

Ahlfeldt, Gabriel; Moeller, Kristoffer; Waights, Sevrin; Wendland, Nicolai

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## The economics of conservation area designation

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# The economics of conservation area designation<sup>\*</sup>

**Abstract:** Provided that there are positive external benefits attached to the historic character of buildings, owners of properties in designated conservation areas benefit from a reduction in uncertainty regarding the future of their area. At the same time, the restrictions put in place to ensure the preservation of the historic character limit the degree to which properties can be altered and thus impose a cost to their owners. We test a simple theory of the designation process in which we postulate that the optimal level of designation is chosen so to Pareto-maximize the welfare of local owners. The implication of the model is that a) an increase in preferences for historic character should increase the likelihood of a designation and b) new designations at the margin should not be associated with significant house price capitalization effects. Our empirical results are in line with these expectations.

**Keywords:** *Heritage, Hedonic Modelling, Difference-in-Difference, Gentrification, England, Value*

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**DRAFT VERSION**

## 1 Introduction

One of the key motivations for a variety of spatial planning policies is to solve coordination problems inherent to free markets. Where ever non-traded positive or negative technological externalities exist, prices no longer provide efficient signals to market actors. With positive externalities related to individual actions, the resulting good or service will typically be underprovided on free markets. Theoretically, the allocation of scarce resources can be improved via targeted policies. Among such policies historic preservation that aims at the protection of historic buildings with a particular aesthetic,

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⊗ *Corresponding author:* Address for correspondence: London School of Economics and Political Science, Department of Geography and Environment, Houghton Street, London WC2A 2AE, g.ahlfeldt@lse.ac.uk, www.ahlfeldt.com

\* London School of Economics and & Spatial Economics Research Centre (SERC)

• Darmstadt University of Technology and Center for Metropolitan Studies TU Berlin.

◇ Darmstadt University of Technology, London School of Economics and Center for Metropolitan Studies TU Berlin.

♦ Darmstadt University of Technology.

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cultural or historic value, occupies a leading position in terms of the rigidity of the related regulations as well as the complexity of related social and private costs and benefits. The policy is controversial because preservation of socially desirable buildings comes at the cost of restricting individual property rights. On the one hand, the policy would not be equitable if individual owners bore the cost of a presumed social welfare improvement. On the other hand it can be argued that by imposing binding standards the policy helps overcoming a coordination problem among homeowners. Since owners can no longer “free ride” on character of nearby buildings while making inappropriate changes to their own properties, which is individually rational, the policy helps solving a so called prisoner’s dilemma and eventually benefits the owners (Holman & Ahlfeldt, 2012).

In practice it is not clear to which degree planning authorities take into account the local costs and benefits faced by the owners or follow their own agendas. Authorities may be committed to the preservation of historic buildings in the interest of wider society and future generations or even seek to expand their activities in expansionist Niskanen type budget maximizing behaviour. Whether the policy solves a prisoner’s dilemma of the owners likely depends on the degree to which owners are able to influence the policy in their own interest, i.e. the planner behaves as an agent of the owners. Against this background, we investigate the designation process of conservation areas in England to get insights into the nature of the designations process and likely outcomes and conflicts of the policy, which are otherwise difficult to observe.

We develop a simple model world in which we distinguish between a *heritage effect*, which can be internal or external, i.e. the effect of the appearance of a historic building on the perceived value of the house itself (internal) or nearby houses (external), and a *policy effect*, which results from the legal treatment of the designation policy. We argue that with positive heritage effects, the policy benefits the owners by removing uncertainty regarding the future of the neighbourhood, i.e. the presence of the heritage effect. These benefits are opposed by the costs of regulation (in form of development restrictions and maintenance obligations) so that the net effect of the policy effect is ambiguous. Our theoretical framework predicts positive, but diminishing returns to designation so that the policy is Pareto-efficient if designation share is maximized under the condition that benefits of designation do not exceed the costs for any owner in the neighbourhood. Under some restrictive assumptions, provided that the planner behaves as an agent of the owners, new designation will only occur as a result of changes in the local preferences for heritage. At the margin, costs and benefits of designation will offset each other, resulting in a zero impact on property value. At all other locations in neighbourhood the effect would be positive.

We test these implications using a combination of spatial estimation techniques and data. Firstly, we identify a causal effect of changes in neighbourhood composition, i.e. gentrification, on the likelihood of designations using a tobit IV approach. Secondly, we provide evidence for the existence of external effects heritage effects that give rise to potential policy gains in a spatial hedonic property price analysis. Thirdly, using a quasi-experimental differences-in-differences identification strategy we demonstrate that new designations do not impact significantly on the market value of properties. We find weak evidence that adjoining areas benefit modestly.

Our analysis is based on the whole of England and about 1 million property transactions from 1995 to 2010 and about 8000 designated conservation areas, out of which 915 have been designated in the same period. We also make use of ward level data from the UK census for 1991 and 2001 in order to analyse the effect of changing neighbourhood characteristics on designation status.

We contribute to several strands of the literature. Our analysis of the designation process adds to the literature on the political economy of housing markets, which implicitly or explicitly assumes that property owners are able to influence political outcomes in their own interest (e.g. Ahlfeldt, 2011; Ahlfeldt & Maennig, 2011; Brunner & Sonstelie, 2003; Brunner, Sonstelie, & Thayer, 2001; Cellini, Ferreira, & Rothstein, 2010; Dehring, Depken, & Ward, 2008; Fischel, 2001a, 2001b; Hilber & Mayer, 2009; Oates, 1969). We also contribute to a literature investigating the costs and benefits of spatially targeted policies that aim at improving neighbourhood quality (e.g. Cheshire & Hilber, 2008; Cheshire, Hilber, & Kaplanis, 2011; Hilber & Vermeulen, 2010; Rossi-Hansberg, Sarte, & Owens, 2010) as well as research that has looked into the value amenities add to neighbourhoods and cities more generally (e.g. Brueckner, Thisse, & Zenou, 1999; Cheshire & Sheppard, 1995; Edward L. Glaeser, Kolko, & Saiz, 2001). Notably, there is also a growing body of literature that has investigated property price effects of designation policies, mostly focused on the U.S. (e.g. Asabere, Hachey, & Grubaugh, 1989; Asabere & Huffman, 1994; Asabere, Huffman, & Mehdian, 1994; Coulson & Lahr, 2005; Coulson & Leichenko, 2001; Edward L Glaeser, 2011; Leichenko, Coulson, & Listokin, 2001; Noonan & Krupka, 2011; Schaeffer & Millerick, 1991). Whereas Glaeser (2011) argues that historic preservation restricts supply and raises prices, looking at the broader supply/demand effects, we focus on the political economy of designation and the local effects at the neighbourhood level.

The key contribution of this study is to provide insights into the political economy of conservation area designation and whether the outcome is Pareto-efficient for local homeowners. We also make a number of more specific, though still important contributions. Firstly, the theoretical framework we develop lends a structure to the designation process that helps interpreting the existing reduced

form evidence that has typically been derived from ad-hoc empirical models. Secondly, our spatial hedonic analysis of conservation area effects is one of the few rigorous analysis of this kind available for Europe (e.g. Ahlfeldt & Maennig, 2010; Koster, Van Ommeren, & Rietveld, 2012; Lazrak, Nijkamp, Rievald, & Rouwendal, 2011) and the first to analyse England. It is unique in terms of size and spatial detail of the data set and special in its focus on spatial modelling of heritage externalities. Thirdly, our differences-in-differences analysis of designation effects on property prices is the only study along with Koster et al. (2012) that uses a quasi-experimental research design to separate the policy effect of designation from correlated location effects. It is unique in using a particularly carefully selected control groups and allowing for a flexible temporal pattern of designation effects, i.e. lagged adjustment or anticipation effects. Thirdly, we provide the first empirical analysis of the determinants of heritage designation allowing benchmarking the role owners' interests play in the designation process against alternative motivations for designation, e.g. preventing decline or redevelopment. This analysis is further in connecting the spatial outcome of a political bargaining process to one of the most striking contemporary urban phenomena: gentrification.

The structure of the paper is as follows. The next section introduces our theoretical model of heritage designations and the institutional setting. Section three presents our empirical strategy, including our unique data sets. A presentation and discussion of our empirical results is in section 4. Previewing our findings, the last section concludes that the positive effects of locating inside a conservation area outweigh the cost, heritage externalities exhibit a significant impact on the value of location, and that the policy – on average – responds to local demand for designation without harming the owners.

## 2 Theory and context

### 2.1 Theoretical Framework

We assume a linear neighbourhood exists along  $x$  on the interval  $[0,1]$ . At each point along  $x$  there exists housing with an amount of internal<sup>1</sup> heritage. The initial endowment of internal heritage depends on location in the neighbourhood and is denoted  $h(x)$ . We define an external heritage amount  $H$  that is the aggregate of the internal heritage in the neighbourhood at a given point in time. In the long-run there is a probability that at any location owners (re)develop their properties

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<sup>1</sup> By *internal* heritage we mean all heritage effects at  $x$  that originate from the unit itself.

causing a deterioration in internal heritage from the initial endowment  $h(x)$ . Such deterioration implies a fall in the external heritage amount  $H$  everywhere in the city. While at any location  $x$  the internal heritage  $h(x)$  is under full control of the owner, the external heritage at all locations can be expressed as an expected value determined by the probability of heritage deterioration across the neighbourhood. Within this context a planner chooses an amount of designation  $D$  to prevent socially costly developments so that the expected value of external heritage is conditional on the level of designation i.e.  $E[H|D]$ .

We develop our designation model by assuming a particular functional form for the distribution of internal heritage endowments across the neighbourhood. Housing units possess an initial endowment of internal heritage that depends on the age of the housing unit. We imagine a neighbourhood that grew outwards from its historical centre (at  $x = 0$ ) until the neighbourhood limit (at  $x = 1$ ). This historical growth path implies that the age of the housing units falls with respect to  $x$ . The theoretical argument does not depend on the functional form of the distribution of internal heritage endowments  $h(x)$  to the extent that  $h(x)$  monotonically decreases in  $x$ . For simplicity  $h(x)$  is assumed to be a linear function of the heritage endowment at the neighbourhood's centre ( $h_0$ ):

$$h(x) = h_0(1 - x) \quad (1)$$

In  $x$  locations protected by preservation policies the internal heritage endowment is conserved with full certainty. A planner can choose to designate a conservation area that covers all locations in the neighbourhood from the historical centre up to a point  $x = D$  and hence, a share  $0 \leq D \leq 1$  of the neighbourhood. Since under the assumptions made, heritage is monotonically decreasing in  $x$  it is always rational for the planner to start designating in  $x = 0$ . If the neighbourhood is fully designated (i.e.  $D = 1$ ) then the full distribution is preserved. Thus, assuming that there is no spatial decay in the heritage externalities effect, the expected level of external heritage ( $E[H|D = 1]$ ) is simply the integral of the distribution of heritage endowments in the neighbourhood:

$$E[H|D = 1] = \int_0^1 h(x) dx = \frac{h_0}{2} \quad (2)$$

In a region populated by many neighbourhoods, this formulation implies that external heritage depends only on the heritage of housing units in the local neighbourhood and not at all on the heritage of units in other neighbourhoods. In  $x$  locations not protected by preservation policies internal heritage deteriorates from the initial value  $h(x)$  to zero with a probability of  $(1 - \pi)$ . Given this probability, expected external heritage conditional on designation is the integral of  $h(x)$  across designated

locations plus the integral of  $\pi h(x)$  across undesignated locations. This is indicated by the whole grey-shaded area in Fig. 1 below.

$$E[H|D] = \int_0^D h(x) dx + \int_D^1 \pi h(x) dx \quad (3)$$

$$E[H|D] = h_0 \left(1 - \frac{D}{2}\right) D + \frac{\pi}{2} h_0 (1 - D)^2 \quad (4)$$

The total policy effect can best be illustrated as the black-dotted area  $\Delta H$  which denotes the difference in (expected) external heritage between a scenario with no designation and a scenario with a designation share  $D$ . This amount is:

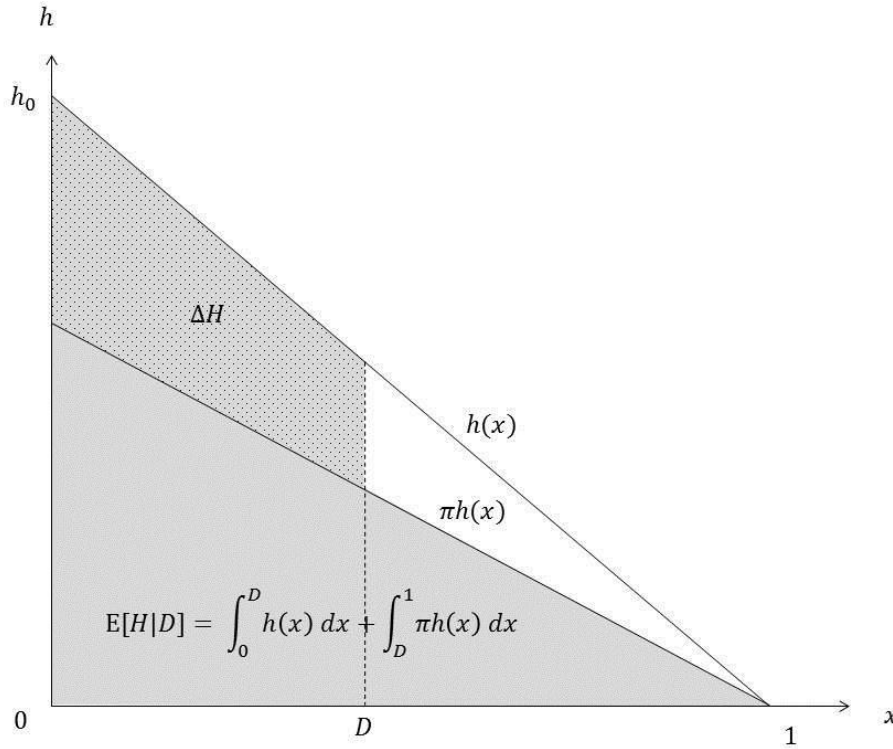
$$\Delta H = h_0 (1 - \pi) \left(1 - \frac{D}{2}\right) D \quad (5)$$

As evident from the partial derivatives, the amount of external heritage saved by the policy increases with designation share but at a decreasing rate:

$$\frac{\partial \Delta H}{\partial D} = \frac{\partial E[H|D]}{\partial D} = h_0 (1 - D) (1 - \pi) > 0 \quad (6)$$

$$\frac{\partial^2 \Delta H}{\partial D^2} = \frac{\partial E[H|D]}{\partial D} = -h_0 (1 - \pi) < 1 \quad (7)$$

The partial derivatives with respect to  $\Delta H$  (which are the same as with respect to  $H$ ) establish a central stylized fact of our theory, i.e. there are diminishing returns to designation.

**Fig. 1 Expected heritage distribution with partial designation**


Notes: The function  $h(x)$  gives the internal heritage at each location in the neighbourhood. The expected external heritage is equal to the grey shaded area and is the integral of  $h(x)$  up to the designation share plus the integral of  $\pi$  times this  $h(x)$  from the designation share until the neighbourhood limit at  $x = 1$ . The stippled area marked  $\Delta H$  is the amount of expected external heritage preserved by the policy.

To link the distribution of heritage in the neighbourhood to the utility of an individual residing at  $x$  we define a utility function:

$$U(x) = A(x)X^\delta L^{1-\delta} \quad (8)$$

where  $X$  is a consumption good,  $L$  is housing space. The Cobb-Douglas form is motivated by the empirical observation that housing expenditure shares tend to be relatively constant across geographies and population groups (Davis & Ortalo-Magné, 2011).  $A(x)$  is a composite amenities term:

$$A(x) = a(x)e^{\varphi h(x)}e^{\gamma E[H|D]}e^{-c\bar{D}(x)} \quad (9)$$

where  $a$  is a further composite indicator of  $m$  non-heritage amenities<sup>2</sup>,  $h(x)$  is the internal heritage endowment (i.e. heritage character of the specific housing unit),  $\varphi$  is the internal heritage parameter,  $E[H|D]$  is external heritage (i.e. expected heritage of surrounding units, which depends on the

<sup>2</sup> Non-heritage amenities are given by:  $a = b \prod_m a_m^{\rho_m}$  where the different amenity levels are denoted  $a_m$  and are given a collective scaling factor  $b$  and individual parameters  $\rho_m$ .



designation policy) and is conditional on designation share as defined above,  $\gamma$  is the external heritage parameter, which can depend on preferences that can be neighbourhood specific, and  $c$  represents the costs of designation policies, which arise from the development restrictions imposed inside conservation areas. The cost to an individual is  $e^{-c\tilde{D}(x)}$  and depends on the local designation status  $\tilde{D}(x)$ , a binary function of  $x$ , which takes the value of one if  $x \leq D$  and zero otherwise.

We assume a social planner seeking a Pareto-efficient designation share, which in the model implies maximizing the designation share (and the external heritage effects) on the condition that by designation utility is not reduced at any location in the neighbourhood.

The positive marginal utility effect at any location in the city is given by:

$$\frac{dU(x)}{dD} = \frac{\partial U}{\partial E[H|D]} \frac{\partial E[H|D]}{\partial D} = \gamma U(x) h_0 (1 - D)(1 - \pi) \quad (10)$$

The negative utility effect to an owner of a property changing designation status from zero to one is:

$$\frac{dU(x)}{d\tilde{D}(x)} = \frac{\partial U}{\partial \tilde{D}(x)} = cU(x) \quad (11)$$

By setting the social marginal benefit equal to the private marginal cost of an affected owner the planner finds the Pareto-efficient designation share  $D^*$  by solving for  $D$ :

$$D^* = 1 - \frac{c}{(1 - \pi)\gamma h_0} \quad (12)$$

Based on the resulting efficiency condition we can derive some useful comparative statics. The (Pareto) optimal designation share is greater when people have a greater taste for external heritage  $\gamma$  or where there is altogether more heritage (determined by the heritage endowment at the neighbourhood centre  $h_0$ , and implicitly the age of the neighbourhood):

$$\frac{\partial D^*}{\partial \gamma} > 0 \quad (13)$$

$$\frac{\partial D^*}{\partial h_0} > 0 \quad (14)$$

There is less optimal designation when the probability  $\pi$  that it internal heritage is not destroyed (if left undesignated) increases or if the cost of designation increases:

$$\frac{\partial D^*}{\partial \pi} < 0 \quad (15)$$

$$\frac{\partial D^*}{\partial c} < 0 \quad (16)$$

These theoretical implications are in line with intuition and can be transformed into empirically testable hypotheses in principle. However, the heritage at the neighbourhood centre  $h_0$ , the probability of its non-destruction if not conserved  $\pi$  and the costs to owners of conservation policies  $c$  are all difficult to observe in reality. For that reason we will concentrate on testing the first comparative statics implication about taste for heritage (proxied by education level of the local population) in the empirical section.

To develop a testable hypothesis on whether the efficiency condition is fulfilled, i.e. the planner sets  $D = D^*$ , we need to incorporate capitalization effects in the next step. We first assume that individuals maximize their utility defined above subject to a budget constraint:  $W = X + \theta(x)L$ , where  $\theta(x)$  is a housing bid-rent. Furthermore we assume spatial equilibrium such that all locations offer the same level of utility  $\bar{U}$  which we set equal to one:

$$U(x) = A(x)[\delta W]^\delta [(1 - \delta) \frac{W}{\theta}]^{1-\delta} = \bar{U} = 1 \quad (17)$$

This can be rearranged to give the spatial equilibrium bid-rents for a representative individual:

$$\theta(x) = (1 - \delta) [\delta^\delta W a(x) e^{\phi h(x)} e^{\gamma E[H|D]} e^{-c\tilde{D}(x)}]^{-\frac{1}{1-\beta}} \quad (18)$$

In keeping with intuition, the bid-rent increases in the expected external heritage, which depends on the designation share  $D$  and the internal heritage endowment  $h(x)$  and decreases in the designation cost, which is locally constrained to  $x \leq D$  as defined above.

The spatial equilibrium condition can be used to derive the marginal effect of an increase in designation share on rents in the neighbourhood. At all locations in the city a marginal increase in designation share  $D$  triggers a positive effect on rent through an increase in expected external heritage. At the margin, in addition, the change in designation status  $\tilde{D}$  also creates a cost.

$$\frac{d\theta(x)}{dD} = \begin{cases} \frac{\partial \theta(x)}{\partial E[H|D]} \frac{\partial E[H|D]}{\partial D} + \frac{\partial \theta(x)}{\partial \tilde{D}(x)} d\tilde{D}(x) & \text{if } x = D \\ \frac{\partial \theta(x)}{\partial E[H|D]} \frac{\partial E[H|D]}{\partial D} & \text{if } x \neq D \end{cases} \quad (19)$$

Substituting in the Pareto optimal designation share  $D = D^*$  derived above we get:

$$\frac{d\theta(x)}{dD} = \begin{cases} \frac{\theta(x)}{1-\delta} \left[ \gamma h_0 \left( 1 - 1 + \frac{c}{(1-\pi)\gamma h_0} \right) (1-\pi) - c \right] = 0 & \text{if } x = D \\ \frac{\theta(x)}{1-\delta} \left[ \gamma h_0 \left( 1 - 1 + \frac{c}{(1-\pi)\gamma h_0} \right) (1-\pi) - c \right] = \frac{\theta(x)}{1-\delta} & \text{if } x \neq D \end{cases} \quad (20)$$

The two conditions directly translate into two testable hypotheses. If the designation process in reality is Pareto optimal, we expect the marginal effect of designation on housing rents to be zero at newly designated locations and to be positive at all other locations in the neighbourhood.

## 2.2 Institutional context

In England, the designation of conservation areas started in 1967 and continues under the provisions 69 and 70 of the Planning Act 1990 (Listed Buildings and Conservation Areas).<sup>3</sup> Conservation areas are those that have been identified as having "special architectural or historic interest, the character or appearance of which is desirable to preserve or to enhance" (Section 69). The Planning Policy Guidance Note 15 (PPG15) states that a conservation area "may form groups of buildings, open spaces, trees, historic street patterns, village greens or features of historic or archaeological interest. It is the character of the areas rather than individual buildings that conservation areas seek to enhance". Consequently, designations are usually made on the basis of sustaining the local character of an area. While the historic importance of listed buildings is determined on a national level, conservation areas are designated on the grounds of local and regional criteria. There is a limited consistency, because criteria for designation vary across the United Kingdom. This is consistent with Pendlebury's (2009) work on heritage, where the 'value' and meaning attached to the heritage itself is culturally inflected by the society defining what does and does not constitute special historical or architectural character. After the designation, the Local Authority has more control over minor developments and the demolition of buildings (Botrill, 2005). However, the protection an area receives when it is designated a conservation area is determined at the national level to reflect the wider interests of society.

There are currently (2011) around 9,800 areas, up from around 9,300 just two years ago, in 2009. Conservation areas vary in character and size. Many have strong historical links, for example an architectural style associated with a certain period. Besides these characteristics, designation is made

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3 However, the first legislation to protect the historic environment was enacted in 1882 when the Ancient Monuments Protection Act was passed to protect a small number of designated ancient monuments. More statutory measures came into force in the ensuing years, but it was the passage of the Ancient Monuments Consolidation and Amendment Act in 1913 that set out a more comprehensive legislative framework for the protection of ancient monuments.

based on softer benefits said to emanate from conservation area designation including: the creation of a unique sense of place-based identity, encouraging community cohesion, and promoting regeneration (HM Government, 2010).<sup>4</sup> This 'instrumentalisation' of conservation policy, which seeks to encompass heritage values, economic values and public policy outcomes, has been identified as a key shift in the English policy context (Pendlebury, 2009; Strange, 2003). This is reflective of the notion of heritage not as a single definable entity, but as a political, social, cultural and economic "bundle of processes" (Avrami, 2000 cited in Pendlebury, 2009: 7).

In combination with bottom-up schemes leading to designation (e.g. community led designation), the complex heritage preservation agenda pursuing a multitude of objectives and the institutional setting with responsibilities shared across several institutional layers creates significant scope for organized interest groups like property owners to influence the outcome of a political bargaining process.

### 3 Empirical Strategy

#### 3.1 Designation process

The first set of potentially testable implications of our theoretical model are the partial derivatives (13) to (16). As mentioned in the theory section it is difficult to find feasible proxies for the variables  $\pi$ ,  $c$  and  $h_0$ . Therefore we concentrate on testing the first of these conditions i.e. the 'taste' for heritage  $\gamma$  has a positive effect on optimal designation share  $D^*$  in a neighbourhood. We adopt the common assertion that the demand for urban consumption amenities increases in income and education (Brueckner, et al., 1999; Edward L. Glaeser, et al., 2001). In particular we assume that the preference for heritage  $\gamma_n$  in a neighbourhood  $n$  is related to the share of people in the neighbourhood who hold a higher education certificate ( $DEG_i$ ) with the following functional form:

$$\gamma_{nt} = DEG_{nt}^{\vartheta} \quad (21)$$

where  $\vartheta > 0$  such that the relationship is positive. Rearranging the Pareto-efficient designation share equation (12), substituting the education degree proxy relationship and taking logs we arrive at the following empirical specification:

$$\log(1 - D_{nt}) = \alpha - \vartheta \log(DEG_{nt}) - \omega_n + \varepsilon_{nt} \quad (22)$$

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<sup>4</sup> See for details HM Government (2010): *The Government's Statement on the Historic Environment for England*. London: DCMS.

$$\text{where } \alpha = \log(1 - \pi) - \log(c) \text{ and } \omega_n = \log(h_{0n}) + l_n. \quad (23)$$

The  $n$  subscripts correspond to the individual ‘neighbourhoods’ of our theoretical model and we choose to represent these empirically as UK Census wards. Wards are the smallest geographical areas that are comparable between 1991 and 2001 Censuses. Subscript  $t$  stands for time periods for which we use the Census years of 1991 and 2001. All idiosyncratic time-invariant location components  $l_n$  and the unobserved heritage endowment  $h_{0n}$  of a neighbourhood  $n$  are captured by  $\omega_n$  and removed by taking first-differences:

$$\Delta \log(1 - D_n) = \Delta \alpha - \vartheta \Delta \log(DEG_n) + \Delta \varepsilon_n \quad (24)$$

Our estimation equation now describes that a positive change in educational degree causes the (logged) share of undesignated land on the left hand side to decrease. This is nothing else than saying that a positive change in educational degree leads to a higher designation share, although the transformation is non-linear. We therefore expect the sign of the estimated coefficient to be negative. We note that implicitly we assume that we are in equilibrium in the sense that all areas that should be designated at  $t$  are in fact designated. The on-going designation is then only determined by the local changes in preferences and the steady aging of buildings and the effects on heritage, which are differentiated out.

A number of empirical concerns remain even after differentiating out time-invariant local factors. For one thing, the policy itself could make it more likely that educated people are attracted to designated areas due to a different valuation of uncertainty. For another thing, in practice, preservation policies may operate for reasons other than modelled in our theory, which are difficult to control for empirically. As an example, areas can be designated if the heritage is threatened by poor maintenance in a declining neighbourhood. Such derelict is likely to be negatively correlated with our explanatory variable. As a result, an OLS estimation of equation (24) can result in significant bias in either direction. In order to circumvent these issues we estimate an instrumental variable model. The identifying assumption is that our instruments  $z_n$ , which we keep in levels, predict a change in education,  $\rho(z_n, \Delta \log DEG_n) \neq 0$ , but are uncorrelated with the differenced error term,  $\rho(z_n, \Delta \varepsilon_{nt}) = 0$ . We argue that rail station (in London tube station) density as well as museum density fulfil these requirements and act as drivers of neighbourhood gentrification (Florida, 2002; Edward L. Glaeser, et al., 2001). At the same time we believe that the two amenities do not directly impact on designation. In robustness checks we use alternative instruments which are reported in Table 6 in the appendix.

To the extent possible we aim at controlling for alternative determinants of designation. We use vacancy rate and average household size (both in differences and lagged levels) to capture development pressure. We also use a housing quality indicator since this is likely to capture areas with a greater need for preservation due to deterioration and also to be associated with a threat of redevelopment. Another control we include is the initial period (1991) degree share to ensure that the effect of change in degree share is not simply due to initial degree share which it may be correlated with. Finally we control for the extent of designation in the initial period (1991) which is expected to give a positive effect if designations sparks further designation as in a contagion model. A final set of controls is driven by the interest in homeowners within the designation process. Since homeowners experience extra benefits/costs from designation they have additional incentives to engage in political bargaining. In line with our theoretical model, all control variables enter our empirical specification in logs. Travel To Work Areas (TTWA) fixed effects enable us to control for unobserved location features that are common to a TTWA area and have an impact on trends in the designation activity, like e.g. different bureaucratic practices. We refer to the appendix for a more detailed description and motivation of the controls applied.

Our theory suggests that designation depends on the preference for heritage. This implies that a decrease in preference must also provoke a reduction of the designated area. Abolishment of conservation areas, however, is extremely rare in England (as in most institutional contexts) so our data is left-censored (we do not observe increases in the share of undesignated land). Partly as a result, we end up with a large number of zeros in our sample. Only 1,211 of 7,968 (15.2%) wards experience a positive change in designation share between 1991 and 2001. While we show OLS and IV models based on wards with observable changes in designation share for the purpose of comparison, our preferred empirical approach is the latent variable implementation of the tobit model. We take the dependent variable of the empirical model (24) as our latent variable  $Y^*$ :

$$Y_n^* = \Delta \log(1 - D_n) \quad (25)$$

The latent random variable log-linearly depends on education and the usual assumptions about the distribution of the (differenced) error term hold:

$$Y_n^* = \Delta \alpha - \vartheta \Delta \log(DEG_n) + \Delta \varepsilon_n, \quad \Delta \varepsilon_n \sim N(0, \sigma^2) \quad (26)$$

We think of the designation share to be censored below zero which implies that the latent variable is censored above zero as designation share gets subtracted inside the latent variable term. The observed value  $Y_n$  is then given by

$$Y_n = \begin{cases} Y_n^*, & \text{if } Y_n^* = \Delta \log(1 - D_n) < 0 \\ 0, & \text{if } Y_n^* \geq 0 \end{cases} \quad (27)$$

### 3.2 Capitalisation effects and Pareto optimality

The above empirical analysis describes the comparative statics of the model i.e. how a change in parameters triggers a change in designation to accommodate additional demand for heritage. But by assuming spatial equilibrium we have also derived a pair of hypotheses that allow us to test whether the policy is set in a Pareto optimal manner. Testing these hypotheses is empirically challenging because of the difficulty in identifying the policy effect separately from the heritage effects. Both the internal and external heritage effects are unobserved in our dataset and there is a great likelihood that they will be spatially correlated with designation status. The policy effect can therefore not be inferred directly from observable price effects associated with designation status.

Therefore we approach the problem in three stages. Firstly, we estimate the overall capitalisation effect associated with conservation areas using the hedonic method. This is a useful exercise because it helps to illustrate the nature of our unobserved variable problem. Secondly, we investigate the strength and spatial decay of heritage externalities from which we have abstracted in the theory. This helps defining areas in which we expect and do not expect new designations to have an impact. Finally, we develop our difference-in-difference empirical specification which attempts to isolate the pure policy effect in order to test the above hypotheses. All of these models are set up here with just the essential level of detail but more detailed descriptions are available in the appendix 3.3.

#### *Capitalisation effects*

We begin by taking logs of the equilibrium rents condition<sup>5</sup>:

$$\ln \theta(x) = \tau + \frac{1}{1-\delta} \ln a(x) + \frac{\phi h(x)}{1-\delta} + \frac{\gamma E[H|D]}{1-\delta} - \frac{c\bar{D}(x)}{1-\delta} \quad (28)$$

We take the equilibrium condition to the data by estimation the following reduced-form equation<sup>6</sup>:

$$\ln P_{it} = \aleph CA_i + \sum_m \mu_m X_{im} + \sum_r \sum_t \varphi_{rt} (R_{ir} \times Y_{it}) + \epsilon_{it} \quad (29)$$

where the bid-rent is captured by transaction price (per m<sup>2</sup>) denoted  $P_{it}$ ,  $\aleph$  is the conservation area parameter,  $X_{im}$  is a set of  $m$  controls (described in the data appendix 3.3) and  $\mu_m$  are their param-

<sup>5</sup> Where  $\tau$  is a constant and equal to:  $\ln(1-\delta) + \frac{\delta}{1-\delta} \ln \delta + \frac{1}{1-\delta} \ln W$

<sup>6</sup> Locations  $x$  from the theory are replaced empirically with housing units  $i$ .

ters<sup>7</sup>. We have introduced two sets of indicator variables ( $R_{ir}$  and  $Y_{it}$ ) for regions  $r$  and years  $t$  along with a respective set of parameters  $\varphi_{rt}$  to capture fixed effects specific to each region-year combination<sup>8</sup>. A region  $r$  is defined as a 2km buffer area surrounding the conservation area that is nearest to the property transaction. The conservation area parameter  $\aleph$  measures the combined policy and heritage effect because our  $CA_i$  variable identifies internal heritage  $h_{it}$ , external heritage (with designation)  $E[H_{it}|D_t]$  and the policy cost  $\tilde{D}_{it}$ . Therefore  $\aleph = (\varphi + \gamma - c)/(1 - \delta)$ .

### *Heritage externalities*

In an additional specification we also examine the spatial externalities of external heritage by introducing distance variables that capture proximity to conservation areas. We 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 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 up to a distance of 1950m to allow for one residual category within the 2km conservation area fixed effects described above.

In our baseline equation, we define indicator variables that take the value of one if a property falls into a given internal (ID) or external (ED) distance interval, measured from the boundary of the nearest conservation area.

$$\ln P_{it} = \aleph CA_{it} + \sum_u \beta_u ID_{uit} + \sum_v \beta_v ED_{vit} + \sum_m \mu_m X_{im} + \sum_r \sum_t \varphi_{rt} (R_{ir} \times Y_{it}) + \epsilon_{it} \quad (30)$$

where  $\beta_u$  is the coefficient for internal buffer  $u$  and  $\beta_v$  is the coefficient for internal buffer  $v$ . In a further alternative specification, we replace each of the outer dummy variables with a count measure for the number of distance interval buffers surrounding different conservation areas a transaction falls in. With this specification we account for the potentially complementary effect of having more than one conservation area nearby. For both alternative specifications the coefficients and 95% confidence intervals are plotted against distance and jointly form the non-linear heritage externality function. Note that the coefficients on the internal and external rings capture distinct economic phe-

<sup>7</sup> Where  $\mu_m = \frac{\rho_m}{1-\delta}$

<sup>8</sup> These capture otherwise not observed labour market characteristics and broader regional differences as well as macro-economic shocks that are common to the country



nomena. The internal effects are a composite of policy, internal and external heritage effects, whereas the latter are suspected to be a function of internal distance  $\gamma = g^I(ID)$ , so that  $\beta_u = (\varphi - c + g^I(ID))/(1 - \delta)$ . External ring parameters capture exclusively the effect of heritage externalities  $\gamma = g^E(ED)$  if appropriately separated from other location effects, hence,  $\beta_v = (g^E(ID))/(1 - \delta)$ . A discontinuity at the conservation area border can therefore indicate either a policy effect, an internal heritage effect or a highly localized external heritage effect.

#### *Pareto optimality*

We use a difference-in-difference methodology to test our key hypothesis that the marginal policy effect is zero since it allows us separating the policy effect from correlated heritage effects (and other time-invariant location effects). We define a treatment group of property transactions that fall within the boundaries of any of the 912 conservation areas designated over the transactions sample period (1995-2010). Taking the difference in prices between pre- and post-treatment periods i.e.  $(\bar{P}_{POST}^T - \bar{P}_{PRE}^T)$  removes the effect of the internal and external heritage that these observations are endowed with. Thus, this difference leaves only the effect of the policy i.e. the increase in expected external heritage.

Further, to establish the counterfactual of what would have happened to the prices had the treatment group not been treated (designated) we define a control group of housing units that are close, either spatially or in characteristics, to the treatment group but are themselves not treated.

We produce a subsample of the overall housing transactions dataset that includes only observations that are either in the treatment group or in the control group. Then we estimate the difference-in-difference effect using the following specification:

$$\log(P_{it}) = \beta CA_i + \beta^{POST}(CA_i \times POST_{it}) + \sum_m \mu_m X_{im} + \sum_r \sum_t \varphi_{rt}(R_{ir} \times T_{it}) + \epsilon_{it} \quad (31)$$

The conservation area dummy variable  $CA_i$  indicates whether the observation is in the treatment group or the control group. Therefore the coefficient  $\beta$  captures unobserved effects correlated with being in the treatment group. The  $CA_i$  term is interacted with the dummy variable  $POST_{it}$  that indicates whether the observation's transaction date is greater than or equal to the designation date. The parameter of interest is  $\beta^{POST}$ , which gives the additional effect of being in the treatment group after the treatment compared with before the treatment. As we show in the appendix 3.2 the net marginal policy effect can be inferred from this coefficient. We also discuss the selection of our various groups in more detail.

In an alternative specification, we allow for time varying designation effects by grouping transactions into “bins” depending on the number of years that have passed since the conservation area they fall in or are near to had been designated. Negative values indicate years prior to designation. These bins ( $b$ ) are captured by a set of dummy variables  $PT_b$ .

$$\log(P_{it}) = \beta CA_i + \sum_{b \neq 0} \beta_b (CA_i \times PT_{bi}) + \sum_m \mu_m X_{im} + \sum_r \sum_t \varphi_{rt} (R_{ir} \times T_{it}) + \epsilon_{it} \quad (32)$$

With this more flexible specification we are able to capture the lagged effects of designation as well as potential anticipation effects.

### 3.3 Data

To rigorously analyse the process behind designation of conservation areas and to estimate the effect of conservation areas on housing value, we have compiled two unique data sets. Both datasets make use of a comprehensive digital map of conservation areas in England accompanied by a detailed survey and provided by English Heritage.

#### 3.3.1 Designation process dataset

The first dataset contains ward level household characteristics and some instrumental variables (station density and museums) in order to analyse how the designation process is driven by changes in heritage preferences.

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.<sup>9</sup> The data set furthermore contains information about areas that received the status of world heritage sites in England.<sup>10</sup> Evidence of community support and risk status comes from the Conservation Areas Survey and is provided by English Heritage. Using this conservation area spatial data we calculated the share of designated land area for each Census ward.

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<sup>9</sup> The implementation of Article 4 Direction in conservation areas puts extra restrictions on the development of properties.

<sup>10</sup> According to the provided information, there are 59 conservation areas with the corresponding status as World Heritage. We note that the rather small sample does not allow us to draw general lessons about the effect of the status as such. The list of districts hosting conservation areas that are located within World Heritage sites is provided in the appendix.

Data on the educational level (degree) in 1991 and 2001 were obtained from the UK Census. Any changes in ward boundaries between 1991 and 2001 were corrected for using the online conversion tool GeoConvert<sup>11</sup>. The education data are used as a proxy for a preference for heritage and represent the key explanatory variable our analysis. In order to instrument the education variable, which may be endogenous, we used amenities that may be considered attractive to the educated and therefore serve as predictors for inwards migration. Specifically we used station density (from the Ordnance Survey) and museums density (GB Ordnance Survey). These amenities are also used in the hedonic analysis and are described in more detail in the data appendix 3.3.

We obtained a number of control variables from the UK census: average household size and home-ownership status. Vacancy rates were taken also from the UK census for 1991 and 2001. The share of housing failing to meet basic quality standard was obtained from the Indices of Deprivation for 2004.

### 3.3.2 Capitalisation effect dataset

The second dataset is used to analyse capitalisation effects and to test out hypothesis relating to the Pareto optimality of the planner. 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 the spatial conservation areas data. Merging these data within a GIS environment sets the base for the comparison between sales prices of buildings inside and outside conservation areas.

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<sup>2</sup>), 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. 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

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<sup>11</sup> <http://geoconvert.mimas.ac.uk/>

measures (e.g. densities) for the amenities and environmental characteristics that will be used as control variables.

In addition to housing characteristics we use a broad set of control variables. For neighbourhood characteristics we use median income and ethnic composition. For environmental variables, we make use of geographical data for designations such as National Parks, as well as natural features like lakes, rivers and coastline. We also make use of definitions for natural land cover and land use. For amenities we make use of data for accessibility, employment opportunities, schools quality and the proximity of cultural and entertainment establishments. A more detailed description of all the data used is in the appendix.

## 4 Empirical Results

### 4.1 Designation process

In order to test our theoretical implication that changes in heritage preferences lead to changes in designation we estimate the regression modelled as outlined in section 3.1. To confirm this relation the coefficient of our variable of interest needs to be negative. Preliminary OLS regression results are reported in Table 4 in the appendix. We drop all zeros and identify the effect based on the sample of observations with observable changes in conservation area shares. The models generally support our view on the designation process and a positive change in degree leads to higher designation. However, we concentrate our analysis on the tobit models due to the right censored nature of our data.

Table 1 reports the tobit estimates for five different specifications. We start with the baseline model in column (1) where we only include our degree variable in the right-censored model and do not instrument for the purpose of comparison. Despite the correct sign the coefficient is not statistically significant. This might be caused by unobservables inside our error term which are correlated with our proxy for heritage preferences and the dependent variable. We therefore turn our view towards our preferred and presumably unbiased estimates of IV models reported in the remaining columns. Instrumenting the degree variable by rail station and museum density yields significant estimates (at a 1% level). Our estimates suggest that doubling the degree share leads to a reduction in the undesignated land share by 25%. Given the structure of the model, an elasticity parameter of  $\vartheta = 0.25$  also implies that heritage preferences increase relatively sharply in education level. All IV models are in line with our expectations that wards which experience a positive change in degree (heritage preferences) do also experience an increase in designation share.

When we introduce a basic set of controls in column (3) this effect slightly falls in magnitude. We observe an increase in designation not only in wards where the degree shares increased over time but also where the initial levels were already high. A change in homeownership has a negative effect on designation whereas lagged homeownership turns out to be insignificant. Residents that become owners between 1991 and 2001 take the costs associated with designation into consideration. Positively correlated (negatively in the actual table) vacancy rates suggest that higher development pressure leads to fewer designations seemingly refuting the idea that authorities might designate in response to the threat of development that may adversely harm heritage character. It is a result that seems more in line with the way our model explains the designation process, specifically that authorities are an agent of the local population and designate when it is in their interest to designate. Designation share in 1991 is significant and positive with respect to designation change between 1991 and 2001. This is in line with a contagion type spread of designation. The remaining controls turn all out to be insignificant. Overall, model (3) is in line with our theoretically derived relation between heritage preferences and designation. We refer to this model as our benchmark model. A more detailed interpretation of the controls is given in the appendix 4.1.

**Tab. 1 Designation process: tobit models**

	(1) $\Delta \log$ designation share (t)	(2) $\Delta \log$ designation share (t)	(3) $\Delta \log$ designation share (t)	(4) $\Delta \log$ designation share (t)	(5) $\Delta \log$ designation share (t)
$\Delta \log$ degree share (t)	-0.013 (0.008)	-0.252*** (0.026)	-0.250*** (0.046)	-0.321*** (0.058)	-0.274*** (0.076)
$\log$ degree share (t-1)			-0.107*** (0.011)	-0.117*** (0.013)	-0.128*** (0.021)
$\Delta \log$ homeownership (t)			0.158*** (0.030)	0.159*** (0.030)	0.156*** (0.039)
$\log$ homeownership (t-1)			0.015 (0.015)	0.124*** (0.021)	0.031** (0.015)
$\Delta \log$ vacancy rate (t)			-0.013*** (0.005)	-0.012** (0.005)	-0.014** (0.006)
$\log$ vacancy rate (t-1)			-0.001 (0.007)	0.002 (0.007)	0.000 (0.009)
$\Delta \log$ average household size (t)			0.019 (0.036)	0.055 (0.036)	0.009 (0.038)
$\log$ average household size (t-1)			0.023 (0.034)	0.017 (0.035)	-0.042 (0.044)
$\log \Delta$ poor housing share 2004 (t)			0.001 (0.006)	-0.001 (0.006)	-0.008 (0.009)
$\log$ designation share (t-1)			-0.053*** (0.013)	-0.061*** (0.013)	-0.059*** (0.012)
$\Delta \log$ degree share (t) x homeownership (t-1)				-0.415*** (0.088)	
IV	NO	YES	YES	YES	YES
Controls	NO	NO	YES	YES	YES
Interactive	NO	NO	NO	YES	NO

<i>FE</i>	NO	NO	NO	NO	YES
Observations	7968	7968	7958	7958	7958
<i>CHI2</i>	-	93.320	209.643	205.433	595.541
<i>EXOG_P</i>	-	0.000	0.000	0.000	0.003
<i>OVERID</i>	-	1.208	0.641	0.916	0.325
<i>OVERIDP</i>	-	0.272	0.423	0.339	0.569

Notes: See the data section for a description of control variables. Standard errors in parentheses and clustered on fixed effects. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

The key relationship between degree and designation holds throughout the remaining specification. The effect is stronger in areas with more homeowners (column 4) indicating a specific interest in designation which they manage to enforce. In some sense these results supports the homevoter hypothesis literature, which suggests that homeowners are particularly successful in promoting their interests. The results remain robust in the TTWA fixed effect model.<sup>12</sup>

Robustness tests confirm the validity of our instruments. A Wald test of exogeneity (*EXOG\_P*) supports the application of our IV models instead of standard OLS. The instruments are overidentified as indicated by the Amemiya-Lee-Newey minimum  $X^2$  statistic (*OVERID*) and its p-values (*OVERIDP*). They are also considered to be relevant in terms of explanation power since the  $F$ -statistics of the first stage regressions (Table 5 in the appendix) are all significantly larger than ten (Stock, Wright, & Yogo, 2002). We have tried four alterations of the benchmark model (3) using different sets of instruments for the purpose of robustness. The coefficient estimates remain qualitatively similar to the main model. Regressions results, also of the first stage, are reported in Table 6 and Table 7 in the appendix.

## 4.2 Capitalisation effects

### *Capitalisation effects*

Table 1 shows the results of our hedonic estimations using equation (29). We ran several different versions of this model, incrementally increasing the controls. In Table 1 we report only two specifications, the simplest in column (1) and the most demanding in column (2). The full set of models are reported in Table 8 in appendix 4.2. Throughout all models transactions inside conservation areas sell at a significant premium. These premia decrease as the strength of the controls is increased from 23.1% on column (1) with only year effects to 8.4% in column (2) with the full set of controls.

<sup>12</sup> There are 135 TTWA with sufficient observations to identify a within-effect.

**Tab. 2 Conservation area premium - conditional estimates**

	(1) Natural logarithm of price per sqm	(7) Natural logarithm of price per sqm
Transaction inside a conservation area at a time when des.	0.231*** (0.002)	0.084*** (0.002)
Year Effects	YES	
Hedonics Controls		YES
Location Controls		YES
Neigh. Controls		YES
Nearest CA x Year Effects		YES
Study Area	ALL	INSIDE 2KM CA BUFFER
Observations	1088446	830055
$R^2$	0.514	0.913
AIC	1135699.9	-547097.0

Notes: See the data section for a description of control variables. Models include full sets of dummy variables denoting missing observations in location attributes. Standard errors in parentheses and clustered on fixed effects. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ . Full models reported in appendix.

### *Heritage Externalities*

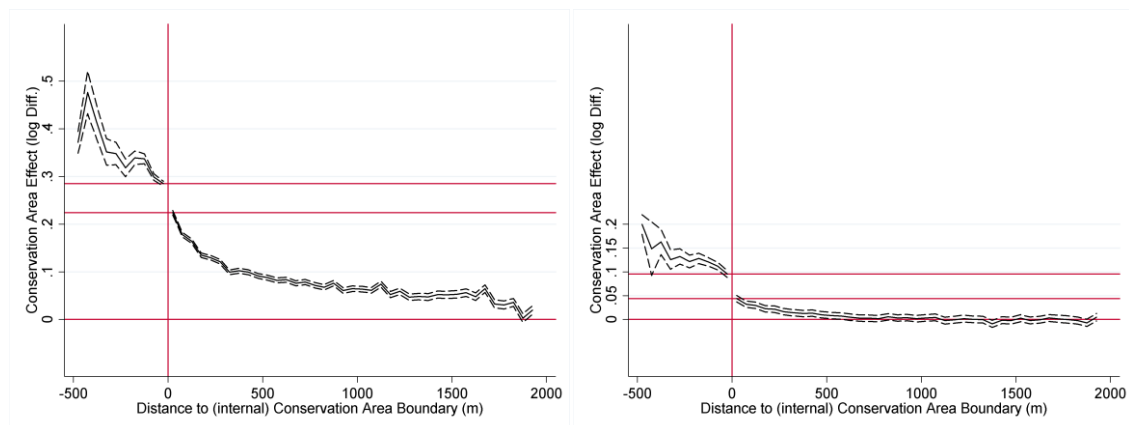
To account for the presence of heritage externalities, we extend our specification by spatial variables as given by equation (30). These should capture otherwise not explained variation in sales prices that can be attributed to external heritage effects. We run equation (30) for the seven variations used in the above capitalisation effects analysis (Table 8 in appendix 4.2), but limit the presentation to versions that correspond to models (1) and (2) from Table 2 above<sup>13</sup>. In Figure 2, we plot the estimated coefficient estimates jointly with the 95 per cent confidence intervals. In line with the intuition, 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. As in the previous models, the estimated premia are significantly lower in the model with strong controls (right). Still, the conservation area premium at the boundary (0-50m) of 9.5 per cent roughly doubles once the innermost zone is reached (inside the conservation area, but more than 450m from the boundary). Just outside the conservation area (0-50m) there is still a significant premium of close to 5 per cent. This external premium declines in distance and becomes virtually zero at about 700m and statistically indistinguishable from zero at about 500m. This spatial scope 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

<sup>13</sup> As in the estimation tables, 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)

context (Berlin, Germany). To the extent that the price effects found near to conservation areas are driven by external heritage effects, this refined specification gives a cleaner estimate of the conservation area premium.

Another interesting feature of Figure 2 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%). Notably, the discontinuity seems considerably more pronounced in the model with strong controls (right). Several (non-exclusive) explanations may account for this pattern. Firstly, the external heritage effect will decline abruptly as one moves out 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. Fourthly, the results would also be in line with positive net-policy effect of designation.

**Fig. 2 Heritage externalities - buffer dummies**



Notes: Both figures are based on equation (30) type estimations using dummy variables denoting buffer rings. The left (right) figure uses the set of control from Table 2, column 1 (2). The black solid line connects the point estimates, centred on the middle of a distance interval (e.g. 25m for 0-50m), the black dashed lines similarly indicate the 95% confidence intervals.

### 4.3 Designation effects

To separate the pure policy effect of designation associated with a designation status from the unobserved local characteristics and heritage effects we can make use of 912 new designations that occurred after 1995. We aim to test our hypothesis that at the margin the policy



effect should be zero for the newly designated areas if the planner behaves in a Pareto optimal manner. We also expect a positive effect for the areas just outside the newly designated conservation areas. Table 3 presents treatment estimates of equation (31) using a range of different control groups. We use our most demanding baseline specification (Table 2, column 2) as a starting point, since we believe it is particularly important to control for unobserved spatio-temporal heterogeneity at a very local level in a specification that identifies the treatment from a comparison over time and –on a very disaggregated scale - across space.

The benchmark specification in column (1) uses all properties that lie within 2km of the nearest conservation area. As was the case for the time-varying treatment estimates presented above, we define two CA dummies, one for transactions inside conservation areas and another for transactions inside a 500m buffer drawn around the conservation areas that were designated during the study period. Effectively, this specification estimates the effect of two related, but technically separate treatments at the same time: being located in a conservation area that is being designated and locating close to such an area while being exposed to potential spatial spillovers. The control group is defined as being 500m-2km from the conservation area border and therefore outside of the range of spatial externalities, as estimated in the previous section. In relation to our hypotheses the first dummy allows us to test whether units inside the conservation area experience a zero policy effect, and the second allows us to test if units directly outside a newly designated area experience a positive effect.

In line with our hypothesis, the designation effect is very close to zero in magnitude and indeed not statistically significantly different from zero in a range of specifications where we try to match treatment and control groups more closely. This is true both when we increase homogeneity based on space or based on a matching on observable location characteristics. In model (2), we consider only a 2km buffer surrounding the treated conservation areas. Model (3) reduces the control group to properties within conservation areas that are within 2km of the treated areas (and do not change designation status during the observation period). In models (4) and (5) we use a propensity score matching procedure to find a subset of similar, untreated conservation areas that serve as a control. We use kernel (4) as well as nearest neighbours (5) matching to define a broader and a narrower treatment group.

One final concern with model (1) in Table 3 is that the designation effect could be confounded with the general appreciation trend in conservation areas. A positive trend associated with the value added to a property due to a location inside a conservation area irrespectively of chang-

es in designation status could mask a negative designation effect, even though our specification is set up to minimise such problems through strong controls for unobserved spatiotemporal heterogeneity. In column (6), we therefore repeat column (1) estimates including a full set of time-varying treatment measures. Reassuringly, the point estimate changes only marginally.

Another interesting feature of models (1), (2), and (6) is that we find a moderate, but positive and significant treatment effect for the buffer areas surrounding the treated conservation areas. Such a joint effect of an insignificant designation effect inside and a positive effect just outside conservation areas confirms our pair of hypotheses derived from assuming Pareto optimal behaviour on the planner's behalf. As discussed, the policy potentially delivers cost and benefits to owners in conservation areas. On the benefit side, owners gain from a sense of security regarding the appearance of their neighbourhood. On the cost side, owners face potential costs from some restrictions regarding possible alterations of their properties. At the edge of a conservation area, property owners may receive some of the benefits, while not being exposed to the cost. However, when using the particularly carefully selected control groups in models (3), (4) and (5), there is also an insignificant effect of policy treatment on the unit directly outside (<500m) the newly designation conservation areas. These control groups are made up of units *inside* CAs designated in the past and therefore may not serve as a good control for units just *outside* recently designated CAs. The unobserved factors of these units, specifically the heritage character, may be higher in the control group and therefore the identifying assumption that they would have followed similar post period growth paths in the absence of treatment may have failed in for this particular treatment group.

Overall, the evidence provided suggests that the policy effect is not statistically different from zero inside new designation. This result is clearly in line with the first of our pair of hypotheses relating to the Pareto optimal planner. One limitation of our empirical approach is that we cannot rule that the policy is not Pareto-efficient (in either direction), but the costs and benefits related to designation and uncertainty are very small. The evidence also suggests either a positive or a non-negative effect on units near to conservation areas providing partial support for the second hypothesis.

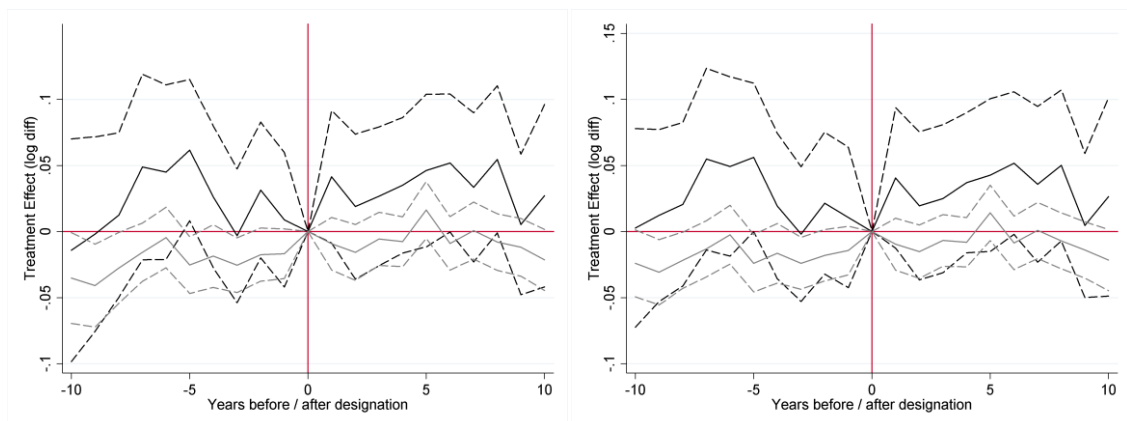
These main results are supported further by an equation-(32)-type estimation where the designation treatment effect is allowed to vary by years prior to and after designation to account for potential anticipation and gradual adjustment effects (see Figure 3). We exemplarily show

the estimation results for two specifications with time-varying designation effects that correspond to models (1) and (2) in Table 3. While there is some volatility in the relative trend, the results do not reveal a conclusive pattern that would support the existence of a positive adjustment around the designation dates in either case.

**Tab. 3 Conservation area premium - designation effect**

	(1) Natural logarithm of price per sqm	(2) Natural logarithm of price per sqm	(3) Natural logarithm of price per sqm	(4) Natural logarithm of price per sqm	(5) Natural logarithm of price per sqm	(6) Natural logarithm of price per sqm
Inside treated CA x Post Designation	0.013 (0.010)	0.010 (0.010)	-0.004 (0.013)	0.019 (0.066)	-0.180 (0.189)	0.005 (0.010)
Within 500m Buffer of treated CA x Post	0.017*** (0.004)	0.014*** (0.004)	0.007 (0.009)	0.008 (0.010)	0.013 (0.011)	0.014*** (0.004)
Inside treated CA	-0.036*** (0.007)	-0.021** (0.007)	-0.025* (0.010)	0.002 (0.049)	-0.019 (0.114)	-0.033*** (0.007)
Within 500m Buffer of treated CA	-0.007* (0.003)	0.001 (0.003)	0.004 (0.008)	-0.004 (0.008)	0.010 (0.008)	-0.006* (0.003)
CA Effects	YES	YES	YES	YES	YES	YES
Hedonic Cont.	YES	YES	YES	YES	YES	YES
Location Cont.	YES	YES	YES	YES	YES	YES
Neigh. Cont.	YES	YES	YES	YES	YES	YES
Nearest CA x Year Effects.	YES	YES	YES	YES	YES	YES
Internal x Year Effects						YES
External x Year Effects						YES
Control Area (ex- cluding treatment)	2KM BUFFER (ALL CAs)	2KM BUFFER (TREATED CAs)	INSIDE CAs WITHIN 2KM OF TREATED CAs	INSIDE CAs MATCHED ON KERNEL	INSIDE CAs MATCHED ON NEAR- EST NEIGHBOR	2KM BUFFER (ALL CAs)
Observations	830055	301978	93446	104658	109045	830055
$R^2$	0.913	0.921	0.934	0.937	0.931	0.913
AIC	-548479.1	-196404.3	-67424.3	-83152.2	-82062.5	-548654.4

Notes: CA Effects are dummies for internal and 500m buffer rings around all CAs, a dummy for unknown designation date, and post x update interactives for the internal and external area. See the data section for a description of control variables. Models include full set of dummy variables denoting missing observations in location attributes. Standard errors in parentheses and clustered on fixed effects.. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**Fig. 3** Time-varying designation effects

Note: Estimates are based on specification (32) using the same control variables and the control group as in Table 3, column 1 (left) and 2 (right). Black (grey) solid lines indicate the point estimates for the area inside newly designated conservation areas (in the 500m buffer). Dashed lines indicate the 95% confidence intervals.

## 5 Conclusion

Historic preservation policies are among the most significant planning policies used to overcome coordination problems in the market internationally. These policies aim at increasing social welfare at the cost of restricting individual property rights. From the perspective of owners of properties in conservation areas, the policy may help solving a collective action problem, preventing owners from freeriding on the heritage character of nearby buildings while inappropriately altering their own property. If property owners value the heritage character of nearby buildings and can influence the designation process they will seek to choose a (local) level of designation where the marginal costs of designation equate the marginal benefits. An increase in the marginal benefit of designation will lead to an increase in designation activity. If the policy is Pareto-efficient, additional designations in a neighbourhood will not lead to an adverse impact on those being designated. We provide evidence that is supportive of this scenario.

We propose a theory of heritage conservation where the optimal level of designation is determined by the trade-off of costs and benefits of the policy. The model hypotheses lead us to two testable predictions. Firstly, an increase in preferences for heritage in a neighbourhood will increase the benefits of the preservation and therefore the optimal designation amount. Secondly, if the planner behaves in the hypothesized Pareto optimal manner we expect a zero policy effect for new designations (and a positive effect for nearby areas).

We test our first prediction using educational level as a proxy for preferences for heritage. We estimate a tobit model at the neighbourhood level and find a causal effect of an increase in degree share on an increase in designation share. The implication of this result is that neighbourhood demographic characteristics are a significant factor in determining the level of historic preservation or in other words, gentrification can lead to designation.

We test our second prediction using a micro-level dataset of housing transaction prices and a particularly rich set of property and location attributes. With this dataset we find a positive premium of 8.5% inside conservation areas and confirm the existence of spatial externalities significant up to 500m. We employ a difference-in-difference approach to estimate the pure policy effect of designation. In line with our predictions we find the formal act of designation not to exhibit a statistically significant impact on property prices inside a conservation area. This finding is robust to the consideration of a range of carefully selected properties outside the newly designated areas that make for a comparison. Also in line with our predictions we find a significant positive premium for properties lying just outside the boundaries of new designation.

Together, the evidence provided suggests that the preservation policy shows signs of agent-type behaviour in the interest of property owners. Either, the policy is deliberately Pareto-maximizing local owner welfare, or as suggested in the literature on the political economy of housing markets, homeowners are able to successfully influence the outcome of local policies in their interest. In this case, owners would make use of the policy to solve a collective action problem. In any case, our results show that – on average – our results demonstrate that local owners are not being negatively affected by the policy and the restriction it imposes onto their property rights.

## Literature

- Ahlfeldt, G. M. (2011). Blessing or Curse? Appreciation, amenities and resistance to urban renewal. *Regional Science and Urban Economics*, 41(1), 32-45.
- Ahlfeldt, G. M., & Maennig, W. (2010). Substitutability and Complementarity of Urban Amenities: External Effects of Built Heritage in Berlin. *Real Estate Economics*, 38(2), 285-323.
- Ahlfeldt, G. M., & Maennig, W. (2011). Homeownership and NIMBYism: A Spatial Analysis of Aircraft Noise. *SERC Discussion Paper 85, Revise & Resubmit: Journal of Public Economics*.
- Asabere, P. K., Hachey, G., & Grubaugh, S. (1989). Architecture, Historic Zoning, and the Value of Homes. *Journal of Real Estate Finance and Economics*, 2(3), 181-195.
- Asabere, P. K., & Huffman, F. E. (1994). Historic designation and residential market values. *Appraisal Journal*, 62(3), 396.
- Asabere, P. K., Huffman, F. E., & Mehdian, S. (1994). The Adverse Impacts of Local Historic Designation: The Case of Small Apartment Buildings in Philadelphia. *Journal of Real Estate Finance & Economics*, 8(3), 225-234.
- Avrami, E. M., R. and Torre, M. (2000). *Values and Heritage Conservation Los Angeles*: The Getty Conservation Institute.
- Botrill, C. (2005). Homes in Historic Conservation Areas in Great Britain: Calculating the Proportion of Residential Dwellings in Conservation Areas. Environmental Change Institute.
- Brueckner, J. K., Thisse, J.-F., & Zenou, Y. (1999). Why Is Central Paris Rich and Downtown Detroit Poor? An Amenity-Based Theory. *European Economic Review*, 43(1), 91-107.
- Brunner, E., & Sonstelie, J. (2003). Homeowners, property values, and the political economy of the school voucher. *Journal of Urban Economics*, 54(2), 239-257.
- Brunner, E., Sonstelie, J., & Thayer, M. (2001). Capitalization and the Voucher: An Analysis of Precinct Returns from California's Proposition 174. *Journal of Urban Economics*, 50(3), 517-536.
- Cellini, S. R., Ferreira, F., & Rothstein, J. (2010). The value of school facility investments: Evidence from a dynamic regression discontinuity design. *The Quarterly Journal of Economics*, 125(1), 215-261.
- Cheshire, P. C., & Hilber, C. A. L. (2008). Office Space Supply Restrictions in Britain: The Political Economy of Market Revenge\*. *The Economic Journal*, 118(529), F185-F221.
- Cheshire, P. C., Hilber, C. A. L., & Kaplanis, I. (2011). Evaluating the Effects of Planning Policies on the Retail Sector: Or do Town Centre First Policies Deliver the Goods? *SERC Discussion Papers* 66, 1-34.
- Cheshire, P. C., & Sheppard, S. (1995). On the Price of Land and the Value of Amenities. [Article]. *Economica*, 62(246), 247-267.
- Coulson, N. E., & Lahr, M. L. (2005). Gracing the Land of Elvis and Beale Street: Historic Designation and Property Values in Memphis. *Real Estate Economics*, 33(3), 487-507.
- Coulson, N. E., & Leichenko, R. M. (2001). The Internal and External Impact of Historical Designation on Property Values. *Journal of Real Estate Finance & Economics*, 23(1), 113-124.
- Davis, M. A., & Ortalo-Magné, F. (2011). Household expenditures, wages, rents. *Review of Economic Dynamics*, 14(2), 248-261.
- Dehring, C. A., Depken, C. A., & Ward, M. R. (2008). A direct test of the homevoter hypothesis. *Journal of Urban Economics*, 64(1), 155-170.
- Fischel, F. A. (2001a). *The Homevoter Hypothesis* (Vol. Cambridge, MA.): Harvard Univ. Press.
- Fischel, F. A. (2001b). Why Are There NIMBYs? *Land Economics*, 77(1), 144-152.
- Florida, R. (2002). Bohemia and economic geography. *Journal of Economic Geography*, 2(1), 55.

- Glaeser, E. L. (2011). *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*: The Penguin Press HC.
- Glaeser, E. L., Kolko, J., & Saiz, A. (2001). Consumer city. *Journal of Economic Geography*, 1(1), 27-50.
- Halvorsen, R., & Palmquist, R. (1980). The Interpretation of Dummy Variables in Semilogarithmic Equations. *American Economic Review*, 70(3), 474-475.
- Hilber, C. A. L., & Mayer, C. J. (2009). Why Do Households Without Children Support Local Public Schools? *Journal of Urban Economics*, 65(1), 74-90.
- Hilber, C. A. L., & Vermeulen, W. (2010). The impacts of restricting housing supply on house prices and affordability. *Department for Communities and Local Government Report*.
- HM Government. (2010). *The Government's Statement on the Historic Environment for England*. London: DCMS.
- Holman, N., & Ahlfeldt, G. M. (2012). No escape? The coordination problem in heritage preservation. *Working Paper*.
- Koster, H. R. A., Van Ommeren, J. N., & Rietveld, P. (2012). Upscale Neighbourhoods: Historic Amenities, Income and Spatial Sorting of Households. *Mimeo, VU University Amsterdam*.
- Lazrak, F., Nijkamp, P., Rievald, P., & Rouwendal, J. (2011). The market value of listed heritage: An urban economic application of spatial hedonic pricing.
- Leichenko, R. M., Coulson, N. E., & Listokin, D. (2001). Historic Preservation and Residential Property Values: An Analysis of Texas Cities. *Urban Studies*, 38(11), 1973-1987.
- Noonan, D. S., & Krupka, D. J. (2011). Making—or Picking—Winners: Evidence of Internal and External Price Effects in Historic Preservation Policies. *Real Estate Economics*, 39(2), 379-407.
- Oates, W. E. (1969). The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. *Journal of Political Economy*, 77(6), 957-971.
- Pendlebury, J. (2009). *Pendlebury*. London: Routledge.
- Rossi-Hansberg, E., Sarte, P.-D., & Owens, R. (2010). Housing Externalities. *Journal of Political Economy*, 118(3), 485-535.
- Schaeffer, P. V., & Millerick, C. A. (1991). The impact of historic district designation on property values: An empirical study. *Economic Development Quarterly*, 5(4), 301-312.
- Stock, J. H., Wright, J. H., & Yogo, M. (2002). A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments. *Journal of Business & Economic Statistics*, 20(4), 518-529.
- Strange, I. a. W., D. (2003). The changing roles and purpose of heritage conservation in the UK. *Planning Practice and Research*, 18(2-3), 219-229.