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No Escape? The Co-ordination Problem in Heritage Preservation

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Abstract
Conservation areas (CAs) are among the most restrictive English planning policies. Designation implies a significant limitation of owners' control over the shape and appearance of their properties. The policy, however, can also be argued to solve a sort of 'prisoners' dilemma', in which it might be collectively rationale to preserve the character of an area, but an individual homeowner may be tempted to inappropriately alter their property, thus free-riding on nearby properties' character. The net-benefit of the policy depends largely on the existence of positive 'heritage effects' and acknowledgement from homeowners that policy contributes to neighbourhood stability and the preservation of these positive effects. Our results of a mixed-method analysis of close to 1 million property transactions near to about 8000 CAs and 111 interviews with residents in nine representative CAs in Greater London suggest that positive heritage externalities exist and that residents in CAs tend to value their local environments, acknowledge the need for planning control and execute their right to object to neighbour's planning request.

Keywords: Designation, England, Heritage, Property Value, Prisoner's Dilemma
JEL: R52, D23, C7

1 Introduction

The setting aside and protecting of areas of special architectural, historic or cultural interest is a long established part of planning in the North American and European context. From the initial historic districts of Charleston, South Carolina in 1931 and New Orleans, Louisiana in 1937 in America (Gale, 1991) to the Civic Amenities act in the United Kingdom in 1967, which set up conservation areas (CAs), historic districts have proved a popular way of protecting and enhancing buildings and landscapes of local importance. The policy rhetoric behind the conservation of these spaces, at least in England, is based on the benefits that the areas are purported to bring to neighbourhoods and communities. These are wide-ranging and include economic regeneration, enhanced environmental quality, stronger place-based identity, more active social communities and the provision of better quality more creative new build (HM Government, 2010).

However, despite their appeal the districts have also met with critics who worry about the economic impacts designation may have on property owners and the impingement of property rights that these designated districts naturally imply (See Glaeser, 2011; Glaeser, 2010). A great deal of research has gone into the financial impact of designation in a number of national and local contexts (Zahirovic-Herbert & Chatterjee, 2012, Ahlfeldt & Maennig, 2010; Diaz *et al,* 2008, Leichenko *et al*, 2001, Koster, Van Ommeren, & Rietveld, 2012), most of which indicate a generally positive price impact on properties. However, relatively less is understood about other tensions that may exist in these districts. One of these tensions is a sort of 'prisoners' dilemma 'whereby all those living inside an historic district benefit from localised heritage amenity but individual property owners may be tempted to inappropriately alter or not adequately maintain their properties thus 'free-riding' on the overall character of the area (Coulson & Lahr, 2005). Historic preservation then represents an instance where, in game-theory terms, a co-ordination problem exists. Here all parties could gain from the conservation of their neighbourhood through heightened amenity and raised property values, but in order to realise this gain residents are required to make mutually consistent decisions about the alteration and upkeep of their properties. The situation corresponds to the standard welfare economics problem where a *non-pecuniary* externality that cannot be traded on an economic market leads to a misallocation of resources since external costs and benefits are not taken into account in the market equilibrium. These types of coordination problems have also been examined in the context of home-

ownership and social capital investment (Hilber, 2010 and DiPasquale & Glaeser, 1999) and in the shaping of landuse regulation (Hilber & Robert-Nicoud, 2013).

The theoretical answer to the problem is regulation, which must ensure that the external effects are reflected in individual behaviour either by means of incentives or binding standards. The practical question, however, is if regulation can realistically overcome this co-ordination problem in light of large enforcement costs and if so, how? Our work shows that in many cases this co-ordination problem can be overcome, however the mechanisms for this are more complex than simple regulation; evolutionary concepts of reciprocity and group selection also play a role in the rectification of the prisoners' dilemma.

What we will demonstrate is that, in the first instance, positive heritage externalities, which create the co-coordination problem, do exist. Controlling for other factors, the price of a property significantly increases the closer it is located to (other) heritage buildings, within and outside CAs. In addition, we show that residents not only value their local environments, considering them to be attractive and distinctive, they also value the planning system as a way of preserving local amenity. Moreover, when residents feel that their neighbour's planning application may damage their enjoyment of this amenity they are more than prepared to become involved in the planning process. We conclude that the policy creates a framework, which residents use – even beyond the mere legal scope of the legislation – to solve a collective decision dilemma, which would otherwise be difficult to escape due to prohibitive cost of bilateral coordination. In so doing, this research offers unique insights into the 'meanings of value' (Lee, 2006) and the value of regulation in conservation areas. In order to illustrate this we combine two primary strands of literature on heritage preservation. The first deals with relative price effects of designation on properties (Ahlfeldt & Manennig, 2010; Coulson, & Lahr, M. 2005; Lazrak, et al 2013) where the second explores the meaning of heritage and its value as a public policy goal (Lowenthal, 1985; Lowenthal, 1996; Townshend & Pendlebury, 1999; Pendlebury, 2009).[1] We then apply a robust approach that combines quantitative econometric techniques with qualitative interview data and show that designation itself does not necessarily come with a net cost to the owner and

[1] The existing literature has also made use of contingent valuation methods to assess the value of heritage (e.g. Alberini & Longo, 2009).

that owners derive value from a multiplicity of factors embedded in the concrete relational economic geographies of place.

This paper proceeds as follows; Section 2 introduces the key components of the prisoners' dilemma and emergent co-operative strategies as well as the practice of preservation policy in England before outlining our methodology for this mixed-methods study. Section 3 explores the quantitative material taken from over 8,000 CAs and over a million property transactions, which help us to establish the abovementioned price effects within and just outside CAs. In Section 4 we utilise our qualitative data of surveys and in-depth interviews with residents and property professionals in nine selected CAs in London to establish the value residents placed on living in a CA and their attitudes and behaviours with regard to planning regulation. The final section concludes offering key insights into cooperative behaviour and planning illustrating the importance of values, reciprocity and group-level selection in overcoming the prisoner's dilemma and fostering neighbourhood co-ordination.

2 Theory, institutional setting, and empirical strategy

2.1 Co-operation and Co-ordination in the Prisoners' Dilemma

Simply put, "the prisoners' dilemma illustrates the tension between private and common interest." (Rand *et al*, 2009: p.272). It has been used as tool to understand co-operation and competition in fields like evolutionary biology and as a rational way of explaining human behaviour in economics and politics. It is also not a new concept for planners. Both Terry Moore (1978) and Richard Klostermann (1985) in separate articles, showed how economic theory, especially where it relates to public goods and issues of co-operation and co-ordination, could offer a convincing justification for the practice of planning.

In its classic form, the prisoners' dilemma relates to two co-conspirators in crime who, once caught, face the difficult choice of co-operation or defection. If both remain silent (co-operation) each will receive a two-year sentence; however, if one defects and confesses and the other remains silent the defector receives a one-year sentence and the co-operator is left with the 'sucker's payoff', a four-year sentence. As both prisoners know the rules of the game ahead of time it creates a situation where the rational choice is to defect and confess since, conditional on any choice of the counterpart, the individual outcome will be superior to the alternative of co-operation. The individually rationale outcome (3 years for both), the Nash equilibrium, howev-

er, is not collectively rationale since it is inferior to the (unstable) situation of mutual co-operation (2 years for both). The following payoff matrix determines their choices.

Tab. 1. Classic Payoff Matrix for the Prisoners' Dilemma

Individual 1 (payoff in bold)		Individual 2	
		Co-operate (remain silent)	Defect (confess)
	Co-operate (Remain Silent)	**2 years in jail** 2 years in jail	**4 years in jail** 1 year in jail
	Defect (Confess)	**1 year in jail** 4 years in jail	**3 years in jail** 3 years in jail

When this scenario is extended to more than two players it is known of as a public goods game (Rand *et al*, 2009). In this incarnation there are common pool resources that are non-rivalrours and non-excludable meaning that the use of the resource by one actor does not preclude its use by another nor is it possible to exclude individuals from using the resource. Given these characteristics, the effect of individual actions on others (externality) is *non-pecuniary* and cannot be traded on (economic) markets, a *market failure*. Any externality will remain unconsidered in a market equilibrium that resembles the Nash equilibrium in the sense that it is individually rationale, but co-operation would be welfare maximizing (collectively rationale). The lack of an economic market corresponds to the physical separation of the actors in the prison's dilemma, which makes the cost of co-ordination prohibitive. An example in planning terms might be the upkeep of residential property, which benefits all residents by increasing property values in the neighbourhood and is therefore non-excludable (Terry, 1978). The prisoners' dilemma here arises from free-riders and is most classically described by Hardin's (1968) *tragedy of the commons* whereby common pool resources are exploited by users who do nothing to maintain them leading to their ultimate destruction.

However, an over-reliance on *homo economicus* as the arbiter of decision-making in human relations has been challenged (see Henrich, *et al,* 2001; Gintis, 2000) and evidence from experimental public goods games would indicate that actual responses tend to rest somewhere between complete defection and complete co-operation (Cressman, *et al*, 2012) and depend greatly on societal norms of behaviour (Henrich *et al*, 2001).

So, why might co-operation emerge in the face of competition? Here, turning to the field of evolutionary biology, we see five mechanisms that drive co-operative behaviour: direct reciprocity, indirect reciprocity, kin selection, group selection, and network reciprocity (Taylor & Nowak, 2007). Of these, direct reciprocity, indirect reciprocity and group selection are most relevant to our work. Briefly, direct reciprocity occurs in two person games where repeated interactions help to shape behaviour. So, for example, in colonies of vampire bats, altruistic food sharing occurs and studies have shown that those bats that have been generous in the past are remembered when they are in need and are more likely to receive assistance (Nowak, 2012). Indirect reciprocity takes this notion further and postulates that my behaviour will depend on how you have behaved to others in the past. In other words indirect reciprocity has a reputational effect and, "…arises out of direct reciprocity in the presence of interested audiences." (Alexander, 1987 cited in Taylor & Nowak, 2007:2284). Group selection contains within it the notion of the *greater good* and is predicated on the understanding that groups of co-operators can out compete groups of defectors.

In addition to understanding the evolutionary mechanisms by which co-ordination may emerge it is also important to discuss what role regulation may play in facilitating co-operation. Here, as stated before, authors like Moore (1978) and Klostermann (1985) have made cogent arguments as to how planning could serve as means to overcome negative market externalities. So too, Voogd (2001) illustrated the importance of government and regulation when applied to the preservation of urban heritage. In each instance the authors argue that planning serves as a framework through which collective good can be understood and protected from individuated interests. By way of example, Voogd (2001) gives us the case of Appingedam, Netherlands, where local shopkeepers wanted to construct awnings over their shops, protecting customers from wind and rain but disrupting building façades and the historic fabric of the street. Whilst the public was "…slightly in favour of this idea" the local council tenaciously stood by historic preservation regulations recognising the amenity value of heritage to the local economy (IBID: p. 81-82).

In fact, looking at the literature on heritage from a real estate perspective we see additional support for historic preservation policies as a means to overcome the prisoners' dilemma (Ahlfeldt & Maennig, 2010). Here the arguments are that, given free market equilibriums, there will be an under provision of heritage conservation as owners will not be compensated for maintaining their properties (Coulson and Leichenko, 2001). In this instance preservation policies, particularly those that apply to entire districts, help to impose regulations like maintenance obligations that ultimately benefit the neighbourhood as a whole (Coulson & Lahr, 2005). There is also evidence that these policies communicate an overall public commitment to the area (Schaeffer & Millerick, 1991), thereby making investors less wary and add a certain prestige to places (Leichenko *et al*, 2001) providing a psychological fillip to homeowners and residents in terms of how they value their properties. What we would now like to illustrate is how co-operative strategies may emerge within the framework of regulation in CAs thus overcoming the prisoners' dilemma as described earlier.

2.2 Conservation area policy and co-operative behaviour

English planning has been the subject of frequent criticism from economists (Cheshire 2013; Barker, 2006) and politicians who claim that, as a restrictive system, it is a brake on the economy and a driver of house price inflation. Here, the argument goes that as any change of landuse requires planning permission, as development rights were nationalised in 1947, supply is unnecessarily restricted driving prices ever upwards. Whilst this paper does not deal with this question, we do look at an area of planning policy, which is even more restrictive than standard planning. Heritage planning, or the ability of the government to restrict property owner's rights without compensation to alter or demolish structures deemed valuable to society, came about by an accretion of policy from the 1882 Ancient Monument's Protection Act to the 1953 Historic Buildings and Monuments Act, which set up the current system. As noted by Pendlebury (2009:1) one of the striking features of conservation policy is how accepted it has become.

Whist the 1953 Act covered single buildings deemed to have heritage value, it was not until the passage of the 1967 Civic Amenities Act that areas could be statutorily described, as having "…special architectural or historic interest, the character or appearance of which is desirable to preserve or enhance." (1967 Act, Section 1). As such, conservation areas represent England's attempt to protect not simply individual buildings of historic importance but also groups of buildings, streetscapes, trees and open spaces that form significant sites of local character. They

came into being in a time punctuated by slum clearance and comprehensive redevelopment, which many have agreed helped to spur the development of the legislation (Townshend & Pendlebury, 1999). Since 1967, some 9,800 areas have been designated in England, making the policy a significant aspect of local planning.

Unlike many historic districts in North America, owners of properties in CAs typically receive no special grants or assistance for the upkeep and maintenance of their properties. CAs are created at the local level and are designated by local planning authorities (LPAs) employing local or regional criteria. These criteria therefore vary across the country, allowing the 'value' attached to heritage to be culturally inflected (Pendlebury, 2009) highlighting the complexity of value so aptly described by Lee (2006). In practice this means that CAs can range from masterplanned communities like Hampstead Garden Suburb to open spaces like Richmond Park to attractive areas of suburbia to modernist housing estates. Each of these very different, locally defined places are then afforded protection under national planning legislation and advice issued by central government, thus reflecting the wider interests of society.

Once an area has been designated, alterations to individual properties require 'Conservation Area Consent' (CAC) thus limiting what owners may do with their properties. It is a criminal offence to totally or substantially demolish any building within a CA without first seeking consent from the LPA. In cases where alterations to the property require planning permission, owners are also required to apply for CAC and applications are determined based on the enhancement and protection of the area. The LPA must be given notice if work is proposed on any tree with a trunk larger than 75mm; the LPA then has six weeks to determine if a Tree Preservation Order should be applied. Under the Town and Country Planning (General Permitted Development Order) 1995 (revised 2012), householders are allowed to make certain small alterations to their buildings without the need for planning permission. However, these alterations may be construed as detrimental to the fabric of CAs and are therefore partially or wholly restricted. Householders therefore must apply for permission to install certain types of cladding, roof extensions and side and rear extensions of more than one storey and satellite dishes and antennae that are visible from the highway. In addition to this, the GPDO gives LPA and the Secretary of State the right to further withdraw permitted development rights under Article 4 directives. In these cases, LPA are able to require permission to be sought for alterations like, building a porch, removing a chimney or replacing windows and exterior doors. As of 2009

some 13% of CAs in England were under the added protection of Article 4 directives (English Heritage, 2009).

2.3 Empirical strategy

In order to illustrate how we believe certain CAs are overcoming the co-ordination problem set-up by the prisoners' dilemma we make four core arguments. In the first instance we must establish that there is a pay-off to co-operation. Here we will present evidence from our quantitative study, which has established that prices increase in the density of heritage embedded in CAs. We argue that these effects reflect a non-market (heritage) externality, which can motivate a regulation that seeks to correct individually rational but collectively irrational behaviour by setting binding legal rules and standards. Such a regulation, however, is obviously difficult to enforce in practice due to the cost of monitoring so that effectiveness and efficiency of the policy depend on the understanding and participation of residents. We will therefore argue next, that in order for the dilemma to be overcome, residents must be generally aware that a price effect exists and they must attach some sort of value to their neighbourhoods. Our third point is that for this regulation to be effective, residents must be confident in using it to help enforce CA policy. Finally, we will argue that for the regulation to not simply be about tit-for-tat exchange people should have generally positive attitudes toward the system.

It is notoriously hard to unpick policy effects using solely quantitative or qualitative means. We therefore employ a mixed methods approach, which has allowed us to unite both socially-critical and spatially-analytical forms of analysis (Sui & DeLyser, 2012). In Section 3.1 we we will present a spatial hedonic analysis of some 1,088,446-property transactions that took place between 1995-2010. Through this analysis we were able to determine the degree to which heritage externalities increase property values within or near to 8167 CAs.For the qualitative section of our research we sought to better understand the softer impacts of conservation policy and the lived experience of residents. The analysis presented in Section 3.2 entailed 111 interviews and surveys with residents in nine representative CAs in London and in-depth interviews with conservation officers in each of the selected areas.

3 Property price analysis

3.1 Methodology

Our quantitative analysis started from the conventional assumption in spatial economics that property prices reflect all the costs and benefits owners derive from the location of their property. The overall net-benefits to owners of properties in CAs can be distinguished into *heritage* and *policy* effects. Benefits include the pleasure of living in a building with certain historic and aesthetic features (*internal heritage effect*) or near to buildings with similar characteristics (*external heritage effect*). In addition, the legal status of designation brings the benefit of reduced uncertainty regarding the future of the neighbourhood and the cost of increased planning control, i.e. development restrictions and maintenance obligations (*policy effect*). Since we were interested primarily in the non-market heritage externality we focused on comparing how prices changed at different distances from a CA boundary, both internally and externally. The rationale for such an analysis is that we assume the *internal heritage effect* and the *policy effect* to exist inside CAs alone and to be constant within a given CA. The *external heritage effect* can then be concluded from spatial variation in prices within and outside CAs assuming that the strengths of the heritage externality must be lower at locations further away from a CA (larger external distance) and higher at locations closer to the centre of a CA (larger internal distance).

Our empirical specification builds on the seminal work by Rosen (1974) and a long tradition of hedonic property price analyses. In this literature, the price of the composite good housing is typically expressed as a function of various internal and locational attributes and their implicit prices that can be estimated using multivariate statistical methods.

$$\log(P_{it}) = \alpha + \sum_u \beta_u ID_{uit} + \sum_v \beta_v ED_{vit} + \sum_j \gamma_j S_{ij} + \sum_k \gamma_k L_{ik} + \sum_l \gamma_l N_{il} + \sum_r \sum_t \varphi_{rt} R_{ir} \times T_{it} + \varepsilon_{it}$$

where P_{it} is the price per square metre of floor space of a property i that sells at time t. S_j, L_k, N_l are structural property, location and neighbourhood characteristics. ε_{it} is a random error term and all other Greek letters represent the hedonic implicit prices to be estimated. R_r stands for a set 7,737 fixed effects capturing location characteristics that are common to properties that share the same nearest conservation area. T_t are a set of time fixed effect capturing unobserved shocks in each of the 16 years covered by the analysis. The resulting 123,792 time-location ($R_{ir} \times T_{it}$) effects ensure that we identify the effect associated with a property's location relative

to the nearest conservation areas controlling for all unobservable factors that are common to any CA neighbourhood in a given year. These neighbourhoods are small as we restrict the sample of observations to 2km surrounding any of the conservation areas.

To assess how property prices, on average, depend on the location of a property relative to the nearest CA we compute the distance to the nearest CA boundary for each of the transactions in the sample in GIS. We then define impact areas inside and outside conservation areas in the form of mutually exclusive 50m buffers in either direction from the boundary. For the interior, we define nine 50m buffer rings (ID_u) up to a distance of 450m and one residual buffer covering all properties that are located inside a conservation area, and more than 450m away from the boundary. This relatively large innermost buffer is defined in response to a relatively small number of transactions in this area. For the exterior, we define 39 50m buffer rings (ED_v) up to a distance of 1950m to allow for one residual category within the 2km conservation area fixed effects described above. The parameters of interest are β_u and β_v, each of which represents the average difference between the sales prices within a distance ring relative to the outermost (1950-2000m) ring across all neighbourhoods. These price differences (log terms) are adjusted for observable property and location effects and unobservable effects that are common to any neighbourhood in any year.

We note that we control for whether a CA by the time of the transaction of a property was designated or not. The effect on the spatial property price trend is virtually zero, which is in line with previous evidence suggesting that the characteristics associated with conservation areas impact on the sales price, the designation status itself is not a significant determinant (Koster, Van Ommeren, & Rietveld, 2012).

3.2 Data

The property data utilised in the analysis were provided by the Nationwide Building Society, one of the large mortgage providers in England with a market share of about 10%. The data set contains the selling price and date of properties sold between 1995 and 2010 in England along with a range of property characteristics such as floor space (m^2), the type of property (detached, semi-detached, flat, bungalow or terraced), the date of construction, the number of bedrooms and bathrooms, garage or parking facilities and the type of heating. The data also come with the full postcode as a detailed georeference, which allows for geocoding in GIS. Previous applications of the data in academic research include e.g. Ahlfeldt (2013)and Gibbons & Machin (2005).

More details on the transactions data and the comprehensive set of locational and neighbourhood control data, including the various data sources, is provided in the appendix.

For the empirical analysis we merge the 1,088,446 property transactions provided by Nationwide to 8167 conservation areas in GIS. English Heritage provided the exact boundaries of the CA in form of an electronic map (shapefile). In the econometric analysis we utilise 830,055 transactions, which are within 2km of 7,737 CAs. The remaining transactions and CAs remain unconsidered in the analysis.

3.3. Results

In Figure 1, we plot the estimated $\hat{\beta}_u$ and $\hat{\beta}_v$ coefficient estimates jointly with the 95 per cent confidence intervals.[2] Our results reveal that prices decline as one moves towards the conservation area boundary from the inside of the area and as one moves away from the boundary outside the area. The conservation area premium at the boundary (0-50m) of 9.5 per cent roughly doubles once the innermost zone is reached (inside the CA, but more than 450m from the boundary). This increase in value is in line with a positive external heritage effect as heritage density increases as one approaches the centre of the CA. Just outside the conservation area (0-50m) there is still a significant premium of close to 5per cent. This external premium declines in distance and becomes virtually zero at about 700m and statistically indistinguishable from zero at about 500m. Again, this spatial trend is in line with a positive external heritage effect, as the benefit of being close to a CA should be associated with both its relative visibility and 'visitability' from the effected property. This spatial scope of the effect is very similar to the evidence provided by Ahlfeldt and Maennig (2010), who detect heritage externalities within a range of about 600m, though in a different institutional context (Berlin, Germany).

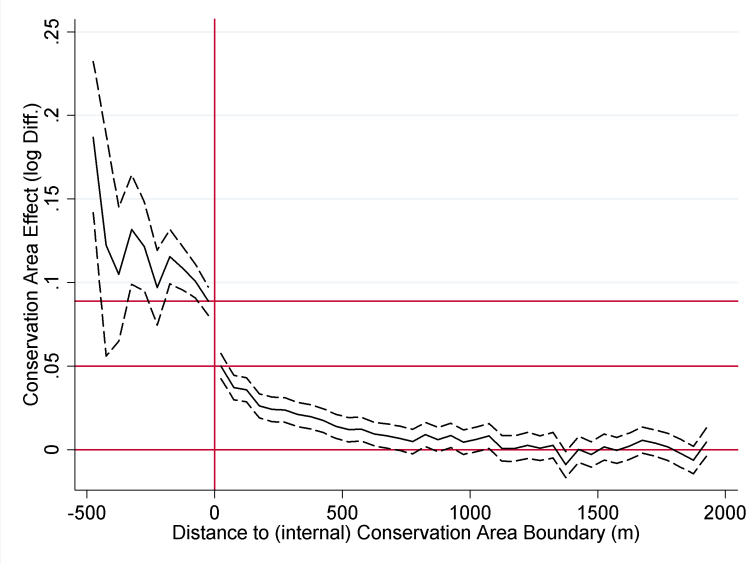
Another interesting feature of Figure 1 is the relatively steep decline in prices per square metre as one moves from the inner 0-50m ring to the outer 0-50m ring (about 5%). These results are in line with Koster, Van Ommeren, & Rietveld (2012) who found a similar discontinuity at conservation area boundaries in the Netherlands. Several (non-exclusive) explanations may account for this pattern. Firstly, the external heritage effect will decline abruptly as one moves out

[2] The effects measured in log-differences can be interpreted approximately in percentage terms. The exact percentage premium can be computed according to the standard formula (Halvorsen & Palmquist, 1980).

of the conservation area if a significant proportion is attributable to an aesthetic utility and the visibility of historic properties, which in most settings is limited to a very local area, e.g. due to narrow streets and frequent corners. Secondly, there could be an internal heritage effect, which determines the boundary of the conservation area, and directly capitalises into the price of buildings with such characteristics. Thirdly, there may be other benefits such as a specific place identity and a particular community involvement from which residents receive a utility and which are exclusive to the area inside the conservation area boundary.

While the discontinuity at the boundary can be attributed to either an *internal heritage effect*, or an *external heritage effect* or a *policy effect,* we interpret the evident spatial trends within and near to the CA boundaries as strong evidence of a positive *external heritage effect*. Moreover, the relatively large and positive discontinuity at the boundary indicates that the potentially negative policy effects associated with a location in a conservation area on property values, if at all present, are relatively small compared to the (internal and external) heritage benefits.

Fig. 1. Internal and external CA effects



Notes: Black solid (dashed) lines shows point estimates (95% CI). Positive (negative) distances denote internal (external) distance from the CA border.

4 Survey analysis

4.1 CA selection

Our qualitative analysis builds on 111 in-depth residential interviews conducted in the nine CA according as described in Table 2.

Tab. 2. Qualitative Case Study Selection

Step 1	Step 2	Step 3	Step 4
Inner London	High Premium	High Deprivation	De Beauvoir (Hackney)
		Low Deprivation	Ladbroke (RBKC)
	Low Premium	High Deprivation	St Marks (Hackney)
		Low Deprivation	Courtfields (RBKC)
Outer London	High Premium	High Deprivation	Brentham Gardens (Ealing)
		Low Deprivation	Sheen Road (Richmond)
	Low Premium	High Deprivation	Bowes Park (Haringey)
		Low Deprivation	St Matthias (Richmond)
Outside London	Low Premium	X	Overcliffe (Gravesham)

Our CA selection model, reflected in the table above, was guided by the quantitative data and is predicated on property price premia, which we estimate as the difference in average property prices just inside and outside around CA boundaries.[3] We chose CAs, which we describe in more detail below, with high and low price premia located in inner and outer London. In addition, we used the 2007 Indices of Multiple Deprivation to select areas that were considered to be at the higher and lower ends of the deprivation scale. One area was also selected outside of London to add richness to the data.

De Beauvoir CA is located in the London Borough of Hackney and was designated in 1971 and further extended in 1977 and 1998. It is notable as the first large-scale, planned housing development in Hackney and its formal street patterns, consistent architectural style and layout are in stark contrast to the relative informality and irregularity of the rest of the borough. The area suffered considerable decline from the 1930s and by the 1950s Hackney's wholesale redevelopment plan threatened the area with demolition. However, with the publication of the Civic Amenities Act in 1967 and considerable action from an active local residents association the area was preserved. De Beauvoir also experiences similar pressures to many inner London neighbourhoods with high housing costs, wealth disparities and pressure to find sites for higher density development.

The Ladbroke Estate is located in the Royal Borough of Kensington and Chelsea and was designated as a CA in 1969 making it one the first in the borough. It was developed in the 19th Century and is situated in the now fashionable Notting Hill. Like De Beauvoir, the Ladbroke Estate

[3] We compare prices within 1km area inside and outside conservation areas and only consider those conservation areas with at least five transactions each of the to two areas (inside/outside). We adjust prices for local time trends. See the notes in Figure 5 for additional detail.

also suffered from dilapidation and property subdivision after the war. However, unlike De Beauvoir the area has experienced a significant rise in property values, driven at least in part by substantial interest from wealthy foreign investors looking for property in London. This has led to a diminution of "traditional" residents, a comment made to us frequently in our surveys. In addition to this 'loss of the typical resident', Ladbroke is also faced with other unique development pressures brought by an influx of capital and tight planning regulations, which limit how homes can be expanded. Chief amongst these concerns is the rise in the number of subterranean extensions in the area. The general features to consider in Ladbroke are its relative architectural integrity; its history as an outstanding and longstanding CA in the borough; its location relative to central London; its fashionable position as a part of Notting Hill; and internal development pressure to add value to homes.

St Mark's CA like De Beauvoir it is located in the London Borough of Hackney. In 2007 a CA appraisal was completed for the area laying out its history, its local value and its strengths and weakness. St Mark's is noted as an enclave of fairly well preserved middle class Victorian speculative development, which was laid out and built in the mid-1860s. Interestingly, as this development was speculative it does not have the 'planned' aspects that some of our other CAs possess. St Mark's has the advantage of having many listed buildings and Buildings of Townscape Merit along with several surviving front gardens in the Victorian houses, numerous street trees and green spaces, especially those around St Mark's church, all of which add to its residential character and help to create a sense of local coherence. However, it is situated near a very busy road; litter is a problem; there is a lack of public open space; some areas and houses appear neglected and there has been some loss of architectural character (especially windows and doors) (Hackney, 2008, pp. 38-39).

Courtfields CA is located in the Royal Borough of Kensington and Chelsea and bounded by several major roads was designated in a piecemeal fashion beginning in 1971 and culminating in a final extension in 1985, which expanded it to what is seen to-day. Courtfields contains a mixture of properties from the 1870s many of which are 2-3 storey terraces and paired villas with stucco; later properties from the 1890-1900s are typically brick in a reaction against the earlier Italianate properties of the 1870s; and there are some mews developments, which have been converted to residential use. There are also a number of notable private garden squares in the CA. In the period following the First World War up until the mid-1980s many of the homes were converted to multiple occupancy and some buildings were converted to hotel use as fami-

lies could no longer afford to occupy entire structures (RBKC, 1985, p. 2). Current features to consider in Courtfields are pressures caused by hotel developments and traffic.

Located in the London Borough of Ealing, Brentham Gardens was designated as a CA in 1969. It was developed in the early 20th century based on the principles of the Garden City movement and follows the designs of Raymond Unwin and Barry Parker, the architects of Letchworth Garden City and Hampstead Garden Suburb (Ealing Council, 2008, p. 4). It was founded with social aims in mind and was a leader in the co-partnership suburb movement. There are roughly 650 cottages and houses on the estate along with recreational facilities and allotments; the street pattern is curvilinear in contrast to the surrounding rectilinear streets and terrace housing. This and many cottage style properties give Brentham Gardens a village like quality. The primary factors influencing the area are its overall coherence as a planned development; its active amenity society and pressure from homeowners to extend and alter their properties not considered suitable for modern life.

The Sheen Road CA is located in the London Borough of Richmond and was designated in 1977. It forms part of the linear development that links Richmond with East Sheen. Its buildings date from the 18th century to the late 19th century and, as a busy urban road, it is characterised by mixed use from small businesses to residential. Notably the road contains two mid-19th century almshouses - the Hickeys and Houblons both of which have a courtyard style. Residential properties in the area tend to be set within gardens with mature trees. There are also rows of large terraced houses to the north of Sheen Road. The primary issues for Sheen Road have come from unsympathetic alterations causing the loss of traditional architectural features; loss of front gardens to parking; lack of coordinated and poor quality street furniture and paving; traffic domination and a poor cluttered pedestrian environment; and the loss of original shopfronts (Richmond Borough Council, undated-a, p. 1).

Bowes Park CA is located in the London Borough of Haringey, although part of the Bowes Park development is also in the London Borough of Enfield. It was designated a CA in 1994 and development is primarily of a Victorian suburban character with a variety of early Victorian housing, including semi-detached villas and small and large terraced houses. Many of the older houses are in yellow brick. Newer homes are often in soft red brick of the Queen Anne Revival. Bowes Park also has one of the best preserved Victorian shopping areas in the Borough in the form of the Myddleton Road, which, according to the Supplementary Planning Guidance (SPG),

has been described by local people as "...a jewel in decline (Haringey Council, 1999, p. 2). Since the publication of the SPG the road has gone through further decline with a loss of some of the traditional shops like the bakeries and butchers. In addition, few of the original shopfronts remain unaltered. Current features to consider in this area are overall levels of deprivation and pressures from home and business owners wishing to alter their properties.

St Matthias CA was designated in 1977; the area's focal point is St Matthias' Church, which was consecrated in 1856 during the period when the South Western Railway was extended to Richmond. The extension of the railway brought with it development. Here this was in the form of primarily high-class villas on the slopes of the hill leading up to the church. In terms of architectural style, St Matthias has a mix of mid and late Victorian buildings ranging from large detached villas to terraced mews. The townscape is considered to be of high quality (Richmond Borough Council, Undated-b, p. 1) with a variety of building styles and architectural details along with front gardens forming a cohesive residential mix. St Matthias is also located near to the river Thames, the Terrace Gardens and Richmond Park, offering a number of nearby amenities to residents. The council notes in their CA appraisal that development pressure, which could damage this landscape setting via the obstruction of views, skylines and landmarks to be of concern along with the loss of architectural features, loss of front gardens for parking, and a domination of traffic (Richmond Borough Council, Undated-b, p. 2).

Overcliffe was selected as an exemplar of a CA outside of London. Overcliffe is part of the early 19th century Rosherville New Town development in Northfleet and was developed in the mid-19th century. The area is a mixture of villas and terraced houses, some of which have views northward toward the river Thames. The area is valued for the survival of its historic layout, its historic buildings and its location on top of the chalk cliffs (Gravesham Borough Council, 2009, p. 1). There are a number of features that impact on the area, including high traffic volumes along some of the roads; poor quality modern buildings both inside and just outside the CA; loss of architectural features; graffiti; and the dominance of parked cars in the area.

4.2 Valuing neighbourhoods

The external heritage effect, a non-market externality, sets the stage for the prisoners' dilemma. In order for co-operation to emerge, residents must have an awareness of the added value of the characteristics of their neighbourhood and correspondingly the value preservation brings to their properties. We argue that ideally they should also 'value' the characteristics that make

their area distinctive to embed these into local place-based narratives, which will help to underpin culturally reproductive strategies with respect to co-operative behaviour (Taylor & Nowak, 2007). To appropriate the regulation as a tool that reduces the transaction cost of coordination, residents must also understand and support the policy. To better explain these factors, we will present evidence taken from the surveys and interviews that were conducted in our nine CAs.

In the first instance, residents were asked if they would describe their neighbourhoods as distinctive on a five-point scale where 1 was very distinctive and 5 was not distinctive at all. As can be seen in fig. 2 the majority (apx 70%) of respondents viewed their neighbourhood as either very distinctive or distinctive, indicating that there was a general understanding amongst residents that the area was special in some way. We also gave those surveyed the opportunity to compare their neighbourhood to neighbouring districts. Here they were asked to describe the physical attractiveness their area, again on a five-point scale. Fig. 3 shows that just over 60% of residents believed that their neighbourhood was either much more or more attractive relative to other nearby districts again indicating that residents viewed their areas as somehow unique.

Fig. 2. Area distinctiveness

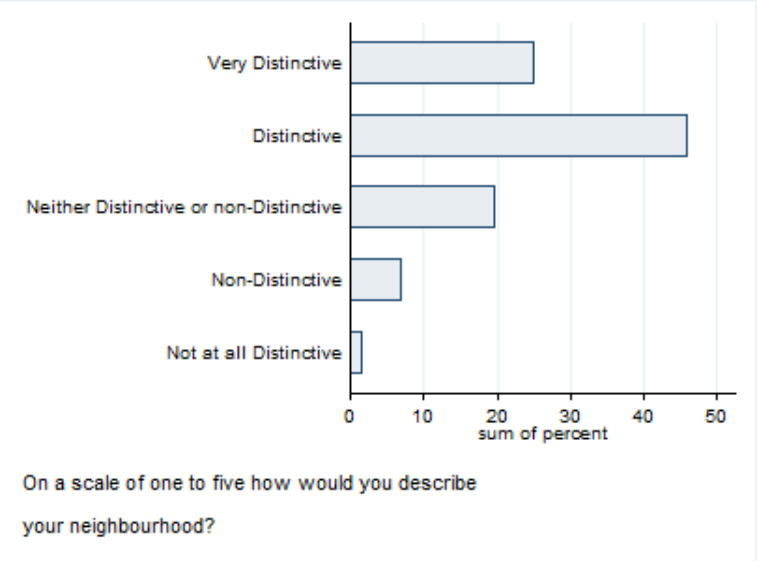
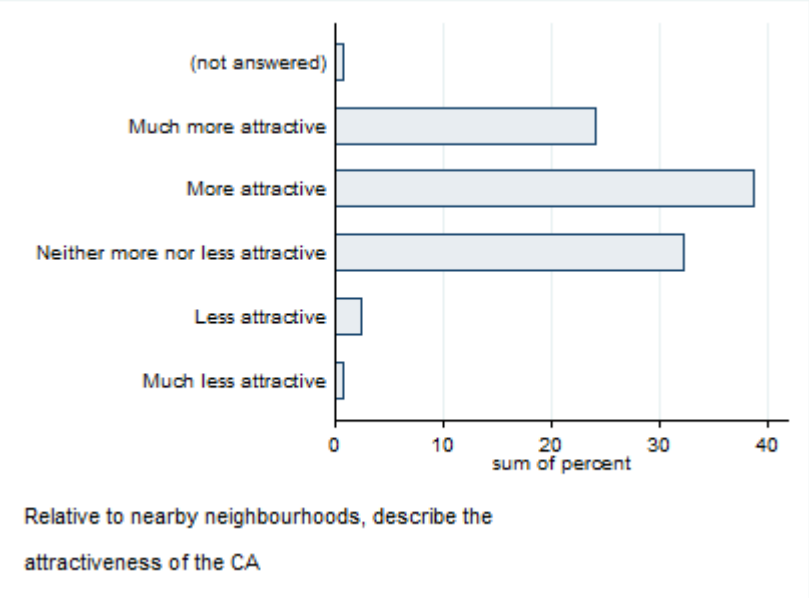


Fig. 3. Area attractiveness



Next, residents were asked to rank how expensive they perceived their area was relative to the surrounding areas. More than 75% ranked their area as expensive or very expensive (see fig 4). Based on the answers we created an index of relative affordability by CA and compared the results to the price premium we estimated based on transactions in and around the respective CAs (see Fig. 5). The evidence suggests that with the exception of Courtfields, owners were well aware of local "value" in their area. In another question we asked, more than 80% of those who responded reported that being in a CA had an impact on the value of their property.

Fig. 4. Relative affordability

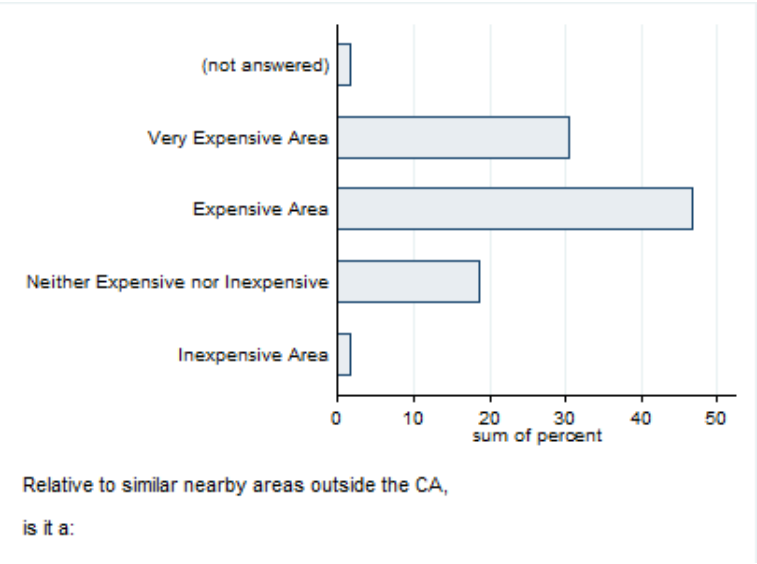
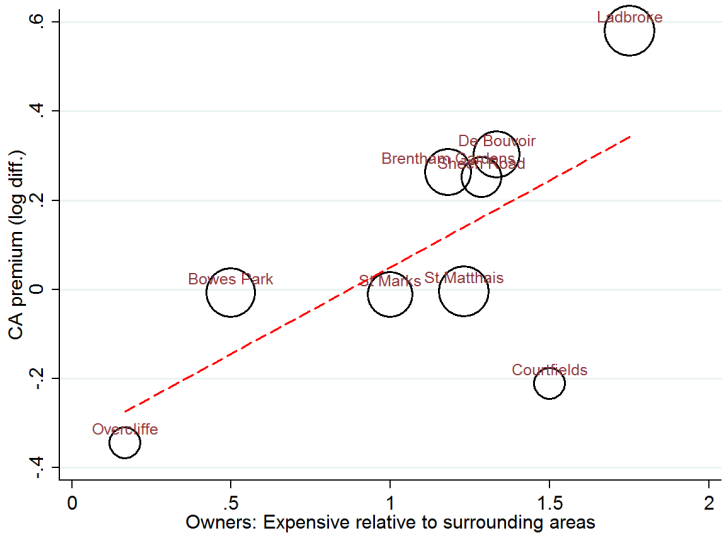


Fig. 5. Effective and self-reported (relative) price level



Notes: Owner's rating is on a -2 to +2 scale. CA premia is the $\hat{\beta}_n$ coefficient recovered from separate regression for each CA n of the following type: $\log(P_{itn}) = \alpha_n + \beta_{nj} CAD_{nij} + \xi_{nj} YEAR_t + \varepsilon_{nij}$, where CAD is a 0,1 indicated for whether a transaction takes place within CA n, and $YEAR$ refers to the year of transaction. Each regression considers transaction that occurred within 1km of the CA boundary (inside or outside)

Whilst the survey data gives us a gross understanding that residents believed their areas to be attractive and distinctive and that this belief was correlated with price premia, it does not give us a qualitative picture of what residents valued. To do this, our researchers asked residents a series of open-ended questions designed to give us a better understanding about how residents viewed their neighbourhoods.

When asked what they liked best about living their area, residents spoke extensively about the quality of the buildings, green spaces and neighbours. For our purposes, we will look specifically at the responses that were directed towards the built environment to help better elucidate the findings from our survey. Our case studies residents commented on aspects of the built form. Narratives developed included discussions around heritage and historic architecture, estate layout and overall building maintenance in eight[4] of the areas that we studied. This indicates that residents were considering aspects of the built environment to be integral to their enjoyment and understanding of their neighbourhoods, which matches well with our survey data.

However, whilst our neighbourhoods engaged with built environment narratives, residents of our high deprivation/ high premium cases were far more likely to make very specific comments on heritage and architectural style. This is perhaps because both Brentham Gardens and De Beauvoir were originally planned estates with a high degree of architectural integrity. However, the comments made by these inhabitants are a testament to the level of passion they had for their homes. In Brentham Gardens the area was noted for its village and cottagy feel with one resident remarking that they loved the "…arts and craft movement feel about the place with all of its quirkiness and unexpected nooks and crannies.". In De Beauvoir residents too described it as a village and noted that the Victorian houses felt "typically English with a good sense of heritage" reflecting Lowenthal's (1985, 1996) notions of the cultural values of heritage.

4.3 Residents and regulation

Having established the value residents place on living in what they view as attractive and distinctive areas we will now turn to the third part of our puzzle: the manner in which regulation is used to enforce CA policy. Here we will see how a form of reciprocity is produced amongst residents and how CA policy acts as a framework for building up co-ordination and co-operation.

If CA policy is to be effective in overcoming the prisoners' dilemma, residents need to feel confident in using the tools made available to them. One of the most important mechanisms for this is the right of objection to requests to alter properties within the CA. It would be surmised that in order to be

[4] Our ninth area, Overcliffe, only commented on the built environment once. Here the Victorian architecture was mentioned as old and beautiful but in need of restoration. These comments fit well with the distinctiveness and attractiveness scores given to the area by residents as well as the relative price measures in fig. 4, all of which were at the low end of the spectrum.

effective, residents must be aware of the right to object and must be able to use this when they feel necessary. In our sample, just over 40% of residents surveyed said that they had objected to a neighbour's request for planning permission and this 40% remained constant when the areas were subdivided into high/low premium and high/low deprivation.

In itself this is a striking finding, indicating that residents were more than willing to make formal objections when they believed that applications were inappropriate. If we delve into this further through the interview data we uncover the attitudes driving this behaviour. In our high premium areas three factors emerged as significant when objections were made. The first, and perhaps the most expected, is that residents object when they feel directly threatened by change. Here being overlooked, the loss of sunlight or the disruption of a cherished view were the reasons most often mentioned for lodging an objection and relate perhaps most strongly with the private enjoyment of personal property rather than to any heritage or aesthetic quality the neighbourhood might have. However, these are also features that impact on how owners value their homes and how they may interact with their properties.

The second feature is of more interest to us and included the role of amenity societies (groups dedicated to maintaining and enhancing the area's heritage) and general neighbourhood pressure when residents made objections. For example, in Brentham Gardens several respondents mentioned the existence of the Brentham Society and noted that they were frequently responsible for helping to organise objections to planning permissions they saw as inappropriate. In Ladbroke interview data suggested the vital role citizens played in reporting development that did not meet CAC requirements commenting that, "Whilst the council is there to intervene in these matters, it is up to us as residents to report any breaches.". The same pattern held true for De Beauvoir, where conservation officers noted that the local amenity society and to a large extent the residents were their "eyes and ears" on the ground and were instrumental in mounting challenges to inappropriate development. This "eyes and ears" function is vitally important, as English planning enforcement can be typified as being reactive and responsive rather than systematic and all encompassing, with a great deal of enforcement reliant upon the general public's reporting of breaches (Harris, 2013).

In Ladbroke an even more interesting pattern emerged with neighbours discussing the pressure they felt about altering the area. One homeowner told the story of a neighbour who had been given permission to alter the roofline of her property but that neighbours felt that this would negatively impact the skyline near the garden square. She stated, "…there was such pressure in the neighbourhood that despite the approval the person did not go ahead with the build.". Similarly the conservation officer

in Richmond, where Sheen Road was our high premia CA, reported that frequently residents felt pressure to replace old wooden sash windows with new wooden sash windows rather than the cheaper uPVC type despite local regulation not requiring this. Here she noted that residents typically mimicked the behaviour of their neighbours. In each instance we see what Taylor and Nowak (2007) might refer to as cultural reproduction, a form of indirect reciprocity, where individuals are imitated by others and thereby the strategies they adopt are then reproduced. These strategies are vital to the production of a culture that supports the integrity of the CA and helps to create co-operation amongst residents.

Finally residents in high premium areas did raise objections that were solely based on maintaining the character and the heritage of the area indicating that heritage narratives were embedded in these CAs. This included objections to changes in the style or form of properties and to the removal of significant trees from the landscape. Planning officers for these areas independently corroborated this noting that residents in these CAs had a "heightened awareness of conservation" and were intent on "keeping the character of the area and stopping detrimental development.". In our low premium areas, whilst the propensity to object was as high, the reasoning behind objections was less well developed and articulated.

4.4 Attitudes about planning

Finally for the system to be successful there needs to be more than a simple willingness to object, there also needs to be a recognition that the system is generally functioning and is fit for purpose. There also needs to be a recognition that the costs placed on homeowners in CAs are outweighed by the benefits they receive in added property value and amenity value. In order to understand these attitudes we asked respondents a series of questions designed to better understand their attitudes toward planning constraints. We have divided our responses by tenure as it might be expected that renters, who in theory bare no costs from planning constraints would be more positive about them than would homeowners. We also divided our responses by those who had and had not previously applied for planning permission. As can be seen in fig. 6 and 7 not only do homeowners not see constraints as any particular problem they also agree that the planning system is the best way for maintaining the attractiveness of the area. When these figures are then broken down into those respondents who had applied for planning permission we see that residents who previously applied for permission feel even more positively about the system than those who did not.

Fig. 6. Constraints on property owners

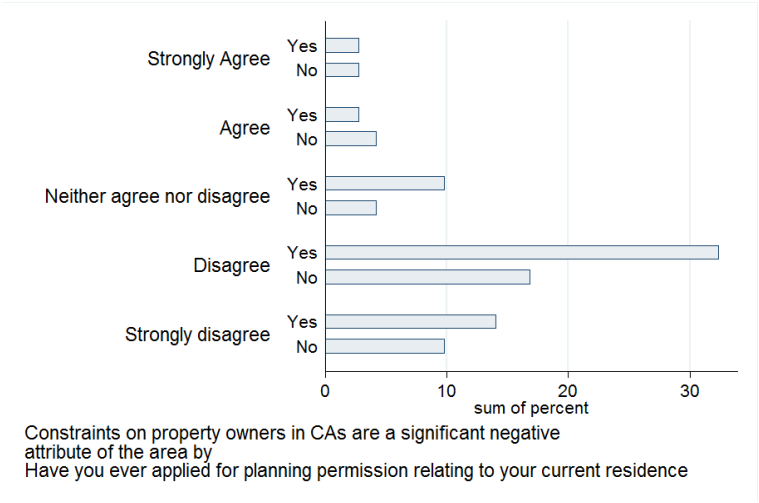
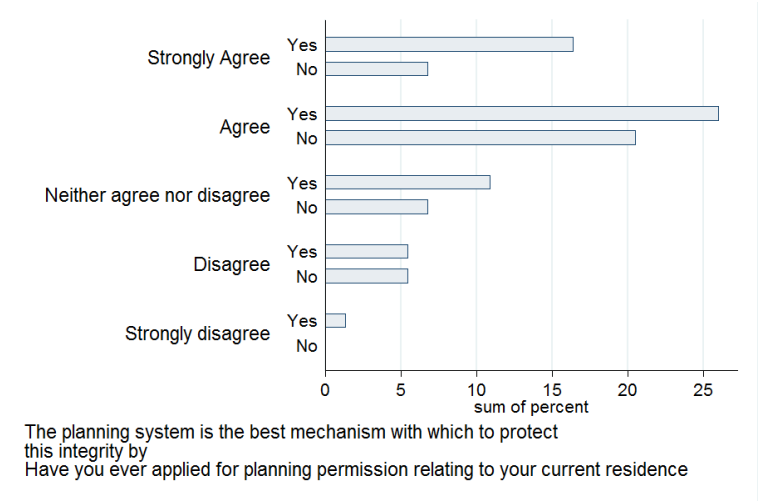


Fig. 7. The planning system and protection



Looking at the textual data we see several instances where, even when planning permission has been denied to an owner they remark on the overall reasonableness of the decision. As noted by one resident, "So, it was a decision that went against us as individuals, but I thought that it was probably correct in a more overall perspective.". These comments were further strengthened by a homeowner who reflected that the local council put in a great deal of effort and resources to help preserve local heritage, which in her words helped residents have "an overall mind-set towards heritage". Again we see how group level selection (Taylor & Nowak, 2007) and an ethos of greater good can be produced through regulation and education provided by local planning officers.

5 Escaping the dilemma?

Literature on valuing built heritage often approaches the question from either the point of view of the financial impact designation has on property (Zahirovic-Herbert & Chatterjee, 2012, Ahlfeldt & Maennig, 2010; Diaz *et al,* 2008, Leichenko *et al*, 2001, Koster, Van Ommeren, & Rietveld, 2012) or as a window into meanings of heritage and its value as a public policy goal (Lowenthal, 1985; Lowenthal, 1996; Townshend & Pendlebury, 1999; Pendlebury, 2009). These more binary approaches obscure deeper understandings of the multiple values practiced in ordinary economic geographies. In our paper we have sought to redress this by combining both quantitative econometric models of property price analysis with qualitative perceptions into local derivations and understanding of value. In so doing, the paper offers unique insights into conservation planning and the production of cooperative behaviour.

So then specifically, what can this study tell us about planning for heritage conservation and more importantly what broader lessons can planners take away to use in practice? In the first instance, it is clear that heritage externalities do exist in CA and that these can motivate regulation that endeavours to correct individually rational but collectively destructive behaviour through the establishment of legal rules and standards. As we have shown, the policy creates a framework in which residents are able to act in order to co-ordinate their behaviour in a more favourable way. We have also shown, through the concepts of reciprocity and group level selection that residents can and do go beyond the mere legal scope of the regulation in both spirit and practice. They have faith in the planning system to preserve heritage, even when this conflicts with their own personal interests, and they at times choose not to act in a way that could be considered detrimental to local heritage values even when these actions would be allowed within the scope of regulation. The role planners play in helping to create local heritage narratives through awareness raising and education was seen as important by residents.

Moving beyond heritage, we feel that this work can be applied to other forms of the prisoners' dilemma where common pool resources are at stake. The core lesson to be learned is that whilst regulation can provide a framework for co-ordination, there must be other factors that help drive co-operation. Our work would indicate that the building up of narratives and values around the non-market based externality is vital if the prisoners' dilemma is to be escaped.

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Data appendix to: No escape? The co-ordination problem in heritage preservation[*]

To rigorously analyse the effect conservation areas have on value with the methods described above, we have compiled a unique data set. This combines data on sales prices and property characteristics provided by the Nationwide Building Society, detailed information on location characteristics collected from various sources as well as a comprehensive digital map of conservation areas in England accompanied by a detailed survey, both of which have been provided by English Heritage. Merging these data sets within a GIS environment sets the base for the comparison between sales prices of buildings inside and outside conservation areas.

Housing transactions

The transactions data relates to mortgages for properties granted by the Nationwide Building Society (NBS) between 1995 and 2010. The data for England comprise 1,088,446 observations and include the price paid for individual housing units along with detailed property characteristics. These characteristics include floor space (m^2), the type of property (detached, semi-detached, flat, bungalow or terraced), the date of construction, the number of bedrooms and

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[*] The results presented in this article partially overlap with a report commissioned by English Heritage (Ahlfeldt, Holman, & Wendland, 2012). The support by English Heritage in terms of funding of the report and the continuous data provision is gratefully acknowledged. The arguments developed and the views presented in this article are those of the authors, which are independent of the position English Heritage may take. We also acknowledge financial support by the Suntory and Toyota International Centres for Economics and Related Disciplines (STICED). We thank seminar and conference participants in London (SERC), Bratislava (ERSA), Halle (IWH) and Reading and especially Tommaso Gabrieli, Steve Gibbons, Henry Overman, Gianluca Marcato, Kristoffer Möller, Jens Südekum, Sevrin Waights and Nicolai Wendland for helpful comments and suggestions on related work. We also thank John Davis from English Heritage for helpful comments on work done at an earlier stage of this project. The usual disclaimer applies.

bathrooms, garage or parking facilities and the type of heating. There is also some buyer information including the type of mortgage (freehold or leasehold) and whether they are a first-time buyer.

Importantly, the transaction data includes the full UK postcode of the property sold allowing it to be assigned to grid-reference coordinates. With this information it is possible within a Geographical Information Systems (GIS) environment to calculate distances to conservation area borders and to determine whether the property lies inside or outside of these borders. Furthermore it is possible to calculate distances and other spatial measures (e.g. densities) for the amenities and environmental characteristics that will be used as control variables. Since the data set refers to postcodes rather than individual properties, it is not possible, however, to analyse repeated sales of the same property. This is a limitation shared with most property transaction data sets available in the England, including the land registry data.

Conservation areas

The GIS data on the English Heritage sites include the precise geographical definition of 8,167 conservation areas (CAs). In addition there is information on the date of designation, the type of CA (urban, suburban or rural), the land use (residential, mixed, commercial or industrial), and Article 4 status.[1] The data set furthermore contains information about areas that received the status of world heritage sites in England.[1] Evidence of community support and risk status comes from the Conservation Areas Survey and is provided by English Heritage.

Neighbourhood characteristics

The main variables on neighbourhood characteristics are median income and ethnic composition. The income data is a model-based estimate of median household income produced by Experian for Super Output Areas of the lower level (LSOA). This is assigned to the transaction data based on postcode. The data on ethnicity is made available by the 2001 UK Census at the level of Output Area (OA). Shares of each of the 16 ethnic groups and a Herfindahl index[1] were computed to capture the ethnic composition of neighbourhoods.

Environmental variables

The environmental variables capture the amenity value of environmental designations, features of the natural environment, different types of land cover and different types of land use.

Geographical data (in the form of ESRI shapefiles) for UK National Parks, Areas of Outstanding Natural Beauty and National Nature Reserves are available from Natural England. National Parks and Areas of Outstanding Natural Beauty are protected areas of countryside designated because of their significant landscape value. National Nature Reserves are "established to protect sensitive features and to provide 'outdoor laboratories' for research" (National England website). Straight line distances to these designations were computed for the housing units as geographically located by their postcodes. Furthermore, density measures that take into account both the distance to and the size of the features were created.[1]

The location of lakes, rivers and coastline are available from the GB Ordinance Survey. Distance to these features is also computed for the housing units from the transaction data. The UK Land Cover Map produced by the Centre for Ecology and Hydrology describes land coverage by 26 categories as identified by satellite images. We follow Mourato et al.(2010) who construct nine broad land cover types from the 26 categories. Shares of each of these nine categories in 1km grid squares are calculated and the housing units take on the value of the grid square in which they reside.

The generalised Land Use Database (GLUD) available from the Department for Communities and Local Government gives area shares of nine different types of land use within Super Output Areas, lower level (LSOA). These nine land use types are domestic buildings, non-domestic buildings, roads, paths, rail, domestic gardens, green space, water and other land use. These shares are assigned to the housing units based on the LSOA in which they are located.

Amenities

The locational amenities variables capture the benefits a location offers in terms of accessibility, employment opportunities, schools quality and the proximity of cultural and entertainment establishments.

Employment accessibility is captured both by the distance to Travel to Work Area (TTWA) centroid and a measure of employment potentiality. TTWAs are defined such that 75 per cent of employees who work in the area also live within that area. Thus they represent independent employment zones and the distance to the centre of these zones is a proxy for accessibility to employment locations. A more complex measure of accessibility is the employment potentiality

index (Ahlfeldt, 2011).[1] This is computed at the Super Output Area, lower level (LSOA) and represents an average of employment in neighbouring LSOAs weighted by their distance.

Key Stage 2 (ages 7-11) assessment scores are available from the Department for Education at the Super Output Area, middle layer (MSOA). School quality is thus captured at the housing unit level by computing a distance weighted average of the KS2 scores of nearby MSOA centroids.[1]

Geographical data on the locations of motorways, roads, airports, rail stations and railtracks are available from the GB Ordinance Survey. Distances were computed from housing units to motorways, A-roads, B-roads and rail stations to capture accessibility. Buffers zones[1] were created around the motorways and roads along with distance calculations to railtracks and airports in order to capture the disamenity noise effects of transport infrastructure.

Further data on local amenities were taken from the Ordinance Survey (police stations, places of worship, hospitals, leisure/sports centres) and OpenStreetMap (cafés, restaurants/fast food outlets, museums, nightclubs, bars/pubs, theatres/cinemas, kindergartens and monuments, memorials, monument, castles, attraction, artwork). Kernel densities for these amenities were computed for housing units using a kernel radius of 2km and a quadratic kernel function (Silverman, 1986). The radius of 2km is consistent with amenities having a significant effect on property prices only when they are within walking distance.

Table A1: Variable description

Dependent Variable	
Price	Per square metre transaction price in £ of the corresponding plot of land (expressed as natural logarithm). Transaction data from the Nationwide Building Society (NBS).
Independent Variables	
CA Effects	Dummy variables denoting property transactions taking place within the boundaries of an currently existing conservation area, in a conservation area at the time when designated or where the designation date is unknown as well as various buffer areas surrounding current or treated conservation areas.
Fixed Effect Control	Travel to Work Areas, nearest conservation area catchment areas and interactives with year effects
Housing information	Set of property variables from the NBS including: Number of bedrooms, number of bathrooms, floor size (in square metre), new property (dummy), building age (years), tenure (leasehold/freehold), central heating (full: gas, electric, oil, solid fuel), central heating (partial: gas, electric, oil, solid fuel), garage (single or double), parking space, property type (detached, semi-detached, terraced, bungalow, flat-maisonette)
Neighbourhood information	Set of neighbourhood variables including: median income (2005, LSOA level), share of white population at total population (2001 census, output area level), share of mixed population at total population (2001 census, output area level), share of black population at total population (2001 census, output area level), share of Asian population at total population (2001 census, output area level), share of Chinese population at total population (2001 census, output area level), Herfindahl of ethnic segregation (including population shares of White British, White Irish, White others, Mixed Caribbean, Mixed Asian, Mixed Black, Mixed other, Asian Indian, Asian Pakistani, Asian others, Black Caribbean, Black African, Black other, Chinese, Chinese other population, 2001 census output area)
Conservation area Characteristics	Set of characteristic variables for conservation areas from English Heritage including: Conservation area land use (dummy variables for residential, commercial, industrial or mixed land use), conservation area type (dummy variable for urban, suburban or rural type), conservation area size (dummy for areas larger than mean of 128,432.04 square metres), conservation area (square metre), conservation area has an Article 4 Direction implemented (dummy), oldness of conservation area (dummy for areas older than mean of 1981), conservation area at risk (dummy), conservation area with community support (dummy), conservation area is World Heritage Site (dummy)
Environment Characteristics and Amenities	Set of locational variables processed in GIS including: National Parks (distance to, density), Areas of Outstanding Beauty (distance to, density), Natural Nature Reserves (distance to, density), distance to nearest lake, distance to nearest river, distance to nearest coastline, land in 1km square: Marine and coastal margins; freshwater, wetland and flood plains; mountains, moors and heathland; semi-natural grassland; enclosed farmland; coniferous woodland; broad-leaved/mixed woodland; urban; inland bare ground

Other amenities	Set of locational variables created in GIS including: Average key stage 2 test score (MSOA averages as well as interpolated in GIS), distance to electricity transmission lines, A-Roads (distance to, buffer dummy variables within 170m), B-Roads (distance to, buffer dummy variable within 85m), motorway (distance to, buffer dummy variable within 315m; buffer distances refer to the distance were noise of maximum speed drops drown to 50 decibel), distance to all railway stations, distance to London Underground stations, distance to railway tracks, distance to bus stations, distance to airports, densities of cafés, restaurants/fast food places, museums, nightclubs, bars/pubs, theatres/cinemas, kindergartens, monuments (memorial, monument, castles, attraction, artwork), hospitals, sports/leisure centers, police stations and worship locations, distance to Travel to Work Areas, employment potentiality (based on Travel to Work Areas with an time decay parametre of 0.073).
Neighbourhood Distance Controls	Set of neighbourhood distance dummy variables created in GIS including: Distances outside conservation area border (up to 50m, 100m, 150m, 200m, 250m, 300m, 350m, 400m, 1km, 2km and 3km), distances inside conservation area border (up to 50m, 100m, 150m, 200m)

Further notes on data methods

1. *Employment potentiality*

The employment potentiality index is computed at the Super Output Area, lower level (LSOA) and represents an average of employment in neighbouring LSOAs weighted by their distances. Employment potentiality is calculated for each Lower Layer Super Output Area i (LSOA) based on employment in all other LSOAsj using the following equation:

$$\mathrm{EP_i} = \sum_j \quad \mathrm{E_j} e^{-a\, d_{ij}}, with\ i \neq j,$$

where d measures the straight line distance converted into average travel time and Employment the absolute number of workers in the respective LSOA. The indicator is weighted by a decay parametre of a = -0.073 as estimated by Ahlfeldt(2005). Internal distances are calculated as:

$$\mathrm{d_{ii}} = \frac{1}{3}\sqrt{\frac{\mathrm{Area_i}}{\pi}}$$

2. *Kernel densities for National Parks, Areas of Outstanding Natural Beauty and National Nature Reserves*

The kernel density is a measure that takes into account both the proximity and the size of NPs, AONBs and NNRs. Every 100x100m piece of designated area is assigned a point and the density of these resulting points calculated for 10km kernels and a quadratic kernel function (Silverman, 1986, p. 76, equation 4.5)around each housing unit using a kernel density method. The

result is similar to calculating a share of NP area within a circle apart from the fact that the points are additionally weighted by distance to the housing units according to a normal distribution.

3. Buffers for motorways and roads

The buffer sizes for the different roads are as follows: B-Road (85m), A-Road (170m) and Motorway (315m). These distances are calculated based how far it is expected that the noise from traffic travelling at the speed limit of the respective roads (Steven, 2005) would decline to an assumed disamenity threshold level of noise of 50db (Nelson, 2008).

4. Land cover map Broad Categories

Table A2: Land Cover Broad categories

1	Marine and coastal margins
2	Freshwater, wetlands and flood plains
3	Mountains, moors and heathland
4	semi-natural grasslands
5	Enclosed farmland
6	Coniferous woodland
7	broad-leaved/mixed woodland
8	urban
9	Inland bare ground

Notes: Categories adopted from Mourato et al. (2010).

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