The impact of historic preservation policies on housing values

Are Oust & Ida Q. Nesset

Historic preservation dwellings offer qualities that benefit to both owners and society. At the same time, the preservation politics might involve some cost and restrictions. Although a large number of studies have aimed to assess the impact of historic preservation on housing values, this study is to our knowledge the first investigated whether the observed historic preservation premium is due to the changed juridical status (a policy effect) or to qualities that are observed by the buyers that are unobserved in the model. By using a unique data set that combines data of preserved historic dwellings in Oslo, Norway, and data from the housing market from 1990 to 2017, we study sales prices for the same dwellings both before and after the event of historic preservation. The higher prices of preserved historic dwellings seem to be caused, by qualities in the dwellings that correlate with the forthcoming historic preservation, not by the policy event itself.

Keywords: Historic preservation; housing policies; housing values; fixed effects; differences-in-differences

Introduction

Historic preserved dwellings offer qualities that benefit both owners, users and society in general. Various historic preservation policies may be put into action to preserve and safeguard these qualities for present and future generations "as part of our cultural heritage and identity and as an element in the overall environment and resource management" (Cultural Heritage Act, 1978). The various historic preservation policies limit the possibility of intervention by the homeowner as it usually mandates maintenance of the dwelling. In principle, maintenance should safeguard original materials and details as far as possible. Any measure beyond regular maintenance requires permission of the appropriate authority, and may further increase costs related to the maintenance and insurance of the dwelling, in addition to time spent on maintenance, etc. However, professional support and financial compensation to the homeowners because of increased costs in the case of reconstruction, protection and maintenance of preserved historic dwellings can at best equalize the restrictions followed by the historic preservation policies.

Ahlfeldt and Maenning (2010) argues that a critical aspect of the heritage preservation policy is balancing the cost of preservation between owners and society. One can further that if the owners achieves a price increase on their dwelling due to the change in juridical status (policy effect) it is natural that they take greater part of the cost than if there is no price increase and that the benefits from historical preservation for the most parts benefits the society in general.

To value built heritage, previous studies mainly employ hedonic methods to control for the heterogeneous nature of dwellings when assessing the impact of historic preservation policies on housing values. Amongst the first studies, Ford (1989) suggests that homebuyers pay a premium for homes located within historic preserved districts in Baltimore, MD, USA, which is confirmed by more recent studies, e.g., in Texas, USA (Leichenko et al., 2001). Yet another early study in Chicago, IL, USA suggests that the impact of historic preservation on housing values depends upon whether the historic preservation is put into action by national or local authorities (Schaeffer and Millerick, 1991). Historic preservation orders from national (local) authorities have positive (negative) effects on sales prices. The results of Asabere et al. (1994) partly confirm this, as local historic preservation impacts negatively in Philadelphia, PA, USA.

Outside the United States, there is also evidence for a positive price effect from historical preservation in Australia (Penfold 1994; Deodhar 2004), Canada (Shipley 2000) and Germany (Ahlfeldt and Maenning 2010).

Furthermore, studies of the Norwegian housing market observe significantly positive historic preservation premiums (Nome and Stige, 2016; Gierløff et al., 2017). The results of Nome and Stige (2016) suggest historic preservation premiums of 7.4%, 1.8% and 5.0% per square meter for single-family houses, apartments and small houses (townhouses and semi-detached houses) located in Oslo, Norway, respectively. In Sweden, historic preserved (non-preserved) dwellings sell for 7% (1%) more than expected market value (Kulturmiljö Halland, 2013). Similarly, findings from Denmark suggest that historic preserved single-family houses (apartments) achieve a price premium of 18% (4%) per square meter (Incentive, 2015).

Apart from Ford (2003), the mentioned studies focus on the internal effects of historic preservation. However, historic preservation of either dwellings or districts cause external effects as well, including spillover effects to neighboring housing values and socioeconomic conditions such as tourism. As pointed out in several studies (e.g., Deodahr, 2004; Ahlfeldt et al., 2012; Nome and Stige, 2016; Gierløff et al., 2017), the historic preservation premium measured using a hedonic approach includes both heritage (internal) and policy (external) effects. Preserved historic dwellings are likely to hold a number of unobserved characteristics (e.g., architectonical and aesthetic), which are well known to induce positive price premiums. The observed historic preservation premium is therefore likely to proxy for qualities that contribute to dwelling preservation in the first place, and these studies cannot ascribe historic preservation premiums to historic preservation policies. In attempting to do so, Ahlfeldt et al. (2012) employ a differences-in-differences (DiD) approach and suggest relatively small policy effects relative to heritage effects through an analysis in England including 912 historic preservations that occurred after 1995. Hedonic results in the same study suggest substantially higher premiums, which turn out to be upward bias from unobserved heritage qualities. Using a repeated sales framework, results from Chicago, IL, USA suggest that a dwelling’s sales price increases by 2% for each additional dwelling subject to a historic preservation policy within the same dwelling block (Noonan, 2007). However, using a similar approach, results by Heintzelman and Altieri (2013) suggest negative policy effects from both districts and homes in the USA, the latter being about 1%. In addition, in cases where a home subject to a historic preservation policy is also located within a historic district, these effects seem to magnify each other. Oba and Noonan (2017) employ a repeated sales framework on data from the city of Atlanta, GA, USA. Although the results show sensitivity to different model specifications, local historic districts seem to generate some positive external effects, while national historic districts seem to generate stronger positive internal effects.

We use a unique data set that combines data of preserved historic dwellings in Oslo, Norway, and data from the housing market from 1990 to 2017. Our data set includes 1269 sales prices of dwellings that were later given historic preservation status. This allows us to study sales prices for the same dwellings both before and after preservation. We address the omitted variable bias by estimating a two-way fixed effects model including a DiD estimator. Consistent with previous studies, we find a positive historic preservation premium of about 4%, when applying the hedonic model. Preserved historical dwellings have a higher price than other dwellings that are sold at the same time of similar location, type, size and age. When we test the policy effect using a two-way fixed effects model including a DiD estimator, we are not able to conclude that there is a significant positive price premium. The higher prices of preserved historic buildings seem to be caused, at least for the most part, by qualities in the dwellings observed by the buyers, but not observed in the model. Examples include higher ceilings, more elaborate facades and more elaborate interiors, all of which are qualities that might have contributed to the historic preservation of the dwelling in the first place. To our knowledge, this is the first study being the first to distinguish between the policy and omitted bias effects (the heritage effect). Our findings indicates that society and not the owners should cover most if not all of the cost of preservation.

In addition to having results from our hedonic model that are consistent with previous studies, there are also a consistency in which variables that is included, and therefore excluded. We have no reason to believe that Norwegians are the only one to have preferences and a willingness to pay towards these qualities that often are associated with historic preserved dwellings, but that are unobserved in model. If we are correct in this assumption, our results have policy implications outside the Norwegian context. In the following Section, we provide some facts about the historic preservation policies in Norway and a description of the housing market in Oslo. Next, we describe the data sets underlying the methods in use. Then we presents the results. Finally, we discuss the findings and offer some concluding remarks.

Background

Historic preservation policies in Norway

The Department for Cultural Heritage Management in Norway is responsible for developing strategies and policies within the entire field of cultural heritage. Additional responsibilities include ensuring that Norway fulfills its obligations according to UNESCO conventions on cultural heritage protection and following the European Council conventions on cultural heritage. The management of cultural heritage is allocated to the Directorate for Cultural Heritage, whose purpose is described in the Cultural Heritage Act (CHA). Cultural heritage is to be protected "in all their variety and detail, as part of our cultural heritage and identity and as an element in the overall environment and resource management" (Cultural Heritage Act, 1978). Monuments and sites worthy of historic preservation have undergone a cultural history assessment and been identified as worth preserving because the owner or user, or the society in general, benefits from the various qualities offered by the monument or site. Historic preservation policies ensure that these qualities exist for present and future generations.

In Norway, the most important legislative instruments that help to preserve and manage cultural heritage are the CHA and the Planning and Building Act (PBA). Built heritage originating from 1537 to 1649 is automatically protected by law. Built heritage originating from different periods requires individual protection orders granted on a case-by-case basis. Built heritage of national significance is subject to the CHA, whereas built heritage of regional or local value is subject to the less strict policy, the PBA. These policies imply, to different degrees, restrictions on the owner or the user of the built heritage. These policies also usually detail restrictions related to maintenance, which, in principle, should safeguard original materials and details as far as possible. Any measure beyond regular maintenance requires permission of the relevant authority and may further increase costs related to maintenance insurance of the building, in addition to time spent on maintenance, etc. Such restrictions make it challenging to preserve and manage built heritage and may affect housing values negatively. However, the owner or user of the built heritage can apply for financial and professional support because of increased costs associated with reconstruction, protection and maintenance. In addition, homeowners of dwellings subject to the CHA are exempt from property taxes. These circumstances may affect housing values positively and can at best equalize the restrictions followed by the historic preservation policies.

Nevertheless, private and local commitments are crucial for successful preservation and management of cultural heritage, which points to the importance of balancing restrictions and benefits to the owner or user.

Through an analysis of how the different historic preservation policies affect buildings in Norway, Nesbakken et al. (2015) find that buildings subject to the CHA rarely change. However, many buildings are subject to decay because of a lack of necessary maintenance. At the same time, few buildings are lost, which could be because of the responsibility of the owner to preserve the building. This may indicate a need for policy revisions to prevent preservation rules by the CHA from being ineffective. Buildings subject to the PBA, however, change more often, and relatively few are threatened by decay. The PBA hence seems to succeed with its balance between restrictions and benefits compared with the CHA. In fact, a social survey conducted in Norway suggests that a substantial part of the respondents meant that a heritage should only be historic preserved if new use was possible (Koziot and Einen, 2016). Apparently, the different policies affect buildings in Norway differently.

Oslo housing market

Our study area is Oslo, the capital city of Norway, which is both a county and a municipality. As of 2017, the municipality of Oslo had a population of approximately 670,000, while metropolitan Oslo had a population of more than one million. In the second half of the nineteenth century, both the population and activity in the construction sector increased sharply. Construction boomed in the 1870s, 1880s and 1890s, when a large part of Oslo's current inner city was built. Typically, the buildings were four- or five-story brick apartments. The late nineteenth century also saw segregation between the rich western part of the city and the poorer eastern quarters. Large factories were located alongside the Akerselva, a river in the east of the city, and around them, many high-density, low-standard rental blocks for workers were constructed. This pattern continued for several decades and can probably explain much of the price difference between east and west today. The city boundary has been enlarged several times over the past century. The enlargements of 1859 and 1878 added many wooden residential buildings to the city's housing stock. The biggest enlargement took place in 1948, when the Aker region was added. After the

Second World War and up to the 1980s, construction of residential buildings in Oslo mainly occurred in the new suburbs of the former Aker region.

We refer to the city districts that became a part of Oslo following the enlargement in 1948 as the outer city and to the pre-1948 city districts as the inner city. Figure 1 shows the 15 city districts in Oslo. The inner-city districts are typically more expensive than the outer, and the western city districts are typically more expensive than the eastern. We have grouped the city districts Ullern, Vestre Aker and Nordre Aker and named them as Oslo Vest (Oslo West), treated Grünerløkka and Sagene as one district and named the outer eastern city districts Alne, Bjerke Grorud Nordstrand, Stovner, Søndre Nordstrand and Østensjø as Oslo Øst (Oslo East).

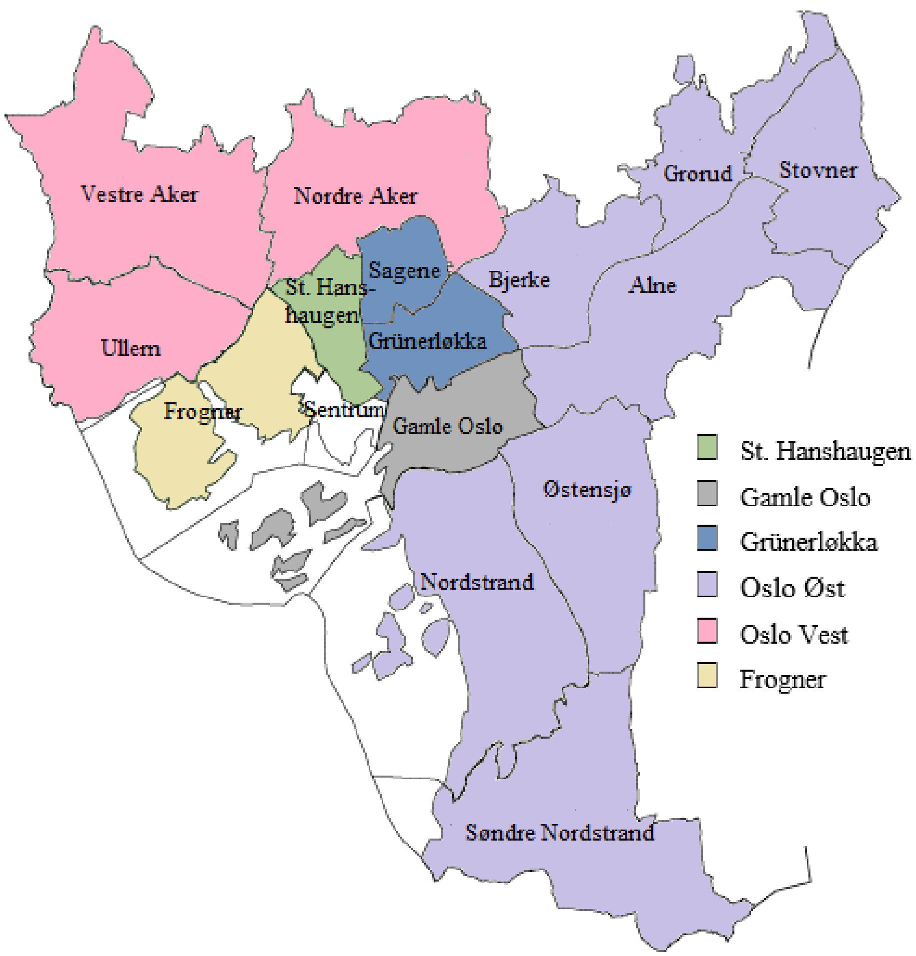

Figure 1. The figure shows the 15 city districts in Oslo and how they are grouped in this paper.

Data

This study combines data from two main data sources. The first source is an up-to-date list of all buildings worthy of protection received from the Cultural Heritage Management Office in Oslo in January 2017. The list includes all buildings constructed after 1600, constituting nearly 13,000 buildings. The list includes buildings of all types, such as schools, commercial properties and storehouses. This study concentrates on dwellings. The list includes each dwelling's address, building type, type of historic preservation, construction year and date or year of historic preservation, as well as a short description. The second data source we make use of is the Norwegian property register. Various providers make the property register available online. Our data are collected from the source Eiendomsverdi.no. By using this address, the construction year and the dwelling description from the list of all buildings worthy of protection by the Cultural Heritage Management Office in Oslo, we were able to combine the two data sets.

The Norwegian property register is organized in such a way that it includes all formal transactions of a property with price and transaction date. We make use of this data to construct a panel data set over the period from 1990 to 2017. We also make use of Eiendomsverdi.no to register dwelling type, size and city district, in addition to price, transaction date and construction year. We also construct a control data set from Eiendomsverdi.no including data on non-preserved historical dwellings.

Transactions in the Norwegian housing market are similar to an English auction where buyers compete with open bids and the highest wins the auction, which should give us a fair valuation of the dwellings. Eiendomsverdi.no marks non-normal market transactions, which might be transactions within the family, transitions where only a share of a dwelling has changed owners or where the price indicates an error in the registration of the transaction. We exclude all non-normal market transactions.

Descriptive statistics

Table 1 presents descriptive statistics of the hedonic data. We have sales price data on 1269 dwellings that were subsequently given historic preservation. To obtain more robust results than previous studies applying hedonic pricing models, we divide the data set using the event of historic preservation as a cut-off, resulting in two data sets: *pre*-historic preservation and *post*-historic preservation. We are thus able to check whether dwellings have the same price premiums before the event of historic preservation.

Table 1. Descriptive statistics.

	Pre-historic preservation			**Post-historic preservation**		
	Total	Historic preserved	Control	Total	Historic preserved	Control
Location						
St. Hanshaugen	379	97	282	1126	844	282
Gamle Oslo	395	121	274	799	522	277
Grünerløkka and Sagene	1257	616	641	2072	1417	655
Oslo vest	2298	199	2099	2304	184	2120
Oslo øst	3223	59	3164	3387	158	3229
Frogner	436	177	259	2,247	1959	288
Total	7988	1269	6719	11,935	5084	6851
Dwelling type						
Single-family house	1218	61	1157	1466	175	1290
Apartment	4688	1113	3575	8011	4437	3575
Townhouse	1157	34	1123	1313	190	1123
Semi-detached house	925	61	864	1145	282	863
Total	7988	1269	6719	11,935	5084	6851
Year of construction						
Prior to 1987	5386	1250	4136	9245	4986	4259
1987−1996	878	8	870	910	38	872
1997−2006	904	8	896	932	34	898
From 2007	815	1	814	831	13	818
Total	7983	1267	6716	11,918	5070	6851
Size (square meters)						
Very small [0,40>	424	77	347	985	634	351
Small [40,80>	3204	814	2390	4903	2493	2410
Medium [80,120>	1772	247	1525	2451	917	1534
Large [120,300>	2495	100	2395	3458	981	2477
Very large [300>	93	31	62	138	59	79
Total	7988	1269	6719	11,935	5084	6851

We now utilize the fact that several of the dwellings sold more than once during the sample period. Table 2 presents descriptive statistics of the panel data. The data are unbalanced as the dwellings are not traded at given times or in given intervals. The panel data set consists of 13,265 sale price observations of 6752 dwellings with an average number of two sales per dwelling. Historic preservation policies have been applied to 2851 (42%) of these dwellings.

Table 2. Descriptive statistics.

	Descriptive statistics		
	Overall freq. (%)	Between freq. (%)	Within (%)
Location			
St. Hanshaugen	1224 (9.23)	628	(100)
Gamle Oslo	925 (6.97)	485	(100)
Grünerløkka and Sagene	2693 (20.3)	1322	(100)
Oslo vest	2525 (19.04)	1305	(100)
Oslo øst	3465 (26.12)	1981	(100)
Frogner	2433 (18.34)	1031	(100)
Total	13,265 (100)	6752 (100)	(100)
Dwelling type			
Single-family house	1584 (11.94)	1065 (15.77)	(100)
Apartment	9127 (68.81)	4089 (60.56)	(100)
Townhouse	1347 (10.15)	842 (12.47)	(100)
Semi-detached house	1207 (9.1)	756 (11.2)	(100)
Total	13,265 (100)	6752 (100)	(100)
Year of construction			
Prior to 1987	10,553 (79.56)	5303 (78.54)	(100)
1987−1996	918 (6.92)	427 (6.32)	(100)
1997−2006	940 (7.09)	468 (6.93)	(100)
From 2007	832 (6.27)	539 (7.98)	(100)
Total	13,243 (99.84)	6737 (99.77)	(100)
Size (square meters)			
Very small [0,40>	1062 (8.01)	518 (7.67)	(100)
Small [40,80>	5719 (43.11)	2547 (37.72)	(100)
Medium [80,120>	2717 (20.48)	1377 (20.39)	(100)
Large [120,300>	3590 (27.06)	2179 (32.27)	(100)
Very large [300>	177 (1.33)	131 (1.94)	(100)
Total	13,265 (100)	6752 (100)	(100)
Historic preservation			
Cultural Heritage Act	1280 (9.65)	603 (8.93)	(100)
Planning and Building Act	5073 (38.24)	2248 (33.29)	(100)
Historic preservation	6353 (47.89)	2851 (42.22)	(100)
Non-preserved	6912 (52.11)	3901 (57.78)	(100)
Total	13,265 (100)	6752 (100)	(100)

Methods

Most studies that examine the price effect of historic preservation have used a simple hedonic model to measure the effect. In order to study the price effect of historic preservation policies, we apply the method developed by Olaussen et al. (2017). First, we reproduce the hedonic model used in earlier studies, and then we control to see if the same price premiums also existed before the event of historic preservation. We then expand upon previous studies by employing a two-way fixed effects model including a DiD estimator to quantify the policy effect itself.

Hedonic models

We start with a simple hedonic model to verify that our results and data are similar to those used in earlier studies. Hedonic models are appropriate when valuing composite products, such as housing assets, which possess several attributes (including historic preservation) that constitute the overall value. We estimate a hedonic time dummy equation of the form

$$\ln(P_{it}) = \gamma_0 + \delta_t + \sum_k \alpha_k \, c_{kit} + e_{it} \qquad (1)$$

where P is the transaction price per square meter, c is a set of explanatory variables for the presence of certain characteristics, k, the time period t (t = 1, …, T), and the residential property, i. We let the term δ represent the year dummy coefficients, controlling for the time trend in the house prices. Finally, we have the error term, e. We apply a log-linear functional form.

In order to study the policy effect itself, we apply the method developed in Olaussen et al. (2017). After reproducing the hedonic model from earlier studies, we run the same hedonic model using the data prior to the historic preservation to see whether the same price premiums existed *before* the historic preservation.

Two-way fixed effects model

We consider the event of historic preservation as a quasi-experiment. Recall that our data set consists of historic preserved and non-preserved dwellings and that we have recorded transactions from both pre- and post-historic preservation periods. Despite the randomness introduced by variations in individual circumstances that make the event appear randomly assigned, there might be remaining differences (Stock and Watson, 2012). We use the DiD approach to address this issue.

Because of the panel structure of the data, we apply two different estimators to search for causal relationships, where each of them makes use of transformation techniques to account for unobserved effects. In cases where unobserved effects are likely to correlate with the included explanatory variables, a fixed effects transformation might be preferable to excluding the time-invariant component of the error term. During the fixed effects transformation, the variables are time-demeaned for each unit, which makes the estimator explore the relation between transaction price per square meter and the presence of historic preservation *within* a unit. When including a dummy for events of historic preservation, its coefficient reports how much the mean value of the transaction price per square meter changes when dwellings change from non-preserved to historic preserved, which is made possible when the transaction price per square meter from before and after the historic preservation is known. We thus assess the price effect from the new information provided by the event of historic preservation itself.

If, however, we assume that the error term is not correlated with the included explanatory variables, a random effects transformation might be preferable. We estimate both fixed and random effects models, although the fixed effects model seems more reasonable because of unobserved effects such as architectural and aesthetic quality, which are likely to be constant over time and therefore correlated with the included explanatory variables. Although we make use of the Hausman specification test (Hausman, 1978), we compare the consistent fixed effects model with the efficient random effects model. Note that the time-invariant explanatory variables drop out during the fixed effects transformation.

The classical DiD estimator involves two periods, one treatment group and one control group. In our case, we operate with more than two periods as the time at which dwellings are subject to the action of historic preservation differ. We therefore generalize the DiD estimation (see e.g., Bertrand et al., 2004) and estimate an equation of the form

$$Y_{st} = \theta_s + \delta_t + \beta T_{st} + \varepsilon_{st} \qquad (2)$$

where θ is the fixed effects for groups. The term δ still represents the year dummy coefficients. T is a binary variable equal to 1 if the treatment is in place in treatment group s in year t. The term β measures the estimated impact of the action of legal protection, and ε_{st} is the error term. Including both group and year fixed effects, the generalized DiD turns out to be a two-way fixed effects model. The intuition of the estimation is the same as in the case of the classical DiD; we assume that the outcome, transaction price per square meter, follows a common trend through time in the absence of the event of historic preservation.

Results

Hedonic results

Based on equation (1), we estimate a two-period hedonic time-dummy pricing model: post-historic preservation (Model 1) and pre-historic preservation (Model 2). The baseline dwelling in both models is an apartment smaller than 40 square meters located in Frogner, constructed before 1987 and sold in 2014. The baseline dwelling is also not subject to any legislative instruments. The intercept in Model 1 is 11.17248, which equals NOK 71,145 per square meter. The controls are highly significant with the expected signs, except for the dummy variable “Townhouses”, possibly because of similarities to the baseline dwelling type. All locations other than the baseline “Frogner” influence the transaction price per square meter negatively, which makes sense, as Frogner is considered the most expensive residential area in Norway. Both single-family and semi-detached houses sell for more than apartments. For year of construction, the results suggest that newer constructed dwellings sell for a premium compared with older constructed dwellings. Transaction price per square meter further declines with the dwelling size. Finally, the time dummies seem to constitute a reasonable price index.

Table 3. Historic preservation and transaction prices, hedonic models.

	Model 1 (post-)		**Model 2 (pre-)**	
	Coef.	Std. Err.	Coef.	Std. Err.
Historic preservation	0.041737***	0.0063789	−0.0093993	0.0087965
St. Hanshaugen	−0.1063096***	0.0083515	−0.1412581***	0.0155349
Gamle Oslo	−0.2615222***	0.0096031	−0.2454613***	0.0154633
Grünerløkka and Sagene	−0.1929895***	0.0073515	−0.2131153***	0.0126038
Oslo vest	−0.1140858***	0.0083677	−0.1187121***	0.0119541
Oslo øst	−0.3977271***	0.008171	−0.4200349***	0.0118874

Single-family houses	0.0866677***	0.0084959	0.0487755***	0.0103969
Townhouses	0.004025	0.007988	−0.0112915	0.0094547
Semi-detached houses	0.0580544***	0.0083831	0.0335165***	0.0102812
Year of const. 2007−2017	0.1526853***	0.0085067	0.1586989***	0.008598
Year of const. 1997−2006	0.1179553***	0.0080802	0.1196905***	0.0081397
Year of const. 1987−1996	0.0329193***	0.0081566	0.0417334***	0.0082223
Small	−0.1751595***	0.0077988	−0.2060601***	0.0113411
Medium	−0.2609533***	0.0087216	−0.2858381***	0.0123964
Large	−0.3462156***	0.0094582	−0.3723617***	0.0138015
Very large	−0.402719***	0.0215226	−0.4203988***	0.026821
1990	−1.74032***	0.0304961	−1.691483***	0.0242336
1991	−1.832094***	0.0233446	−1.9058***	0.0211439
1992	−1.878995***	0.0219037	−1.838208***	0.0224336
1993	−1.957151***	0.0216443	−1.963885***	0.02266
1994	−1.713997***	0.0211982	−1.729608***	0.0220598
1995	−1.654***	0.018239	−1.660304***	0.0179052
1996	−1.526734***	0.0169229	−1.550717***	0.017778
1997	−1.376599***	0.0178638	−1.358196***	0.0183569
1998	−1.192288***	0.0173659	−1.178651***	0.0184706
1999	−1.024031***	0.0171145	−1.068139***	0.0182698
2000	−0.8777361***	0.0166295	−0.8770553***	0.0175365
2001	−0.7378332***	0.0147901	−0.7662977***	0.0163358
2002	−0.7163953***	0.0139561	−0.7209961***	0.0151165
2003	−0.7430563***	0.0132797	−0.7286717***	0.0143677
2004	−0.646888***	0.012738	−0.6042976***	0.0145255
2005	−0.5510403***	0.012081	−0.5364509***	0.0145463
2006	−0.409626***	0.0106947	−0.4241847***	0.0151098
2007	−0.3088279***	0.0114004	−0.3409201***	0.0167443
2008	−0.3385498***	0.0119768	−0.359516***	0.0166621
2009	−0.3112968***	0.0118795	−0.3269082***	0.016394
2010	−0.2471822***	0.0106135	−0.2416422***	0.0152274
2011	−0.1519549***	0.0109717	−0.1447365***	0.0157188
2012	−0.0868534***	0.0108228	−0.0932749***	0.0163993
2013	−0.044757***	0.0106367	−0.0661683***	0.0141306
2015	0.1125159***	0.0099869	0.0682878***	0.0144229
2016	0.2285611***	0.0072322	0.2236903***	0.0079278
2017	0.4301236***	0.0429371	0.5613151***	0.2163432
Constant	11.17248***	0.0109839	11.22576***	0.0158317
Adj. R-square	0.8602		0.8913	
Number of obs.	11,935		7,988	

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table note: “Historic preservation” is a dummy variable that equals 1 if legally protected and 0 otherwise. The dummies “St. Hanshaugen”, “Gamle Oslo”, “Grünerløkka and Sagene”, “Oslo vest” and “Oslo øst” are dummies for different locations in Oslo, where “Frogner” is the baseline. The dummies “Single-family houses”, “Townhouses” and “Semi-detached houses” are dummies for different dwelling types where “Apartments” are the baseline. The dummies “Small”, “Medium”, “Large” and “Very large” allow square meter prices to be different at different square meter levels where “Very small” is the baseline. The dummies “Year of const. 2007−2016”, “Year of const. 1997−2006” and “Year of const. 1987−1996” are dummies for different periods of construction where construction year prior to 1987 is the baseline. The year dummies have a baseline in 2014. Dependent variable: natural logarithm of transaction prices per square meter.

The variable of interest, “Historic preservation”, is highly significant. Preserved historic dwellings are expected to sell for about 4% more per square meter, ceteris paribus. This result is consistent with the majority of previous studies applying the hedonic approach. We test whether the variable of interest has any explanatory power even before the event of historic preservation. From the results of Model 2, presented in Table 3, “Historic preservation” is negative and insignificant, which implies that the observed price premium is the consequence of the action of historic preservation itself. The controls do not change significantly.

Finally, we assess the impact of the various historic preservation policies on housing values. Creating dummies for the two acts of legislation, we estimate a hedonic time dummy equation similar to equation (1) (Table 4). We only discuss the variables of interest, as the controls show only small changes. In Model 3, the post-historic preservation model, both variables are positive and significant. The coefficient of the CHA is of greater magnitude (about 7%) than the coefficient of the PBA (about 4%). This makes sense, as dwellings subject to the former are more valuable. Hence, the CHA does not seem to lead the most significant buildings into decay, as suggested by Nesbakken et al. (2015). However, in Model 4, the pre-historic preservation model, the coefficient of the PBA is negative and significant at the 5% level (about 2%). We suspect that the event of historic preservation and the time of renovation may be correlated, considering that historic preservation by the PBA implies fewer restrictions, but yet comparable opportunities for funding, compared with historic preservation by the CHA. The coefficient of CHA is insignificant.

Table 4. Historic preservation and transaction prices, fixed and random effects model.

	Model 5 (fixed effects)		**Model 6 (random effects)**	
	Coef.	Std. Err.	Coef.	Std. Err.
DiD (historic preservation)	0.0433449***	0.0085318	0.1124463***	0.0055791
1990	−1.744015***	0.0184391	−1.711575***	0.017531
1991	−1.887609***	0.015362	−1.862244***	0.0147632
1992	−1.933198***	0.0157154	−1.912514***	0.0150549
1993	−1.97017***	0.0150786	−1.955955***	0.0144621
1994	−1.755816***	0.0146314	−1.732976***	0.0141524

1995	−1.665112***	0.0127979	−1.65075***	0.012263
1996	−1.577018***	0.012107	−1.5543***	0.0116711
1997	−1.38141***	0.0123394	−1.364482***	0.0119235
1998	−1.208167***	0.0125155	−1.193742***	0.0120842
1999	−1.037807***	0.0125148	−1.021314***	0.012022
2000	−0.8724405***	0.0121045	−0.8591824***	0.0116304
2001	−0.7843372***	0.0108377	−0.7601144***	0.0104223
2002	−0.7369122***	0.0104175	−0.7217368***	0.0098773
2003	−0.7589806***	0.0098564	−0.7360341***	0.0093085
2004	−0.6174571***	0.0097866	−0.6036884***	0.0091563
2005	−0.5461812***	0.0095899	−0.5331475***	0.009044
2006	−0.4307487***	0.0090518	−0.4224622***	0.0085393
2007	−0.316241***	0.0095522	−0.3116842***	0.0090943
2008	−0.3522508***	0.0099569	−0.3491129***	0.009525
2009	−0.3244261***	0.0099593	−0.3196632***	0.0094673
2010	−0.257726***	0.0089659	−0.247784***	0.008488
2011	−0.1592093***	0.0091757	−0.151048***	0.0087216
2012	−0.0800736***	0.0095586	−0.077002***	0.0089118
2013	−0.0556351***	0.0097185	−0.0521436***	0.0089828
2015	0.1049001***	0.0118251	0.1311175***	0.0095438
2016	0.2790965***	0.0124776	0.187274***	0.0076368
2017	0.385367***	0.0372792	0.3991025***	0.0355094
Constant	10.78862***	0.0054925	10.75152***	0.0054041
R-square				
Within	0.9379		0.9365	
Between	0.6687		0.6893	
Overall	0.8045		0.8163	
Rho	0.78730285		0.72523422	
Number of obs.	13,265		13,265	
Number of groups	6752		6752	

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.
Table note: The DiD equals 1 if the treatment is in place in the treatment group *s* in year *t*. The year dummies have a baseline in 2014. Min. (avg.) max. obs. per group: 1 (2) 11. Dependent variable: natural logarithm of transaction prices per square meter.

Two-way fixed effects results

We now turn to the results presented in Table 5 for both the fixed effects (Model 4) and random effects (Model 6). Under the current specification, the Hausman specification test (Hausman, 1978) rejects that a random-effects model adequately models the group effects[1]. Henceforth, we

[1] Hausman specification test statistics: χ^2 (28) = 275.60. Prob. > χ^2 = 0.0000.

focus on the fixed effects result. Even when addressing the omitted variable bias, the result remains about the same. Historic preservation is, on average, expected to command a policy price premium of about 4%.

Table 5. Historic preservation and transaction prices in the city districts of Grünerløkka and Sagene, fixed effects models.

	Model 8		**Model 9**	
	Coef.	Std. Err.	Coef.	Std. Err.
DiD (historic preservation)	−0.0156688	0.0150264		
DiD (Cultural Heritage Act)			−0.0214057	0.0158521
DiD (Planning and Building Act)			0.003034	0.0222987
Constant	10.9095***	0.0135767	10.90627***	0.01387
Time dummies	Yes		Yes	
R-square				
Within	0.9554		0.9554	
Between	0.8099		0.8091	
Overall	0.8828		0.8826	
Rho	0.70057036		0.70151386	
Number of obs.	2693		2693	
Number of groups	1322		1322	

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.
Table note: The DiD variables equal 1 if the treatment is in place in treatment group *s* and year *t* for historic preservation in general (Model 8) and for the different acts of legislation (Model 9). The baseline year for the year dummies is 2014. Min. (avg.) max. obs. per group: 1 (2) 10. Dependent variable: natural logarithm of transaction prices per square meter.

Assessing the impact of the different historic preservation policies on housing values, the results suggest that dwellings subject to the PBA enjoy a higher policy premium than dwellings protected by the CHA (Table 6).

Table 6. Historic preservation and transaction prices excluding dwellings constructed after 1986, fixed effects models.

	Model 10		**Model 11**	
	Coef.	Std. Err.	Coef.	Std. Err.
DiD (historic preservation)	0.0191052**	0.0090285	-	-
DiD (Cultural Heritage Act)	-	-	0.0161548	0.0132689
DiD (Planning and Building Act)	-	-	0.0210924*	0.0111541
Constant	10.8137***	0.0071958	10.81314***	0.0074342
Time dummies	Yes		Yes	
R-square				
Within	0.9401		0.9401	
Between	0.6837		0.6841	

Overall	0.8135	0.8138
Rho	0.77715528	0.77685507
Number of obs.	10,553	10,553
Number of groups	5303	5303

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.
Table note: The DiD estimators equals 1 if the treatment is in place in treatment group *s* in year *t* for historic preservation in general (Model 10) and for the different acts of legislation (Model 11). The baseline year for the year dummies is 2014. Min. (avg.) max. obs. per group: 1 (2) 11. Dependent variable: natural logarithm of transaction prices per square meter.

Results robustness tests

We perform three additional robustness tests. A disproportionately large share of the preserved historic dwellings in our data set is located in the city districts of Grünerløkka and Sagene, where house prices seem to have increased by more than the rest of the city. To exclude the possibility of our results being driven by a special price development in Grünerløkka and Sagene and not by the event of historic preservation, we rerun the regression for the city districts of Grünerløkka and Sagene only. The results are presented in Table 7. Two of the three coefficients are negative, and neither historic preservation nor historic preservation by the acts of legislation are significant.

Table 7. Historic preservation by act of legislation and transaction prices, hedonic models.

	Model 3 (post-)		**Model 4 (pre-)**	
	Coef.	Std. Err.	Coef.	Std. Err.
Cultural Heritage Act	0.0648211***	0.0106247	0.0131627	0.0131064
Planning and Building Act	0.0371555***	0.0065964	−0.0196924**	0.0098485
St. Hanshaugen	−0.106915***	0.0083522	−0.1424562***	0.0155392
Gamle Oslo	−0.2649293***	0.0096821	−0.2480933***	0.0155006
Grünerløkka and Sagene	−0.2029872***	0.0082196	−0.223627***	0.0133891
Oslo vest	−0.1179979***	0.0084885	−0.1214736***	0.0120098
Oslo øst	−0.4017092***	0.0082993	−0.4234536***	0.011975
Single-family houses	0.0875403***	0.0084997	0.0487476***	0.010394
Townhouses	0.0049455	0.007993	−0.0112214	0.0094521
Semi-detached houses	0.059448***	0.0083965	0.0339172***	0.0102798
Year of const. 2007−2017	0.1539237***	0.0085166	0.1592012***	0.0085983
Year of const. 1997−2006	0.118403***	0.0080797	0.1200003***	0.0081386
Year of const. 1987−1996	0.0325724***	0.0081554	0.041415***	0.0082212
Small	−0.176928***	0.0078239	−0.2067578***	0.011342
Medium	−0.2626319***	0.0087411	−0.2864406***	0.0123957
Large	−0.3481923***	0.0094836	−0.373486***	0.0138062
Very large	−0.4046676***	0.0215287	−0.4204877***	0.0268136
Constant	11.17775***	0.0111511	11.23014***	0.0159394
Year dummies	Yes		Yes	
Adj. R-square	0.8603		0.8914	

Number of obs.	11,935	7988

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.
¤Table note: "Cultural Heritage Act" and "Planning and Building Act" are dummy variables referring to the acts of legislation applied to residential properties regarding historic preservation. If the residential property is protected by law, the respective dummy equals 1, and 0 otherwise. The dummies "St. Hanshaugen", "Gamle Oslo", "Grünerløkka and Sagene", "Oslo vest" and "Oslo øst" are dummies for different locations in Oslo, where "Frogner" is the baseline. The dummies "Single-family houses", "Townhouses" and "semi-detached houses" are dummies for different housing types where "apartments" are the baseline. The dummies "Small", "Medium", "Large" and "Very large" allow square meter prices to be different at different square meter levels where "Very small" is the baseline. The dummies "Year of const. 2007−2016", "Year of const. 1997−2006" and "Year of const. 1987−1996" are dummies for different periods of construction where construction year prior to 1987 is the baseline. The year dummies have a baseline of 2014. Dependent variable: natural logarithm of transaction prices per square meter.

Second, to make the dwellings in the control data set more similar to the preserved historical dwellings along the age dimension, we remove dwellings constructed after 1986. The results are presented in Table 8 Here the different historic preservation coefficients are between 1.5% and 2.1%. Historic preservation is significant at the 5% level, historic preservation by the PBA is significant at the 10% level and historic preservation by the CHA is not significantly different from zero.

Table 8. Historic preservation and transaction prices, fixed and random effects model.

	Model 7	
	Coef.	Std. Err.
DiD (Cultural Heritage Act)	0.0364417***	0.0125782
DiD (Planning and Building Act)	0.0480885***	0.0106361
Constant	10.78753***	0.0056874
Time dummies	Yes	
R-square		
Within	0.9379	
Between	0.6693	
Overall	0.8051	
Rho	0.78684105	
Number of obs.	13,265	
Number of groups	6752	

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.
¤Table note: The DiD estimator equals 1 if the treatment is in place in treatment group *s* in year *t* for the different acts of legislation (Cultural Heritage Act versus Planning and Building Act). The year dummies have a baseline in 2014. Min. (avg.) max. obs. per group: 1 (2) 11. Dependent variable: natural logarithm of transaction prices per square meter.

Finally, we do not have data on renovation of dwellings. If the event of a historic preservation and the time of renovation are correlated, this might create an omitted variable bias, as discussed in hedonic result section. We believe that this correlation should be less likely for apartments than for other dwellings because the historic preservation applies to the entire building, not just to each apartment. Therefore, we reestimated our regression including apartments only and the results show only small changes.

Discussion and concluding remarks

In this paper, we extend the literature on preserved historical dwellings by, to our knowledge, being the first to distinguish between the policy and omitted bias effects. We introduce a unique panel data set from the Norwegian capital, Oslo, which covers the period 1990 to 2017. The data set includes transaction prices for 1269 dwellings that were historically preserved. Our panel data set makes it possible to treat the event of historic preservation as a quasi-experiment. We are able to study the price effect of the event of historic preservation itself, not only whether preserved historical dwellings have a higher or lower price compared with other dwellings. If we believe that preserved historical dwellings have higher (or lower) architectural and aesthetic quality than non-preserved dwellings, we need this type of panel data set to be able to separate the heritage effect from the architectural and aesthetic quality and the policy effect from the event of the historic preservation.

In order to study the price effect of the historic preservation event, we apply the method developed by Olaussen et al. (2017). First, we reestimate the hedonic model from earlier studies and obtain a similar positive historic preservation premium of about 4%. Preserved historical dwellings have a higher price than other dwellings that are sold at the same time with similar location, type, size and age. We then expand upon previous studies by employing a two-way fixed effects model including a DiD estimator to quantify the policy effect. We are not able to conclude that there is a significant positive policy price premium. The higher prices of preserved historic buildings seem to be caused mainly by qualities in the dwellings that are observable by the buyers, but not included in the model. Examples include higher ceilings, more elaborate facades, more elaborate interiors and other qualities that might have contributed to getting the dwelling historically preserved in the first place.

The main driver of our results is the household's willingness to pay for qualities often associated with historic preserved dwellings. We have no reason to believe that Norwegians are the only one with these preferences. If we are correct in this assumption, our results have policy implications outside the Norwegian context.

Regarding historical preservation as a principal agent problem, it is important for the principal (the authorities) to use incentives to influence the agent (the dwelling owners) so that the agent act in the principals' interest. If we assume that the authority's main objective with the historical preservation is to safeguard qualities with the dwellings for present and future generations, it is important that the policy do not create incentives that works against these goals. If the dwelling owner believes that a change in juridical status have a positive price effect, the dwelling owner will preserve dwellings that potentially can become historically preserved also before a potential preservation. On the other hand, if the dwelling owners believes that the historical preservation will have a negative economic impact for them, the owners have intensive to reduce the historical values of the dwellings to prevent preservation.

The principal agent problems that occurs if historical preservation does not have a positive price effect can be reduced in two main ways: First, if society cover most of the cost of preservation the principal and the agents' incentives should become more similar to the principals. Second, to reduce the financial burden that comes with society covering most of the cost, the number of new preservations should become reduced.

. We are especially concerned with the effects of historic preservation on low-quality dwellings. Dwellings in need of a more comprehensive renovation or even for which the technical value of the dwelling is negative might experience a larger negative impact from historic preservation than the average dwelling in our data set. The worst-case scenario is that the owners in fear of the price implications of historic preservation will damage or destroy properties of the dwellings that may give it historic preservation status. Our findings reveal the need for future studies to examine the price effects of historic preservation for low-quality dwellings. This includes both the dwellings where historic preservation can maximize value by safeguarding dwelling qualities for present and future generations, as well as dwellings where the policy could give incentives to damage or destroy the veritable properties of the dwelling.

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