of their aesthetic and conservation value. They question whether urban regeneration programmes give sufficient appreciation to the value of greenspace, particularly the value of brownfields that can be 'greened'. They also agree that there is a need to critically review concepts such as urban densification and stress the importance of the preservation and management of urban greenspaces.

Raco and Henderson (2006) assess the role that brownfield redevelopment plays in urban and regional policy agendas in the UK. The site studied here is that of the Thames Gateway. They identify the issues that promote redevelopment, such as regeneration of deprived urban areas; encouragement of spatially balanced economic growth; minimisation of Greenfield redevelopment; and channelling investment into areas where markets once failed. Also described are the concerns which may hinder redevelopment. These include issues such the need to address the role of private developers and objectives of development projects; the 'broad-brush' conceptualisation of the Thames Gateway may underplay the value of existing land uses; the potential exacerbation of regional inequalities by further development in this area; the relationships between brownfield development and social inclusion; and the concern of densification of neighbourhoods which if poorly constructed may potentially reduce quality of life. Raco and Henderson draw three conclusions; brownfield redevelopment can produce new forms of equitable development and raise standards of living in deprived communities; the benefits of brownfield development must be set in a wider context of carefully considered environmental planning and assessments of types of development that actually take place; and thirdly, they describe the danger that urban brownfields become commodified spaces whose value is defined primarily in monetarist or functional terms.

Satterthwaite (1997) identifies five broad categories of environmental action within which the performance of cities should be assessed in regard to the meeting of sustainable development goals, the five being; controlling infectious and parasitic diseases and the health burden they take on urban populations; reducing chemical and physical hazards with the home, workplace and inner city; achieving a high quality urban environment for all urban inhabitants; minimising the transfer of environmental costs to the inhabitants and ecosystems surrounding the city; and ensuring progress towards 'sustainable consumption'. He also reflects on how these goals fit in with the social, economic and political goals of sustainable development in cities, laying some issues out in tabular form. Satterhwaite stresses the importance of taking account of the environmental costs generated by city based activities on people or ecosystems, and of ensuring that urban issues are fully considered within national environmental plans and national sustainable development strategies. He concludes that the environmental goals mentioned will not be achieved by focussing on sustainable cities, but on 'how city consumers, enterprises and governments can contribute more to sustainable development.'

Syms (1999) considers the issues that should be considered as part of the decision making process of brownfield redevelopment, and which should form part of a risk-assessment strategy to determine the viability of development projects and the value, positive or negative, of brownfield redevelopments. He identifies a number of decisionmaking factors which he sorts into six groups relevant to brownfield redevelopment, including; site

specific factors (size, nature of soil, topography); community considerations (time constraints, location of site within settlement, homogeneity); transport considerations (connections to road networks, public transport); environmental factors (soil, groundwater and air quality); risk assessment factors (to humans, ecosystems, crops and buildings); and further factors to consider (restrictions on use, planning permission and liability). Syms' survey involved a mailed questionnaire survey which provided 104 responses from 58 surveyors, 24 developers and 22 other professionals. Respondents were asked to choose their most highly regarded issue in the decision making process from those groups already mentioned. When considering community, the link between the site and the health of the community was felt to be the most important issue. Transport considerations were seen as the least important and were mainly regarded as only being important in financial terms. Syms also finds that being able to obtain insurance cover against first and third party risks was seen as rather more important than insurance against regulatory action. Syms' feels that there may have been bias towards locational issues and away from environmental issues due to the majority of the sample being property professionals. He states that while he has identified many of the factors which should be considered in the decision making process, there are likely to be many more site specific factors which should be investigated.

Tedd et al (2001) investigate the risk management required with brownfield redevelopment and identify major issues. They explain how previous use of land may have left biological physical and chemical hazards, and identify three main interdependent systems which may be at risk in brownfield developments; the human population; the natural environment; and the built environment. They give an account of the process of assessing risks, explaining that Quantitative risk assessment (QRA) can assist in determining the required level of remedial action to achieve a 'suitable for use' situation. Risks to health, safety and finance are of up most importance, and the concept of sustainability may lead to the requirement for audits concerning matters such as energy, entropy and ecology. Tedd et al detail three aspects of risk management (poor physical behaviour, contamination, durability of construction materials in contaminated ground), and give examples of development on brownfield sites, including Snatchill in Corby and Hampton in Peterborough. They concur that it is necessary to identify the most significant problems in redevelopments and what is the acceptable level of risk, while also reminding the reader that redevelopment of brownfield sites can have great advantages while Greenfield sites are not necessarily problem free.

Danielle Miller Wagner and Riti Dhesi of the International City/County Management Association (ICMA) thoroughly report on the idea of revitalizing brownfield sites into green space. It discusses both 'the whys and the hows'. They explain what green space is and the main factors that may act as drivers toward redevelopment of brownfields. They explain that these drivers include collaborations of local officials, developers and community members, which achieve far more in partnerships than if they worked independently. Other drivers include the provision of resources and technical assistance from state government agencies, while federal agencies or private investors can promote redevelopment through programmes and funding respectively. The reporters also describe some of the challenges facing redevelopment of brownfields, and the strategies that local governments use to make greenspace creation attractive, such as tax incentives and development permits. They continue to describe planning processes, cost estimations and resources that developers may utilise. Case studies from USA are used in the report; Parque Ninos Unidos in San Francisco CA, and Nine Mile Run Greenway in Pittsburgh PA.

In a UK study, Walker (2000) examines how the planning system deals in practice with the safety implications of hazardous installations involving the storage and use of toxic, explosive, and flammable substances. He investigates when and where hazard-development conflicts can arise, and finds a high emergence in so called 'consultation zones'. He says that conflicts may arise in these zones principally as a result of the Health and Safety Executive (HSE) recommending the restraint of development on hazard

grounds, something which the local planning authorities (LPA) are not obliged to follow. Walker considers two development based responses to conflict, which he finds may cost local planning authorities in terms of both political loss and loss of development and its related economic/social gains. He goes on to identify 16 examples of risk reduction which lead to the reduction in the size of 'consultation zones' and the alleviation of sometimes significant development restraints.

Wassmer and Anderson (2001) study the use of local economic development incentives within the Detroit metropolitan area.1 They use a simultaneous equation model to conduct regression analyses of panel data from 112 cities. They find that only certain forms of local incentives, at certain times, exert the expected positive influence on the value of commercial and manufacturing property. The findings are tied to issues related to the redistribution of economic activity from the core to the periphery in US metropolitan areas, and the authors conclude with policy suggestions on the future use of local incentives. For example, they find that the establishment of a tax increment finance authority or a downtown development authority district in the average city in the Detroit area in any of the observed years increased the commercial value of properties.

Yount, K.R. (1997) addresses the organizational context in which brownfield lending decisions are made. She aims to identify key actors, policies and processes affecting brownfield redevelopment. The study is based on analysis of 35 in-depth interviews conducted in several large cities, with respondents ranging from loan officers to environmental lawyers. She found that most lenders will offer a loan for a property if an Environmental Review Document is also presented with the loan application. The critical question is whether or not an individual lender will approve a loan before cleanliness has been documented. Yount finds that lenders tend to approve the smallest loans on environmentally suspect properties, with mega lenders (regional, national or international institutions with assets of $10billion+) being more likely than micro lenders (small local institutions such as community banks with assets less than $100million) to offer loans. This is consistent with the findings of both Beard (1990) and Larson (1996).

Table 4.1 Urban, peri-urban, and rural studies on valuation of external costs of brownfields

Urban Studies	Peri-urban studies	Rural studies	Undefined
Alberini et al (2006)	Guntermann (1995)	Gawande and Jenkins-Smith (2001)	Alberini (2007)
Alberini et al (2007)			Alberini et al (2005)
De Sousa (2003)			Jackson (2001)
De Sousa (2004)			McClusky and Rausser (2003)
Del Saz-Salazar and Garcia-Menendez (2003)			Simons and Sementelli (1997)
Howland (2000)			Wernstedt et al (2006)
Howland (2002)			
Ihlanfeldt and Taylor (2004)			

Longo and Alberini (2006)			
McGrath (2000)			
Munneke (1996)			
Schoenbaum (2002)			
Simons et al (1999)			

4.6 Conclusions

The vast majority of brownfields studies are based in urban areas. This may be partly due to the issue of reusing abandoned and contaminated sites within urban areas to limit urban sprawl and to the fact that land in inner cities can be very valuable due to the proximity to infrastructures and services provided by cities. Most studies have looked at urban brownfields with the goals of keeping cities compact, limit urban sprawl and support 'smart groth' policies. A second large set of studies has looked at brownfields independently from their urban Vs rural location.

A few studies use stated preferences, mainly choice modelling to find the monetary costs of brownfield externalities. Most of these stated preference studies have been carried out by Alberini and her co-authors and have employed similar methodologies. A second set of studies have employed the hedonic pricing method; and a third set of research has used qualitative and other quantitative analysis to compare brownfields to non brownfields studies. Finally a large group of studies has looked at the external costs of brownfields and at the policies to overcome brownfields regeneration but has not focused on the monetary valuation of the externalities.

When we look at the external costs of brownfields, results are quite difficult to compare. Not only the magnitude of the external costs differs, but also the unit to measure the external costs varies across studies.

Most hedonic studies find a relationship between brownfields presence and loss in nearby house values. Being one mile closer to a brownfield site lowers the average property value by about €400. The presence of contamination or the suspicious of its presence has been found to be significant in some cities, such as Atlanta or Chicago, but not in others, such as Baltimore City. No relevant hedonic studies on brownfield externalities have been found in Europe. The value of the presence of contamination for the average industrial site is about €0.3M €0.5M.

Stated preference studies on brownfields externalities have mainly been carried out by Alberini and her co-authors. Most studies have assessed the value of brownfields surveying stakeholders. Results show that brownfields actors value the presence of contamination about 0.5M € (Wernsted et al 2006); or about 1/3 of the total value of the project (Alberini et al, 2005).

Other studies that have employed other valuation methods find the extra cost of undertaking a project on brownfield sites to be about €4-5M, but they differ according to the size of the project.

It is difficult to draw any conclusion on the studies assessing the external costs of brownfields. Revealed preference studies have found that the presence of brownfields causes a negative externality on surrounding residential properties, while results are site specific for the effect on surrounding industrial and commercial properties. Stated preference studies are few and they have been carried out mostly by the same team of investigators. There may therefore be some researcher bias in the results. More studies are needed to provide a more robust estimate of the assessment of the external costs of brownfields presence.

5. Cultural Heritage Externalities

5.1 Introduction

In this section a number of cultural heritage studies have been looked at to assess the external costs/benefits associated with cultural goods. Stated preferences appear to be the mostly used methods for valuing cultural heritage externalities, with very little research making use of hedonics and travel cost methods. Thorough reviews of cultural heritage valuation studies have been carried out by EFTEC (2005), Noonan (2002, 2003). In this section we summarize the most interesting studies for this project.

5.2 Stated Preference Studies on Cultural Heritage Externalities

Alberini et al (2003) explore the potential of conjoint choice experiments for planning decisions on urban sites, conducting a survey of 244 people in 2001. They use a split sample design with two sets of regeneration projects. The first involves hypothetical transformations of St. Anne's Square, Belfast which has an important cultural and historical dimension. The other consists of hypothetical transformations of an abstract square which they try to make as close as possible to St. Anne's in all respects, except for its cultural and historical dimension. In the conjoint choice questions, the respondents were asked to indicate which they prefer between alternatives of regeneration projects that differ in the level of at least one of the attributes (e.g. height of building, open space as opposed to buildings, price etc.). They find their results to suggest that individual choices are explained by the attributes, and that the marginal utilities are significantly different across projects.

Beltran and Rojas (1996) use contingent valuation modelling to estimate the valuation of archaeological zones in Mexico, based on individuals' willingness to pay for consumption and preservation of the zones. The study took place in 1994, when a sample of 900 visitors was surveyed on their willingness to pay. This is to show what opportunities are available for increasing and diversifying fundraising through the implementation of non-linear price schedules. Beltran and Rojas find an optimum uniform fee of approximately € 0.83. They also find that people seem to be willing to pay even more to conserve than to visit.

Bille et al (2006) present the economic valuation of a proposed nature wetland restoration project in a river basin area in the Great Aamose area of Denmark. They study 1636 people to find how much people are willing to pay to preserve unique archaeological artefacts from Stone-age villages and sacrificial sites, which are presently buried within the topsoil. They find that people may be willing to pay approximately € 156.75 per year for preservation in the form of wetland restoration, which would save the artefacts from the threat of agricultural cultivation and drainage.

Chambers et al (1998) surveyed 305 individuals in 1994 to find their thoughts on the preservation of the Genevieve Academy, Missouri. They employ the contingent valuation study to measure the non-market value of the Academy's preservation. They find the average willingness to pay is between € 0.83 and € 1.06.

Del Saz Salazar and Marques (2005) conduct a contingent valuation study of 252 respondents to find the valuation of the social benefits of restoring an old Arab tower in Valencia, Spain. The survey took place in summer 2002 and involved interviewing the 252 inhabitants of Godella. The questionnaire was divided into three sections; the first contained questions relating to the knowledge and attitudes of respondents towards cultural heritage protection in general. It was found that respondents had limited knowledge of the site. The second focussed on valuation questions and the third on demographic and economic questions about the respondents. They find an average willingness to pay of € 7.59.

Garrod et al (1996) conducted a contingent valuation study, in 1995, of 217 households to find their preferences on the restoration of historic buildings and the average amount of money resondents were willing to pay by additional tax for this restoration. From an open-ended valuation question, they find the WTP to be about € 20.16 per household. Garrod et al also asked respondents which areas of Grainger Town they would prefer restoration to focus upon. Respondents gave higher priority to more degraded areas.

Grosclaude and Soguel (1994) investigated the damage caused to historic and cultural buildings by traffic-caused air pollution in Neuchatel, Switzerland. In 1992 they conducted a contingent valuation study of 200 people to find the average WTP per person per month to help maintain the historic buildings. They find this to be about € 10.24 per person per month.

Hett and Mourato (2000) studied a sample of visitors to the cultural heritage site of Machu Picchu in Peru. The sample included both Peruvian nationals and foreign tourists, and the aim of the study was to find the mean WTP per person for access to the site. Hett and Mourato found an average WTP of € 21.53 and € 38.93 for national and foreign tourists respectively.

Kling et al (2001) apply the contingent valuation method to estimate public good values of preservation and restoration of a local historic landmark in a medium sized USA city. The landmark in question is that of the Northern Hotel in Fort Collins, which stood in serious risk of irreversible deterioration leading in total loss. A contingent valuation survey was designed according to standard guidelines, and respondents were given a dichotomous choice style questionnaire. The results of their 1997 study suggest that people are willing to pay € 206.32 per household (253 studied) to preserve and restore a historic landmark.

Maddison and Foster (2003) apply stated preference and utility difference approaches to 400 people, to find the cost that marginal visitors pose to The British Museum in Bloomsbury, London. They find this to be about € 12.98. The study also shows that marginal congestion cost decreases at least over a range as visitor numbers increase, so beyond certain levels introducing more visitors does not worsen congestion.

In a 1999 study by Maddison and Mourato, the development of a new road system at Stonehenge, UK is discussed. A contingent valuation survey is undertaken in which willingness to pay for one of two possible new road systems is investigated. In the questionnaire, respondents are asked to place a tick beside an amount of money they would pay, and a cross beside those amounts which they would not pay. They should leave a blank space if they are unsure. Respondents were told that payments would be made by an increase of their taxes over the next two years. Maddison and Mourato find people willing to accept a tax increase of € 27.82 for a new road development.

Mazzanti (2003) presents the results of a choice experiment involving 185 people. Data was taken from a choice experiment study by on site interviews with museum visitors at the Galleria Borghese Museum in Rome. Final surveys were carried out during the summer and autumn 2000. The questionnaire consisted of three sections; the first introduced the study, the second contained a preliminary contingent valuation exercise, while the third presented the experiment and collected information on respondents' socio-economic details. People where asked of their willingness to pay for entry into the museum. Results are generally positive and statistically significant, with Mazzanti finding people willing to pay on average € 10.06 for entry.

Morey et al (1997) use pair-wise choices to estimate the total value (direct and passive use) of an environmental good. The choice experiments were contained in a survey administered to people in a group setting. Morey et al aimed to find how much people would pay to reduce acid deposition damage. They find an average WTP of € 50.66 per person (from a sample of 272 people).

Morey and Rossman (2003) investigate heterogeneity in the willingness to pay to preserve marble monuments in Washington, D.C. They use three different discrete choice random utility models in order to estimate a mixture model of choices over preservation programs for marble monuments. They find that people are willing to pay on average € 68.27 per person to conserve monuments 100% of the time.

Morrison and West (1986) undertook a study in Canada, in which 463 people were interviewed in order to find how much they would be willing to pay for cultural events and activities. They find the average WTP to be € 158.34 per person per year.

Pollicino and Maddison (2001) describe a contingent valuation study of willingness to pay for cleaning the Lincoln Cathedral. For the study, 328 people were ask how much they would be willing to pay to change the frequency of a hypothetical cleaning cycle from every 40 years to every 10 years. They find an average WTP of € 78.37 per every person living within the city limits. This coincides with an earlier study by Pollicino and Maddison (1999) which finds the WTP for a cleanup of Lincoln Cathedral to be approximately € 81.33.

Powe and Willis (1996) explain how while some visitors to cultural heritage sites value their visit more than an entrance fee, some decline to enter at the asking price but would enter for a lower fee. Powe and Willis investigate the preferences of 201 visitors to Warkworth Castle, UK in order to find how much they would be willing to pay to enter the castle. They find an average WTP of € 4.32. A similar study on the willingness to pay for entry to Warkworth Castle was conducted by Garrod and Willis (1998). This time a sample of 97 people was used, the WTP was found to be € 1.93.

Riganti et al (2004) discuss ways of preserving cultural heritage sites and cities, reporting on results from a conjoint choice experiment which aimed to find peoples preferences for cultural heritage management for the Temples of Paestum in Italy. The survey was carried out in August 2002 and involved 7 interviewers who gathered 732 interviews. The final questionnaire consisted of four major sections, which included questions eliciting respondents' attitudes toward the respect of cultural goods, the knowledge level of the goods, the socio-economic characteristics of the respondents, and the attitude of the respondents throughout the interview (this filled out by interviewers). The valuation question took the form of a number of alternative scenarios which were presented to the respondent; each having different attributes defining it (attributes for the Temples site included things such as the presence of bars, tours, exhibits, events and price). Each respondent was asked to express their preference among the three options. Options were shown to them in pairs, with the last option not assuming any extra cost to the current ticket price. They find a willingness to pay value of € 3.97 per person.

Santagata and Signorello (2000) conduct a contingent valuation survey in Autumn 1997 to determine the value to the people of Naples of maintaining the 'Napoli Musei Aperti' (NMA), a cultural public good provided by the city of Naples. The survey comprised four sections, including a valuation question. The authors construct and present a hypothetical scenario based on how much city government currently pays to sustain the NMA, after which they ask respondents how much they would pay to keep supporting the NMA if city funding was withdrawn. They find, from their sample of 468 people, that the average WTP is € 16.16 per person per year.

Scarpa et al (1998) study 1323 people in Italy to find how much they are willing to pay to keep public access to Rivoli Castle in the Turin Provence. They used a dichotomous choice survey, and indicated to respondents that the alternative of paying for public access was the closure of the castle to the public. They find that average willingness to pay per person to keep access is about € 24.50.

Snowball (2005) conducts a study into South African nationals' opinions of two South African arts festivals. They aim to show that, when both benefits and costs of the festivals are considered together, it can be seen that both high income and low income earners benefit. They find there to be a 92% agreement rate between high earners and low earners that the festivals are beneficial.

Snowball and Antrobus (2001) conduct a study in Grahamstown, South Africa, to show that if social as well as economic measures of the value of the arts are considered, many of the benefits provided by the arts can be enjoyed by lower income and education groups also. They find a surprisingly high positive WTP and a high degree of awareness among the poorer and less educated population, finding that 81.30% of the sample are willing to pay at least 5 Rand to support The Standard Bank National Arts Festival.

Suh and Gartner (2004) explore visitor perceptions of Seoul, South Korea, held by three different nationalities of people, the purpose of their visits, and the average travel expenditure per person. Perceptual mapping was used to differentiate between shared preferences of the groups. Their 2000 study of 420 people suggests that tourists are willing to pay € 7770.14 in travel costs. They find that for both pleasure and business trips, travellers from Japan tend to give more importance to shopping activities, while travellers from Europe and North America evaluate the 'intangible' attribute of local culture as more valuable.

Whitehead and Finney (2003) conducted a contingent valuation study in North Carolina in summer 2001. A total of 884 households were surveyed by telephone to find their willingness to pay to maintain local shipwrecks in their pristine state with the creation of a historic shipwreck state park with protection from treasure hunters in North Carolina. Several questions related specifically to historic shipwrecks were included in the survey and two different park sizes were mentioned. They find an average WTP of about € 28.21 per household, in a one time increase in tax states.

Willis (1994) investigates the amount individuals voluntarily donate when visiting a Cathedral where no charge is made for entry. He uses an open ended WTP approach in the survey, and asked questions relating to the main purpose of respondents' visits, the amount of times in the past year that they visited this or other recreational sites, the maximum willingness to pay for entrance, and reasons for not being willing to pay. He used payment cards to elicit the size of any voluntary donation for visits in order to find respondents' WTP. Willis finds that 36% are not willing to pay any entry fee, while 31% would be willing to pay over £1.00 for their current visit, and only 12% would make a voluntary contribution of over £1.00.

Willis (2002) explores the impact of changing the number and distribution of bid levels on the estimate revenue maximising price for entry to the Bosco di Capodimonte Park in Naples. The demand for visits to the park was derived from a contingent valuation IB survey. The contingent valuation study was conducted during summer 1999. Respondents were presented with three IB cards and asked how many times they would visit the Park in a year if they had to pay for access. If they were willing to pay, they were asked how many times they would visit if they had to pay this each time. Upon collecting data from 494 people, he finds the mean revenue maximising price for entry to be about € 3.18.

The Fes study by The World Bank Group (1998) was a pioneering effort in the use of contingent valuation of cultural heritage sites. A total of 600 visitors were studied; these respondents would represent visitors who visited Morocco during June-July 1997. Respondents were asked if they would have included Fes Medina in their itinerary if they had to pay a preservation fee of a specified amount when they registered at their hotel. It was found that people were generally willing to pay a preservation fee of around € 1.88 per person.

5.3 Other Study Methods on Cultural Heritage Externalities

Alberini and Longo (2006) combine the travel cost method with contingent behavior questions to estimate domestic visitors' use values for cultural heritage sites in Armenia. Respondents intercepted at four cultural monuments provided information on their visitation patterns, experience at the site, perception of the state of conservation of the monuments, and rating of the quality of the services and infrastructure. They combine actual trips with stated trips under hypothetical programs that would enhance the conservation of the monuments and improve one of (i) the cultural experience at the site, (ii) the quality of the infrastructure, or (iii) the quality of the services, and use the combined actual and stated trips to fit a panel data model. They find, from a sample of 500, that people are willing to pay about € 0.04 per person per year to visit the heritage site. They show that (i) significant use values are associated with the four study monuments, and (ii) conservation programs and initiatives that improve the cultural experience, or simply make it easier for the respondent to reach and spend time at the monument, are valued by domestic visitors and would encourage higher visitation rates. Actual and intended trips reported by the respondents exhibit good construct validity, in the sense that they are well predicted by price, location, hypothetical scenario and other individual characteristics of the respondents.

Bedate et al (2004) study four different cultural goods; a cultural artistic event, a village comprising a historic ensemble, a museum located in a provincial capital and a cathedral representing an example of a historic monument. They use the travel cost method to estimate the demand curve for these goods, and from this calculate the consumer surplus value of the four goods. They find people are willing to pay € 43.98 to reach a cultural site.

Boter et al (2005) studied 250 museums to find the average travel time that cardholders spent at the museum over 12 months. The dataset used provided information on customer number, type of card, the museum and the date of visit. Using a commercial GIS database, travel distance and time were calculated for each visit over the 12 months. Boter et al find that on average cardholders make 4.3 visits to 3.3 of the 108 museums in the database.

5.4 Conclusions

Most studies in this section are based in urban areas, with relatively few in peri-urban areas. A possible reason for this is that not many site or buildings on cultural heritage importance will be found in the suburbs or fringe area of cities; most are situated well within the urban boundary, such as St. Peter's Basilica in Rome or Westminster in London, or else well outside city areas, such as Machu Picchu in Peru or Stonehenge in Wiltshire, UK.
The majority of cultural heritage studies found have used stated preference methods, mostly choice experiments in order to value sites or buildings of cultural and historical importance. Some of these studies have surveyed not only local residents, but also tourists (Hett and Mourato, 2000; World Bank Group, 2000) casting some doubts on the reliability of the WTP answers as the incentive compatibility for tourists is very weak. cast Hedonic studies and travel cost studies are limited in number. Hedonic studies risk failing to capture the cultural externality in house prices. Within revealed preference techniques, travel cost studies are easier to use than hedonic pricing studies. WTP figures are site specific. In stated preference studies, estimates range from a few Euro for preserving historical landmarks in the US, to more than €250 per household per year to preserve cultural sites in Naples. Most studies using stated preference methods find that on average respondents are willing to pay about €25 to preserve the cultural monument considered in the study.
When we look at revealed preference studies, we find that the welfare that users receive from visiting cultural sites in Europe is about €50 per person.

Table 5.1 Urban, peri-urban, and rural studies on external costs of Cultural Heritage

Urban Studies	Peri-urban studies	Rural studies
Alberini et al (2003)	Bedate et al (2004)	Bedate et al (2004)
Bedate et al (2004)	Beltran and Rojas (1996)	Bille et al (2006)
Garrod et al (1996)	Boter et al (2005)	Hett and Mourato (2000)
Grosclaude and Soguel (1994)	Chambers et al (1998)	Lockwood (1996)
Hansen (1997)	Kling et al (2001)	Maddison and Mourato (1999)
Maddison and Foster (2003)	Scarpa et al (1998)	Powe and Willis (1996)
Mazzanti (2003)	Whitehead and Finney (2003)	Riganti et al (2004)
Morey and Rossman (2003)		Snowball (2005)
Pollicino and Maddison (2001)		
Santagata and Signorello (2000)		
Saz Salazar and Marques (2005)		
Snowball and Antrobus (2001)		
Suh and Gartner (2004)		
Willis (1994)		
Willis (2002)		

6. Conclusions

This review of the literature of odour, brownfield and cultural heritage valuation studies has identified a substantial number of studies in the area of cultural heritage, and a few studies in the other two externalities groups. Cultural heritage studies have mostly used stated preference techniques that seem more useful in this context than other revealed preference studies. When we looked at odour studies we found the opposite conclusion: revealed preference studies have provided more reliable estimates for odour externalities than stated preference studies. This might be a challenge for researchers willing to value odour externalities in the Europe as few hedonic studies have been carried out in Europe. A limited number of studies has looked at brownfield externalities and has mostly used stated preference methods. Clearly more research is needed in these latter two externality valuation in order to provide more robust estimates of the external costs from brownfields and from odour.

We also tried to categorize studied in urban, peri-urban and rural studies. For some studies, it could not be clearly identified where they were conducted. About 25% of the odour studies were conducted in urban areas; 15% in peri-urban areas; 50% in rural areas; and the rest could not be allocated to any particular area. About 61% of the brownfields studies were conducted in urban areas; 6% in peri-urban areas, and 6% in rural areas. It was not clear where the remaining 27% were conducted. About 62% of the cultural heritage studies were conducted in urban areas; 12% in peri-urban areas; 26% in rural areas; and the rest could not be allocated to any area in particular. Clearly more effort should be directed towards assessing the non-market values in peri-urban areas, even though this might be a challenge for economists that may not be too familiar with the concept of 'peri-urban'.

The studies that have been considered provide external costs estimates ranging €2-250 per person for protecting cultural heritage sites, €0.5M for the presence of brownfields (external cost due to the presence of contamination on site), and account for about 3-10% of the value of the average house affected by odour annoyance. These results highlight that the affected population are generally willing to pay to regulate the externality for brownfields and odour annoyances, or to protect the cultural monuments. Results are site specific and it is difficult to generalize them. Caution should be used when exporting results from these studies to policy studies.

7. References

7.1 Odour Studies

Abeles-Allison, M. and Connor, L.J. (1990) "An Analysis of Local Benefits And Costs of Michigan Hog Operations Experiencing Environmental Conflicts" Report #536 *Agricultural Economics*, Michigan State University

Aesthetic, Odours and Economic Workgroup Hamilton-Wentworth Air Quality Initiative (1997) *Odours, Aesthetics & Socio-Economic Aspects of Hamilton-Wentworth's Air Quality* paper prepared for HAQI, November 24th, 1997

Anstine, J. (2003) "Property Values in a Low Populated Area when Dual Noxious Facilities are Present" *Growth and Change* 34 (3): 345-358

Batalhone, S., Nogueira, J. and Mueller, B. (2002) "Economics of Air Pollution: Hedonic Price Model and Smell Consequences of Sewage Treatment Plants in Urban Areas" working paper, *Texto Para Discussao* 234: p1-20, Department of Economics, University of Brasilia, Brazil

Bazen, E.F. and Fleming, R.A. (2004) "An Economic Evaluation of Livestock Odor Regulation Distances" *Journal of Environmental Quality* 33: 1997-2006

Beede, D.N. and Bloom, D.E. (1995) "The Economics of Municipal Solid Waste" *The World Bank Research Observer* 10 (2): 113-150

Beloff, B.R., Beaver, E.R. and Massin, H. (2000) "Assessing Societal Costs Associated with Environmental Impacts" *Environmental Quality Management:* 67-81

Brasington, D.M. and Hite, D. (2005) "Demand for environmental quality: a spatial hedonic analysis" *Regional Science and Urban Economics* 35: 57-82

Burtraw, D. and Toman, M. (1997) *The Benefits of Reduced Air Pollutants in the U.S. from Greenhouse Gas Mitigation Policies* Discussion Paper 98-01-REV for Resources for the Future

Carlsson, F. and Johansson-Stenman, O. (2000) "Willingness to pay for improved air quality in Sweden" *Applied Economics* 32 (6): 661-669

Castle, P.C., Toller, S.V. and Milligan, G.J. (2000) "The effect of odour priming on cortical EEG and visual ERP responses" *International Journal of Psychophysiology* 36: 123-131

Cheshire, P. and Sheppard, S. (1998) "Estimating the demand for housing, land, and neighbourhood characteristics" *Oxford Bulletin of Economics and Statistics* 60 (3): 357-382

DeBruyn, J.C., Mann, D.D. and Zhang, Q. (2001) "Comparison of the odour levels of biofiltered air and ambient farmyard air" *Canadian Biosystems Engineering* 43: 6.7-6.11

Defoer, N., Bo, I.D., Van Langenhove, H., Dewulf, J. and Van Elst, T. (2002) "Gas chromatography-mass spectrometry as a tool for estimating odour concentrations of biofilter effluents at aerobic composting and rendering plants" *Journal of Chromatography A* 970: 259-273

Eshet, T., Ayalon, O. and Shechter, M. (2005) "A critical review of economic valuation studies of externalities from incineration and landfilling" *Waste Management Research 23:* 487-504

Eshet, T., Baron, M.G., Shechter, M. And Ayalon, O. (2007) "Measuring externalities of waste transfer stations in Israel using hedonic pricing" *Waste Management* 27: 614-625

ExternE (1995) ExternE. Extern: externalities of energy. ISBN 92-827-5210-0. vol. 1: Summary; vol. 2: Methodology; vol. 3: Coal and lignite; vol. 5: Nuclear. Published by European Commission, Directorate-General XII. Luxembourg: Science Research and Development; 1995.

Farber, S. (1998) "Undesirable facilities and property values: a summary of empirical studies" *Ecological Economics* 24: 1-14

Fleming, R.A. (1999) "The Economic Impact of Setback Requirements on Land Application of Manure" *Land Economics* 75 (4): 579-591

Fleming, R.A., Babcock, B.A. and Wang, E. (1998) "Resource or Waste? The Economics of Swine Manure Storage and Management" *Review of Agricultural Economics* 20 (1): 96-113

Frechen, F.B. (2003) *State of the Art of Odour Measurement* International Symposium on Odour Measurement, Ministry of Environment, Government of Japan, 30 October 2003, Tokyo

Garrod, G. and Willis, K. (1998) "Estimating lost amenity due to landfill waste disposal" *Resources, Conservation and Recycling* 22: 83-95

Gomez, M.I. and Zhang, L. (2000) *Impacts of Concentration in Hog Production on Economic Growth in Rural Illinois: An Econometric Analysis* paper presented to the American Agricultural Economics Association annual meeting in Tampa, July 31 to August 2, 2000

Hamacher, T., Niess, J., Lammers, P.S., Diekmann, B. and Boeker, P. (2003) "Online measurement of odorous gases close to the odour threshold with a QMB sensor system with an integrated preconcentration unit" *Sensors and Actuators B* 95: 39-45

Herriges, J.A., Secchi, S. and Babcock, B.A. (2003) "Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values" working paper, centre for Agricultural and Rural Development, Iowa State University

Hobbs, S.E., Longhurst, P., Sarkar, U. and Sneath, R.W. (2000) "Comparison of dispersion models for assessing odour from municipal solid wastes" *Waste Management & Research* 18:420-428

Hurlimann, A. and McKay, J. (2007) "Urban Australians using recycled water for domestic non-potable use-An evaluation of the attributes price, saltiness, colour and odour using conjoint analysis" *Journal of Environmental Mangement* 83: 93-104

Jiang, J.K. and Sands, J.R. (2000) *Odour and Ammonia Emission from Broiler Farms* A report for the Rural Industries Research and Development Corporation, RIRDC publication No 00/2

Kim, C.W., Phipps, T.T. and Anselin, L. (2003) "Measuring the benefits of air quality improvement: a spatial hedonic approach" *Journal of Environmental Economics and Management* 45: 24-39

Lake, M.B. and Easter, K.W. (2002) "Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota" Department of Applied Economics college of Agricultural, food and Environmental Sciences, University of Minnesota

Lareau, T.J. and Rae, D.A. (1989) "Valuing WTP for Diesel Odor Reductions: An Application of Contingent Ranking Technique" *Southern Economic Journal* 55 (3): 728-742

Mahin, T. (2003) "Measurement and Regulation of Odors in the USA" *Odor Measurement Review*, Ministry of Environment, Japan

Maier, B., Gisbert, R. and Gronauer, A. (2000) "Recognition and Valuation of Odour Emissions from Agriculture – Use of Chemical Sensor Arrays" *Agrartechnische Forschung* 6 (2): 32-35

Maier, B., Rathmer, B., Riess, G., Zeisig, H. And Gronauer, A. (2001) "Measurements of Odour Emissions" *Agrartechnische Forschung* 7 (1): E6-E10

Milla, K., Thomas, M.H. and Ansine, W. (2005) "Evaluating the Effect of Proximity to Hog Farms on Residential Proerty Values: A GIS-Based Hedonic Price Model Approach" *URISA Journal* 17 (1): 27-32

Miner, J.R. (1997) "Nuisance Concerns and Odor Control" *Journal of Dairy Science* 80: 2667-2672

Muller, R.A. and Diener, A.A. (1997) *Economic Valuation of Air Quality in the Regional Municipality of Hamilton-Wentworth* Final Report (revised June 14 1997) prepared for Hamilton-Wentworth Air Quality Initiative pursuant to a memorandum of understanding among McMaster University, the Ontario Ministry of Environment and Energy and the Regional Municipality of Hamilton-Wentworth, dated November 5 1996

Nicolai, R.E. and K.A. Janni. (1997) "Development of a Low Cost Biofilter for Swine Production Facilities" Paper No. 974040 ASAE, 2950 Niles Road, St. Joseph, MI 49085-9659 USA

Nimmermark, S. (2001) "Use of electronic noses for detection of odour from animal production facilities: a review" *Water Science and Technology* 44 (9): 33-41

Nykanen, J. (no date) *Determination of odour and volatile organic compounds originating from industrial and municipal waste water treatment plants*, [online], Finland: University of Jyväskylä, http://66.102.1.104/scholar?hl=en&lr=&q=cache:aivcgMfzx9EJ:bio.joensuu.fi/enste/Vuosikirja/2005/Jenni%2520Nykanen.pdf+determination+odour+volatile+organic+compounds+industrial+municipal Accessed 5 November 2007

Palmquist, R.B., Roka, F.M. and Vukina, T. (1997) "Hog operations, environmental effects, and residential property values" *Land Economics* 73 (1): 114-124

Park, D., Seidl, F.A. and Davies, P.S. (2004) "The effect of livestock Industry Location on rural Residential Property Values" Colorado State University (DARE)

Park, D. (no date) *Odor Measurement Review – The regulation and measurement of odor in Korea*, Booklet edited by Ministry of the Environment Government of Japan, September 2003, http://www.env.go.jp/en/lar/odor_measure/index.html Accessed 5 November 2007

Pelletier, B.A., Pease, J. and Kenyon, D. (2001) *Economic Analysis of Virginia Poultry Litter Transportation* Bulletin 01-1, Virginia Agricultural Experiment Station, College of Agriculture and Life Sciences, Virginia Tech

Plohman, G. and Zhang, Q. (2001) *Measurement of Odour Emissions from Hog Operations in Manitoba* Report prepared for Manitoba Livestock Manure Management

Ready, R.C. (2005) "Do Landfills Always Depress Nearby Property Values?" *Rural Development* Paper 27

Ready, R.C. and Abdalla, C.W. (2005) "The Amenity and Disamenity Impacts of Agriculture: Estimates from a Hedonic Pricing Model" *Journal of Agricultural Economics* 87 (2): 314-326

Schauberger, G., Piringer, M. and Petz, E. (2001) "Separation distance to avoid odour nuisance due to livestock calculated by the Austrian odour dispersion model (AODM)" *Agriculture, Ecosystems and Environment* 87: 13-28

Smith, V.K. and Huang, J.C. (1995) "Can Markets Value Air Quality? A Meta-Analysis of Hedonic Property Value Models" *The Journal of Political Economy* 103 (1): 209-227

Taff, S.J., Tiffany, D.G. and Weisberg, S. (1996) "Measured Effects of Feedlots on Residential Property Values in Minnesota: A Report to the Legislature" *Staff Paper from University of Minnesota*: 96-12

Taylor, D. (1999) *Fresh from the Farm*, [online], USA: EHP Online, http://www.ehponline.org/docs/1999/107-3/innovations-abs.html Accessed 27 September 2007

Walton, H., Boyd, R., Taylor, T. and Markandya, A. (2007). "Landfill and Urban Amenity Loss: Meta-analysis and Benefits Transfer", revise and resubmit from *Environment and Planning B*. This paper was also presented at the 3rd World Congress of Environmental and Resource Economics in 2006, held in Kyoto

Xiangzhong, L. (2003) "Odour Impact and Control at a Landfill Site in Hong Kong" Proc., *East Asia workshop on odour management and control review*, Ministry of the Environment, Japan, 78-86

Xu, X., Rudolph, V. and Greenfield, P.F. (1999) "Australian urban landfills: management and economics" *Waste Management & Research* 17: 171-180

Yang, S.B. (no date) *Applications of odour measurements in Korea*, [online], Korea: University of Ulsan, http://www.env.go.jp/en/air/odor/eastasia_ws/2-1-2.pdf, Accessed 13 November 2007

Zhou, X. and Zhang, Q. (2003) "Measurements of odour and hydrogen sulphide emissions from swine barns" *Canadian Biosystems Engineering* 45: 6.13-6.18

7.2 Brownfields Studies

Adair, A., Berry, J. and McGreal, S. (2003) "Financing Property's Contribution to Regeneration" *Urban Studies* 40 (5): 1065-1080

Adair, A., Berry, J., McGreal, S., Deddis, B. and Hirst, S. (2000) "The financing of urban regeneration" *Land Use Policy* 17: 147-156

Adams, C. D., Baum, A.E., and MacGregor, B.D. (1988) "The Availability of Land for Inner City Development: A Case Study of Inner Manchester" *Urban Studies* 25 (1): 62-76

Adams, D. (2004) "The changing regulatory environment for speculative housebuilding and the construction of core competencies for brownfield development" *Environment and Planning A* 36: 601-624

Adams, D. and Hutchison, N. (2000) "The Urban Task Force Report: Reviewing Land Ownership Constraints to Brownfield Redevelopment" *Regional Studies* 34 (8): 777-792

Adams, D., Disberry, A., Hutchison, N. and Munjoma, T. (2000) "Mind the gap! Taxes, subsidies and the behaviour of brownfield owners" *Land Use Policy* 17: 135-145

Adams, D., Disberry, A., Hutchison, N. and Munjoma, T. (2001) "Ownership constraints to brownfield redevelopment" *Environment and Planning A* 33: 453-477

Alberini, A., Longo, A., and Riganti, P. (2006) "Using Surveys to Compare the Public's and Decisionmakers' Preferences for Urban Regeneration: The Venice Arsenale" FEEM Working Paper 137.06, Milan.

Alberini, A. (2007) "Determinants and effects on property values of participation in voluntary cleanup programs: the case of Colorado" *Contemporary Economic Policy* 25 (3): 415-432

Alberini, A., Turvani, M., Tonin, S., Chiabai, A. (2007) "Paying for permanence: Public preferences for contaminated site cleanup", *Journal of Risk and Uncertainty*, 34: 155-178.

Alberini, A., Longo, A., Tonin, S., Trombetta, F. and Turvani, M. (2005) "The role of liability, regulation and economic incentives in brownfield remediation and redevelopment: evidence from surveys of developers" *Regional Science and Urban Economics* 35 (4): 327-351

Armstrong, H.W., Kehrer, B., Wells, P. and Wood, A.M. (2002) "The Evaluation of Community Economic Development Initiatives" *Urban Studies* 39 (3): 457-481

Bardos, R.P., Kearney, T.E., Nathanail, C.P., Weenk, A. and Martin, I.D. (2000) *Assessing the Wider Environmental Value of Remediating Land Contamination* paper for 7th International FZK/TNO Conference on Contaminated Soil "ConSoil"

Barlow, J. (1999) "From craft production to mass customisation: innovation requirements for the UK housebuilding industry" *Housing Studies* 14: 23-42

Bartsch, C. and Collaton, E. (1997) *Brownfields: Cleaning and Reusing Contaminated Properties*. Westport, CT: Praeger

BBP Regeneration (2002) *Financial barriers to brownfield development – 5 case studies*, final report prepared for South East England Regional Assembly and RICS, August 2002

Beard, T.R. "Bankruptcy and Care Choice" *RAND Journal of Economics* 21 (1990): 626-634

Bond, S.G. and Kennedy, P.J. (2000) "The valuation of contaminated land: Methods adopted in the UK and NZ" *Journal of Property Investment and Finance* 18 (20): 254-271

Boott, R., Haklay, M., Heppell, K. and Morley, J. (2001) "The use of GIS in brownfield redevelopment" in Halls, P. (Ed) *Innovations in GIS 8: Spatial Information and the Environment*, London: Taylor & Francis

Braswell, B.J. (1999) "Brownfields and Bikeways: Making a Clean Start" *Public Roads* 62 (5): 32-39

Cozens, P., Hillier, D. and Prescott, G. (1999) "The sustainable and the criminogenic: the case of new-build housing projects in Britain" *Property Management* 17 (3): 252-261

Dair, C.M. and Williams, K. (2006) "Sustainable land reuse: the influence of different stakeholders in achieving sustainable brownfield developments in England" *Environment and Planning A* 38: 1345-1366

David Simmonds Consultancy (2003) *Rochester Riverside Barriers To Regeneration: A Case Study*, final report prepared for the Steering and Development Forum, British Urban Regeneration Association

De Sousa, C. (2000) "Brownfield Redevelopment versus Greenfield Development: A Private Sector Perspective on the Costs and Risks Associated with Brownfield Redevelopment in the Greater Toronto Area" *Journal of Environmental Planning and Management* 43 (6): 831-853

De Sousa, C.A. (2001) "Contaminated sites: The Canadian situation in an international context" *Journal of Environmental Management* 62: 131-154

De Sousa, C.A. (2003) "Turning brownfields into green space in the City of Toronto" *Landscape and Urban* Planning 62 (4): 181-198

De Sousa, C.A. (2004) "The greening of brownfields in American cities" *Journal of Environmental Planning and Management* 47 (4): 579-600

Del Saz-Salazaar, S., Garcia-Menendez, L. (2003) "The nonmarket benefits of redeveloping dockland areas for recreational purposes: the case of Castellón, Spain", *Environment and Planning A*, 35: 2115-2129.

Dennison, M. (1998) *Brownfields Redevelopment*. Rockville, MD: Government Institutes

Dixon, T. and Doak, J. (2005) *Actors and Drivers: Who and What Makes the Brownfield Regeneration Process Go Round?* Paper presented to the SUBR:IM Conference, March 1st 2005

Dixon, T., Pocock, Y. and Waters, M. (2006) "An analysis of the UK development industry's role in brownfield regeneration" *Journal of Property Investment and Finance* 24 (6): 521-541

Dobson, S.M. and Goddard, J.A. (1992) "The determinants of commercial property prices and rents" *Bulletin of Economic Research* 44 (4): 301-321

Dye, R.F. and Merriman, D.F. (2000) "The Effects of Tax Increment Financing on Economic Development" *Journal of Economics* 47: 306-328

Eisen, J.B. (1999) "Brownfields policies for sustainable cities" *Duke Environmental Law and Policy Forum* 9 (2): 187-229

Gawande, K. and Jenkins-Smith, H. (2001) "Nuclear Waste Transport and Residential Property Values: Estimating the Effects of Perceived Risks" *Journal of Environmental Economics and Management* 42: 207-233

Greenberg, M. and Lewis, M.J. (2000) "Brownfields Redevelopment, Preferences and Public Involvement: A Case Study of an Ethically Mixed Neighbourhood", *Urban Studies* 37 (13):2501-2514

Greenberg, M., Lee, C. and Powers, C. (1998) "Brownfields and public health: Reviving the past to protect the future" *American Journal of Public Health* 88: 1759-1760

Greenberg, M., Lowrie, K., Mayer, H., Tyler Miller, K. and Solitare, L. (2001) "Brownfield redevelopment as a smart rowth option in the United States" *The Environmentalist* 21: 129-143

Grimski, D. and Ferber, U. (2001) "Urban Brownfields in Europe" *Land Contamination and Reclamation* 9 (1): 143-148

Guntermann, K. L., (1995) "Sanitary Landfills, Stigma and Industrial Land Values," *Journal of Real Estate Research*, 10(5), 531-42.

Harrison, C. and Davies, G. (2002) "Conserving biodiversity that matter: practicioner' perspectives on brownfield development and urban nature conservation in London" *Journal of Environmental Management* 65: 95-108

Healey, P. and Barrett, S.M. (1990) "Structure and Agency in Land and Property Development Processes: Some Ideas for Research" *Urban Studies* 27 (1): 89-104

Heerwagen, J.H. and Orians (1986) "Adaptations to windowlessnes: A study of the use of visual décor in windowed and windowless offices" *Environment and Behaviour* 18: 623-639

Howland, M. (2000) "The impact of contamination on the Canton/Southeast Baltimore land market", *Journal of the American Planning Association*, 66(4), pp. 411 – 420.

Howland, M. (2002). *The legacy of contamination, Carroll Camden Industrial Area*. Presented at the meetings of the Association of Collegiate Schools of Planning, Baltimore, Maryland.

Ihlanfeldt, K.R. and Taylor, L.O. (2004) "Externality effects of small-scale hazardous waste sites: evidence from urban commercial property markets" *Journal of Environmental Economics and Management* 47 (1): 117-139
International City/County Management Association (2002) *Growing Greener: Revitalizing Brownfields into Greenspace*, Washington DC: International City/County Management Association

Jackson, T. O. (2001) "The effects of previous environmental contamination on industrial real estate prices" *The Appraisal Journal*, 69(2), pp. 200 – 210.

Larson, B.A. (1996) "Environmental Policy Based on Strict Liability: Implications of Uncertainty and Bankruptcy" *Land Economics* 72 (1): 33-42

Kaplan, R. (2001) "The Nature of the View from Home: Psychological Benefits" *Environment and Behaviour* 33: 507-542

Ketkar, K. (1992) "Hazardous waste sites and property values in the state of New Jersey" *Applied Economics* 24: 647-659

McCarthy, L. (2002) "The brownfield dual land-use policy challenge: reducing barriers to private redevelopment while connecting reuse to broader community goals" *Land Use Policy* 19: 287-296

McGrath, D.T. (2000) "Urban Industrial Land Redevelopment and Contamination Risk" *Journal of Urban Economics* 47: 414-442

McGreal, S., Berry, J., Lloyd, G. and McCarthy, J. (2002) "Tax based Mechanisms in Urban Regeneration: Dublin and Chicago Models" *Urban Studies* 39 (10): 1819-1831

Meyer, P.B. and Lyons, T.S. (2000) "Lessons from private sector brownfield redevelopers" *Journal of American Planning Association* 66 (1): 46-57

Moore, N.M. (2003) *Brownfields and Urban Sustainability: The Case of Dublin* Paper presented to the IUAV Conference on Brownfields as Opportunities for Sustainable Development, Venice, January 2003

Mundy, B. (1992) "Stigma and Value" *The Appraisal Journal* 60 (1): 7-13
Nelson, A.C., Genereux, J., Genereux, M. (1992) "Price Effects of Landfills on House Values" *Land Economics* 68 (4): 359-365

Munneke, H.J. (1996), "Redevelopment Decisions for Commercial and Industrial Properties," Journal of Urban Economics, 39(2), 229-253.

Nijkamp, P., Rodenburg, C.A. and Wagtendonk,A.J. (2002) "Success factors for sustainable urban brownfield development: A comparative case study approach to polluted sites" *Ecological Economics* 40: 235-252

Pauleit, S., Ennos, R. and Golding, Y. (2005) "Modeling the environmental impacts of urban land use and land cover change - a study in Merseyside, UK" *Landscape and Urban Planning* 71: 295-310

Raco, M. and Henderson, S. (2006) "Sustainable Urban Planning and the Brownfield Development Process in the United Kingdom: Lessons from the Thames Gateway" *Local Environment* 11 (5): 499-513

Schoenbaum, M. (2002) "Environmental contamination, brownfields policy, and economic redevelopment in an industrial area of Baltimore, Maryland", *Land Economics*, 78(1), pp. 60 – 71.

Schoenbaum, M. (2002). Environmental contamination, brownfields policy, and economic redevelopment in an industrial area of Baltimore. *Land Economics*, *78*, 60-71.

Sementelli, A. J. & Simons, R. A. (1997) "Regulation of leaking underground storage tanks: policy enforcement and unintended consequences", *Economic Development Quarterly*, 11(3), pp. 236 – 248.

Simons, R. A. & Sementelli, A. J. (1997) "Liquidity loss and delayed transactions with leaking underground storage tanks", *The Appraisal Journal*, 65(3), pp. 255 – 260.

Simons, R. A., Bowen, W. M. & Sementelli, A. J. (1999) "The price and liquidity effects of UST leaks from gas stations on adjacent contaminated property", *The Appraisal Journal*, 67(2), pp. 186 – 194.

Sivitanidou, R. and Sivitanides, P. (1995) "The Intrametropolitan Distribution of R&D Activities Theory and Empirical Evidence" *Journal of Regional Science* 35 (3): 391–416.

Syms, P. (1999) "Redeveloping brownfield land: The decision-making process" *Journal of Property Investment and Finance* 17 (5): 481-500
Talbot, J.F. and Kaplan, R. (1991) "The benefits of nearby nature for elderly apartment residents" *International Journal of Aging and Human Development* 33: 119-130

Tedd, P., Charles, J.A. and Driscoll, R. (2001) "Sustainable brownfield re-development – risk management" *Engineering Geology* 60: 333-339

Thomas, M.R. (2002) "A GIS-based decision support system for brownfield redevelopment" *Landscape and Urban Planning* 58: 7-23

Walker, G. (2000) "Urban planning, hazardous installations, and blight: an evaluation of responses to hazard-development conflict" *Environment and Planning C: Government and Policy* 18: 127-143

Wassmer, R. W. & Anderson, J. E. (2001) "Bidding for business: new evidence on the effect of locally offered economic development incentives in a metropolitan area", *Economic Development Quarterly*, 15(2), pp. 132 – 148.

Wernstedt, K., Heberle, L., Alberini, A. and Meyer, P. (2004) *The Brownfields Phenomenon: Much Ado about Something or the Timing of the Shrewd?* discussion paper (04-46) for Resources for the Future: Washington D.C., USA

Wernstedt, K., Meyer, P.B. and Alberini, A. (2006) "AttractivePrivate Investment to Contaminated Properties: The Value of Public Interventions" *Journal of Policy Analysis and Management* 25 (2): 347-369

Yount, K.R. (1997) "The organizational contexts of decisions to invest in environmentally risky urban properties" *Journal of Economic Issues* 31 (2): 367-373

7.3 Cultural Heritage Studies

Alberini, A. and Longo, A. (2006) "Combining the travel cost and contingent behavior methods to value cultural heritage sites: Evidence from Armenia" *Journal of Cultural Economics* 30 (4): 287-304

Alberini, A., Riganti, P., Longo, A. (2003) "Can People Value the Aesthetic and Use Services of Urban Sites? Evidence from a Survey of Belfast Residents" *Journal of Cultural Economics* 27 (3-4): 193-213

Bedate, A., Herrero, L.C. and Sanz, J.A. (2004) "Economic valuation of the cultural heritage: application to four case studies in Spain" *Journal of Cultural Heritage* 5 (1): 101-111

Beltran, E., Rojas, M. (1996) "Diversified funding methods in Mexican archaeology" *Annals of Tourism Research* 23 (2): 463-478

Bille, T., Lundhede, T., Hasler B. (2006) *Economic Valuation of Protection of Archaeological Artefacts in Great Aamose, Denmark* Paper presented at the 14th Internatinal Conference of the ACEI, Vienna 6-9 July 2006

Boter, J., Rouwendal, J., Wedel, M. (2005) "Employing Travel Time to Compare the Value of Competing Cultural Organizations" *Journal of Cultural Economics* 29 (1): 19-33

Chambers, C.M., Chambers, P.E., Whitehead, J.C. (1998) *Contingent Valuation of Quasi-Public Goods: Validity, Reliability, and Application to Valuing a Historic Site*, [online], USA, http://www.ecu.edu/econ/wp/96/ecu9614.pdf, Accessed 5 November 2007

Del Saz Salazar, S., Marques, J. (2005) "Valuing cultural heritage: the social benefits of restoring an old Arab tower" *Journal of Cultural Heritage* 6 (1): 69-77

Frey, B.S. and Pommerehne, W.W. (1989) *Muses and markets: Explorations in the economics of the arts*. Oxford: Basil Blackwell

Garrod, G., Willis, K., Bjarnadottir, H. Cockbain, P. (1996) "The non-priced benefits of renovating historic buildings: A case study of Newcastle's Grainger Town" *Issues in Urban Conservation* 13 (6): 423-430

Garrod, G.D. and Willis, K.G. (1994) "Valuing biodiversity and nature conservation at a local level" *Biodiversity and Conservation* 3 (6): 555-565

Grosclaude, C., Soguel, N.C. (1994) "Valuing damage to historic buildings using a contingent market: a case study of road traffic externalities" *Environmental Planning and Management* 37 (3): 279-287

Hansen, T.B. (1997) "The Willingness-to-Pay for the Royal Theatre in Copenhagen as a Public Good" *Journal of Cultural Economics* 21 (1): 1-28

Hett, T. and S. Mourato (2000) "Sustainable management of Machu Picchu: A stated preference approach" Department of Environmental Science and Technology, Imperial College of Science, Technology, and Medicine, London

Kling, R.K., Revier, C.F., Sable, K. (2001) "Estimating the Public Good Value of Preserving a Historical Landmark: The Role of Non-Substitutability and Information in Contingent Valuation" (preliminary draft)

Lockwood (1996) "Analysing Conflict between Cultural Heritage and Nature Conservation in the Australian Alps: A CVM Approach" *Journal of Environmental Planning and Management* 39 (3): 357-370

Maddison, D. and Foster, T. (2001) "Valuing Congestion Costs in the British Museum" Paper presented to the Economic Valuation of Cultural Heritage Conference in the Department of Economics of University College London

Maddison, D. and Mourato, S. (2001) "Valuing different road options for Stonehenge" *Conservation and Management of Archaeological Sites* 4:203-212

Mazzanti, M. (2003) "Discrete choice models and valuation experiments" *Journal of Economic Studies* 30 (6): 584-604

Morey, E. and Rossman, K.G. (2003) "Using Stated-Preference Questions to Investigate Variations in Willingness to Pay for Preserving Marble Monuments: Classic Heterogeneity, Random Parameters, and Mixture Models" *Journal of Cultural Economics* 27 (3-4): 215-229

Morey, E., Rossman, K., Chestnut, L., and Ragland, S. (1997) *Valuing Acid Deposition Injuries to Cultural Resources* Report to the National Acid Precipitation Assessment Programme

Morrison, W.G. and West, E.G. (1986) "Child exposure to the performing arts: The implications for adult demand" *Journal of Cultural Economics* 10 (1): 17-24

Pollicino, M. and Maddison, D. (2001) "Valuing the Benefits of Cleaning Lincoln Cathedral" *Journal of Cultural Economics* 25 (2): 131-148

Powe, N.A. and Willis, K.G. (1996) "Benefits received by visitors to heritage sites: a case study of Warkworth Castle" *Leisure Studies* 15: 259-275

Riganti, P., Nese, A., Columbino, U. (2004) *Eliciting Public Preferences For Managing Cultural Heritage Sites: Evidence from a Case study on the Temples Of Paestum* paper presented to the 44th European Congress of the European Regional Science Association Regions and Fiscal Federalism, University of Porto, Porto, Portugal

Santagata, W. and Signorello, G. (2000) "Contingent Valuation of a Cultural Public Good and Policy Design: The Case of 'Napoli Musei Aperti'" *Journal of Cultural Economics* 24 (3): 181-204

Scarpa, R., Sirchia, G. and Bravi, M. (1998) "Kernel vs. Logit Modeling of Single Bounded CV Responses: valuing Access to Architectural and Visual Arts Heritage in Italy," in Bishop, R. and Romano, D. (eds.), *Environmental Resource Valuation: Applications of Contingent Valuation Method in Italy*, Kluwer Publisher, Boston

Snowball, J.D. (2005) "Art for the Masses? Justification for the Public Support of the Arts in Developing Countries – Two Arts Festivals in South Africa" *Journal of Cultural Economics* 29 (2): 107-125

Snowball, J.D. and Antrobus, G.G. (2001) "Measuring the Value of the Arts to Society: The importance of the value of externalities for lower income and education groups in South Africa" *The South African Journal of Economics* 69 (4)

Suh, Y.K. and Gartner, W.C. (2004) "Perceptions in International Urban Tourism: An Analysis of Travelers to Seoul, Korea" *Journal of Travel Research* 43 (1): 39-45

Whitehead, J.C. and Finney, S.S. (2003) "Willingness to Pay for Submerged Maritime Cultural Resources" *Journal of Cultural Economics* 27 (3-4): 231-240

Willis, K.G. (1994) "Paying for heritage: what price for durham cathedral" *Journal of Environmental Planning and Management* 37 (3): 267-278

Willis, K.G. (2002) "Research Note: Iterative Bid Design in Contingent Valuation and the Estimation of the Revenue Maximising Price for a Cultural Good" *Journal of Cultural Economics* 26 (4): 307-324

World Bank Group (1998) Valuing the Benefits of Conservation of the Fes Medina, [online], USA: World Bank Group, http://www.elaw.org/assets/pdf/Valuing.Benefits.Fes.Medina.pdf Accessed 5 November 2007

7.4 Other References

Hill, S. and Gough, J. (1981) "Discounting Inflation – A Note" *Managerial and Decision Economics* 2 (2): 121-123

US EPA (1997) Brownfields Definition [online] USA: US EPA Brownfields Homepage, http://www.epa.gov/swerosps/bf/glossary.htm

8. Appendices

Appendix 1.1 – Odour Externalities: Hedonics Studies

Authors	Area	only odour	characteristics of the study	WTP	WTP in 2007 Euro
Anstine (2003)	Jonesborough, Tennessee, US	NO	171 assessed house values in 1996; distance from a rubber compounding facility	$5,457 loss in average price of housing	€ 5050.80 loss
Batalhone et al (2002)	Brasilia, Brazil	NO	9522 property values (assessed); air pollution and smell from sewage plant; variable used for smell is a dummy variable equal 1 if there is bad smell	presence of smell has an impact on the house value of $4,624- $9,907 (but no information is provided on the average house value)	€3664.50 - €7851.29 (but no information is provided on the average house value)
Eshet et al (2007)	Israel	NO	distance from waste transfer stations; 9505 residential housing sales	$5,000 loss in property value if located within 2.8km from a transfer station (but lack a measure for noise, odour)	€ 3520.37 loss
Externe (1995)	Cerro Maggiore, Milan, Italy	YES	289 residential sale prices from one estate agent in 1993-1995; odour exposure index used + dispersion model	2.8% average house price loss due to odour disamenity	2.8% average house price loss due to odour disamenity
Gomez and Zhang (2000)	Illinois, US	YES	relationship between hog production concentration and retail spending (no housing data!)	inverse relationship between hog production and retail spending - large hog farms hinder economic growth in local communities	inverse relationship between hog production and retail spending - large hog farms hinder economic growth in local communities

Herriges et al (2003)	North-Central Iowa, US	YES	1,145 residential sales in 1992-2002 near 550 livestock facilities	house values reduction of 0 - 26% according to the size of the hog facility and wind, e.g. a $100000 house may drop by $10000 because of a new $300000 operation	A € 90186.691 house may decrease by € 9018.04 because of new € 270537.37 operation
Milla et al (2005)	North Carolina, US	YES	810 parcel sales in 2000-2001	a home valued at $114,000 (median price) at a distance of 1 mile from a farm with 5000 animals will decrease house price by $0.71 per hog or $3550	A € 93246.05 house decreases by € 0.58 per hog or € 2903.28
Palmquist et al (1997)	North Carolina, US	YES	237 rural residential house sales in 1992-1993 near hog farms	$6,000 or 9% reduction of average sale prices for hog farms within 0.5 mile and having about 2,400 hogs	€ 6,029.90
Ready (2005)	Berks County, Pennsilvanya, US	NO	11,090 residential sales in 1998-2002; proximity to landfills: difficult to see, visible, prominte feature in the landscape - not really an odour study	average price ($130700) increases by 4.12% ($5384.84) or per mile of distance	A € 95859.99 house would increase by € 3989.83 per mile of distance
Ready and Abdalla (2005)	Berks County, Pennsilvanya, US	NO	8090 residential house sales in 1998-2002; proximity to mushroom production and animal production facilities	6.4% average loss in house price due to proximity to animal production facility	6.4% average loss in house price due to proximity to animal production facility

Taff et al (1996)	Minnnesota, US	YES	292 rural residential house sales in 1993-1994 nearby feedlots	WTP increases with proximity to feedlots! The proportional price effect of a new feedlot would be a $1750 change to the $26500 median price. But some econometric problems	A new feedlot makes a € 1708.33 change to the € 25867.34 median house price
Vannucci and Torsello (2006)	Central Italy	YES	77 residential transactions; data obtained from real estate agencies; in 1994-2004; odour measured with an index (0=no odour; 3 very strong odour) WTP is 1999€	59,6 €/m² is WTP for decreasing odour from one level to another	€ 70.38 per m²

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 1.2 – Odour Externalities: Stated Preference Studies

Authors	Area	only odour	methodology	characteristics of the study	WTP	WTP in 2007 Euro
Garrod and Willis (1998)	Gateshead, UK	NO	choice experiments	73 respondents; forced choice	£0.09 - £0.14 /year for one extra day without bad smell from landfill	€ 0.11 - 0.17 per year
Hurlimann and McKay (2007)	Mawson Lakes in South Australia	NO	choice experiments	136 households; phone interview; increase in recycled water quality from having odour at times to being completely odourless (odour, colour, low salt)	A$0.46 per cubic metre	€0.29 per cubic metre
Lareau and Rae (1989)	Philadelphia, US	YES	contingent ranking	140 respondents; avoid all diesel odour exposures	$75/year/housohold	€ 87.84 per year per household
Muller and Deiner (1997)	Hamilton-Wentworth, US	NO	contingent ranking	515 mail interviews in 1997; yes status quo	$19/month per respondent to decrease the number of monthly bad odour days from 4 to 3	€ 17.19 per month

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 1.3 – Odour Externalities: Cost Based Studies and other methods

Authors	Area	only odour	methodology	characteristics of the study	WTP	WTP in 2007 Euro
Beloff et al (2000)	US	NO	medical costs, individual's odour abatement costs, government costs, public interest group costs, legal costs, commercial costs and job loss costs	WTP for hazardous odour to make them non-hazardous (but there is still odour!)	$425/year per household	€ 509.16
Fleming et al (1998)	Iowa, US	YES	avoidance cost	net manure benefit: manure odour can be minimised by incorporating it to the soil	$2.66 per hog is the minimum marginal cost of delivering nutrients when manure is not soil incorporated. No calculation is given for incorporating manure into the soil	€ 2.37 per hog
Nicolai and Janni (1997)	Minnnesota, US	YES	avoidance cost	construction, performance, and management of a low cost biofilter used to treat air from a continuously running pit fan on a swine farrowing barn.	The construction and operating cost was estimated to be $0.28 per piglet produced	€ 0.25 per piglet
Park (?)	Korea	YES	Not a valuation study	He reports that more than 2760 civil petition cases among 1626 manufacturing plants have been filed	He reports that more than 2760 civil petition cases among 1626 manufacturing plants have been filed	-

Taylor (1999)	Faison, Norht Carolina, US	YES	avoidance cost	installation of facilities which can help odour problems	$50,000 for a facility of 800-1,200 hogs	€ 43,530.25
Taylor (1999)	Faison, Norht Carolina, US	YES	qualitative interview	interview of a man living in an area surrounded by 21 hog farms	intense odours can cause mood swings, irritate eyes and even cause neurochemical changes, affecting health	Installation of an upflow biofilter could be around € 43000. Or installation of a lagoon cover including material, labour and equipment rental could cost over € 9500

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 2.1 – Brownfields Externalities: Hedonics Studies

Authors	Year of Publication	Year of Study	Area	Characteristics of Study	VALUATION	VALUE OF THE EXTERNALITY in 2007 Euro
Alberini	2007	1974-2002	USA	Investigated impact of participation in voluntary cleanup programs on property value. 245 sales studied.	Confirmed contaminated properties sold at a 43-56% discount relative to uncontaminated properties	€446,000 (compared to the average property worth €892,000)
Gawande and Jenkins-Smith	2001	unknown	South Carolina, USA	Uses data on 9432 sales in three South Carolina Counties to model effects of a series of highly publicised shipments of nuclear waste at nearby dock	Increase of $500 with every mile from rail route	Increase of €403.09 with every mile from rail route
Guntermann	1995	1984-1994	Phoenix, Arizona, USA	Applies the hedonic pricing model to estimate the impacts of proximity to landfills on a sample of 153 industrial parcels sold in Phoenix, Arizona, from 1984 to 1994	Industrial land value is unaffected by landfills proximity. Whilst landfills sell at about 50% discount compared to non landfill sites	€1,388,819 for landfill sites (compared to non landfill sites worth €2,777,638)
Howland	2004	1990-2000	Baltimore, USA	Survey based study on the impact of contamination on demand for and supply of industrial land in Baltimore City	Parcels with known contamination sold at a 67% discount and parcels with historical reasons to suspect contamination sold at an average 65% discount compared to clean properties in the same areas.	Value of contamination is €500,000; average value of a site with known contamination is €240,000 (compared to average non contaminated site worth €727,000)

Ihlanfeldt and Taylor	2004	1981-1998	Atlanta, USA	Estimate property prices for proximity to sites contaminated, supposed to be contaminated or previously contaminated between 1981-1998 in Atlanta	External costs due to proximity to listed sites are about 10% of assessed property values.	Losses range from €30,000 for industrial sites to €500,000 for offices
Jackson	2001	1999	California, USA	Obtained info on 122 industrial properties sold in California	The sale prices of previously contaminated properties were not significantly different from the prices of other comparable industrial properties.	Value of externality of presence of contamination on industrial properties is €0
Jackson	2002	1995-1999	California, USA	Data on 140 sales of industrial properties in south California	Contaminated properties sold at a 30% discount compared to non contaminated properties	Contamination is worth on average €330,000; the average property is worth €1.1 Million
Longo and Alberini	2006	2001	Baltimore, USA	Data on 2430 commercial properties and 609 industrial property sales	Value of proximity to a listed site: contaminated, previously contaminated or supposedly contaminated site	Value of external cost due to proximity to a listed site for industrial properties is €0; Commercial property values increase by 10% for each additional kilometre away from the listed site

McGrath	2000	1983-1993	Chicago, USA	Obtained info on 195 industrial properties sold in Chicago between 83 and 93	Median land demolition or contamination discount approx $1.9million per parcel	€ 2.29 million contamination discount per parcel
Schoenbaum	2002	1963-1999	Maryland, USA	Comparison of brownfields and non-brownfields to identify variations in assessed land value	$1.3million allocated by Maryland brownfield legislation to aid redevelopment	€1.11million allocated by Maryland brownfield legislation to aid redevelopment

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 2.2 – Brownfields Externalities: Stated Preferences Valuation Studies

Authors	Year of Publication	Year of Study	Area	Methodology	Characteristics of the study	WTP	WTP in 2007 Euro
Alberini et al	2006	2004	Venice, Italy	Choice Experiments	Computer based questionnaire administered to the users of a multimedia library	€41.55 for new moorings €130 for fast transportation links	€46 for new moorings €143 for fast transportation links
Alberini et al	2005	2002	France	Choice Experiments	At a conference in France, examined market based incentives which were intended to promote brownfields reuse	For a project worth €7million, developers would need to be compennsated €2.5million and are willing to give up €1.5million to secure certificate of exemption from future liability	For a project worth €7.77million, developers would need to be compensated €2.77million to accept the presence of contamination and are willing to give up €1.66million to secure certificate of exemption from future liability

Alberini et al	2007	2005	Italy (Milan, Naples, Bari, Venice)	Choice Experiments	Computer based questionnaire; 804 respondents; valuation of risk of death caused by proximity to contaminated sites		Value of a Statistical Life for a risk reduction to be incurred in the current year is €5.9 million
Wernstedt et al	2006	2003	USA	Choice Experiments	Survey of 313 members of USA Urban Land Institute to see which incentives to brownfield remediation were of greatest attraction to developers	cleanup cost risk valued at $702,000 while 3rd party liability valued at $969,000	cleanup cost risk valued at €530,065.54 while 3rd party liability valued at $731,816.996

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 2.3 – Brownfields Externalities: Other Valuation Studies

Authors	Year of Publication	Year of Study	Area	Methodology	Characteristics of the study	WTP	WTP in 2007 Euro
De Sousa	2003	unknown	Toronto, Canada	Interview/ Review analysis	Aims to shed light on how greening projects can be implemented and how they can improve environmental quality and play a role in revitalizing cities such as Toronto	Projects generated 1520 acres of green land, with average project cost of CA$66000 per acre	Cost of redevelopment is €52,231.52 per acre
De Sousa	2004	2003	USA	Questionnaire	Examine the impacts of 20 projects involving the greening of brownfield sites in USA. Questionnaire mailed	Average cost of greening project was $6.05million	€ 4.69million cost for a greening project

Myer and Lyons	2000	1997	USA	Telephone Interview	Telephone interviews with 13 brownfield redevelopers	The necessary return on investment needs to be 12.5% to attract their attention. Also require large parcel size - some want minimum of $5million project	Some developers want minimum of €4.45million worth project to work on a brownfield project
Simons and Sementilli	1997	1989-1992	Cleveland, USA	Database of storage tanks	Comparison of sale prices of commercial properties with leaking underground storage tanks (LUSTs), properties with non-leaking tanks registered with the State of Ohio (RUSTs) and other commercial properties (baseline) in Cleveland for the years 1989 – 92		No valuation study. They find that sites with a history of contamination were about 50% less likely to be sold than non contaminated properties

Simons et al	1999	unknown	Cleveland, USA	Comparison of transaction rates of 11 commercial properties near LUST sites with other commercial properties in Cleveland.	Total price decline of $115,170	Total price decline of $142,614.47	Total price decline of €98,642.46

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 3.1 – Cultural Heritage Externalities: Stated Preferences Studies

Authors	Date of Publication	Year of Study	Area	Methodology	Characteristics of the study	WTP	WTP in 2007 Euro
Alberini, A., Riganti, P., Longo, L.	2003	2002	Belfast, Northern Ireland	Conjoint choice survey	Conjoint choice experient to find its potential for planning decisions on urban sites, 2001 study, 244 completed, aesthetics and use values	No WTP was calculated due to the lack of the status quo in the choice sets. Only marginal prices can be calculated	No WTP was calculated due to the lack of the status quo in the choice sets. Only marginal prices can be calculated
Beltran, E., Rojas, M.	1996	1994	Mexico	Contingent Valuation	1994 study; 300 respondents interviewed at three archaeological sites; 5603 are surveyed in major Mexican cities.	Optimum Uniform Fee: 7.793 pesos (people even willing to pay more to conserve than to visit)	Optimum Uniform Fee: €0.83 (people even willing to pay more to conserve than to visit)
Bille Hansen, T.	1997	1993	Copenhagen, Denmark	Contingent Valuation	1993 study of 1843 people to find mean WTP per person for the Royal Theatre, Copenhagen	154 dk	€ 26.52
Del Saz Salazar, S., Marques, J.	2005	2002	Valencia, Spain	Contingent valuation	contingent valuation study of 252 respondents to find social benefits/WTP of restoring an old Arab Tower	€ 52.95	€ 61.01
Garrod, G., Willis, K., Bjarnadottir, H. Cockbain, P.	1996	1995	Grainger Town, Newcastle upon Tyne, UK	Contingent valuation	202 Newcastle taxpayers to find preferences of restoration of historic buildings. Open ended CV question	Median WTP £ 10 per household	Median WTP £13.6 per household
Grosclaude, C., Soguel, N.C.	1994	1992	Neuchatel, Switzerland	Contingent valuation	200 respondents area asked open ended and iterative bidding CV questions for preserving 16 historic buildings	Mean WTP is 14.3 Swiss Francs	€ 10.24

Hett, T., Mourato, S.	2000		Machu Picchu, Peru	Contingent Valuation	Aimed to find mean WTP per foreign tourist/ Peruvian for access to Machu Picchu	US$47 for foreigners and US$26 for Peruvians	€ 38.93 for foreigners and € 21.53 for peruvians
Kling, R.K., Revier, C.F., Sable, K.	2004	1997	USA	Contingent Valuation	212 people were asked a dichotomous choice WTP question per household for preservation and restoration of a historic landmark in a medium sized USA city	US$ 3-54	€ 2.66 - 37.36
Maddison, D., Mourato, S.	1999		UK	Contingent Valuation	486 people interviewed to find mean WTP for new underground tunnel at Stonehenge	£17.10	€ 27.82
Mazzanti, M.	2001		Rome, Italy	Choice Experiments	185 respondents to find WTP for conservation activity at Galleria Borghese, Rome	6600 - 7470 lira	€ 3.91 - € 4.42
Morey, E., Rossman, K.G.	2003	1997	Washington DC, USA	Choice Experiments	Aimed to find WTP per person per year to preserve monument 100% time	US$88	€ 68.27
Navrud, S. and Ready R.C. (ed)	1992		Trondheim, Norway	Contingent Valuation	163 people studied to find WTP per person per year to preserve original parts of Nidaros Cathedral in Trondheim, Norway	318 NOK per visitor	€ 57.56
Pollicino, M., Maddison, D.	2001	1999	Lincoln, England	Contingent Valuation	Study of 328 people to find WTP per person within city limits, for increasing the cleaning cycle of Lincoln Cathedral. Double Bounded, dichotomous choice model used	£ 15	€ 23.61
Powe, N.A., Willis, K.G.	1996		Warkworth, UK	Contingent Valuation	201 people studied to find mean benefit valuation/WTP per person of visits to Warkworth Castle	£2.53	€ 4.32

Riganti, P., Scarpa, R.	1998		Naples, Itlay	Contingent Valuation	Study of 448 households to find WTP per household per year for conservation of cultural heritage sites in Naples, Italy.	420,000 lira	€ 266.17
Santagata, W., Signorello, G.	2000		Naples, Itlay	Contingent Valuation	Survey of 468 people to find the WTP per person per year to support Napoli Musei Aperti	24932.5 lira	€ 16.16
Scarpa, R., Sirchia, G., Bravi, M.	1998		Italy	Contingent Valuation	1323 respondents to find WTP to keep public access to Rivoli Castle	$28	€ 24.50
Snowball, J.D.	2005	2003	South Africa	Contingent Valuation	Study of 279 South Africans to find mean WTP to preserve local festivals (low and high income)	US$ 1 - 2.68	US$ 1.13 – 3.02
Whitehead, J.C. Finney, S.S.	2003	2001	North Carolina, USA	Contingent Valuation	884 households are surveyed to find WTP per household to maintain shipwrecks in their pristine state	US$35	€ 28.21
Willis, K.G.	1994	1992	Durham, UK	Contingent Valuation	92 people are asked their WTP to access Durham Cathedral	£ 0.76	£ 1.12
Willis, K.G.	2002	1999	Naples, Itlay	Contingent Valuation	494 people are surveyed to find their WTP to visit Bosco Capodimonte, Naples. Iterative bidding game	5131 lira	€ 3.18
World Bank Group	1998		Fes Medina, Morrocco	Contingent Valuation	600 visitors interviewed to find median WTP among European households for preservation	$2.15	€ 1.88

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html

Appendix 3.2 – Cultural Heritage Externalities: Revealed Preferences Studies

Authors	Date of Publication	Area	Methodology	Characteristics of the study	WTP	WTP in 2007 Euro
Alberini, A., Longo, L.	2006	Armenia	Travel cost	2004 travel cost study of 500 people to find WTP per person per year to visit heritage sites. Use value only	18.44 AMD	€ 0.04
Bedate, A., Herrero, C.L., Sanz, J.A.	2004	Castilla y Leon, Spain	Travel cost	1998 travel cost study to find WTP per capita of 914 people for four different cultural goods in Castilla y Leon. Use values only	6457.235 pesetas	€ 43.98
Maddison, D., Foster, T.	2003	UK	Utility difference approach	2000 utility difference approach (Sellar et al 1986) applied to 400 people to find cost posed by marginal visitors to area	£8.05	€ 12.98
Mollard A, Rambonilaza T, Vollet D	2007	Aveyron region and Drome, France	Hedonic pricing	2002 hedonic study of 1529 french cottages. Use values only ie. Rent price	€ 352	€ 390.55

Where applicable, monetary data has been converted into 2007 Euro (€)
US$ inflation was calculated from http://minneapolisfed.org/research/data/us/calc/
CA$ inflation was taken from http://www.bankofcanada.ca/en/rates/inflation_calc.html
AUS$ inflation was taken from http://www.rba.gov.au/calculator/calc.go
FIM inflation was taken from http://www.rahamuseo.fi/english/multi_laskuri.html
Other inflation rates taken from www.wikipedia.org and calculated using the same method as Hill and Gough 1981
Currency conversions were performed with the use of exchange rates found at www.xe.com/ucc, with the exception of Spanish Pesetas which were converted using the website http://coinmill.com/ESP_calculator.html