The real price of parking policy

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Abstract. This paper is the first to empirically examine the residents' willingness to pay for on-street parking permits as well as the cost of cruising using an identification methodology based on house prices for Amsterdam. The average cost of cruising is about € 1 per day. The average residents' willingness to pay for a parking permit is about € 8 per day.

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1. Introduction

In the literature on the economics of on-street parking, parking policy has received substantial attention (Vickrey, 1969; Arnott et al., 1991; Verhoef et al., 1995; Borger and Wuyts, 2007; Proost and van Dender, 2008). A general conclusion is that, given heterogeneity of demand for on-street parking, it is welfare-improving to impose parking tariffs. Furthermore, these tariffs must be the same for different users of parking space. In reality however, parking policies discriminate between residents and non-residents. In many cities around the world, residents have access to on-street parking permits, which allow them to park at a fraction of the parking tariffs faced by other users. One plausible explanation for the presence of parking permits is that residents have voting power and impose a parking tariff structure that favours residents, including higher parking tariffs for non-residents. This reduces demand for on-street parking, and therefore decreases residents' costs due to congestion and cruising.

Economic theory implies that the provision of residential parking permits will generally induce large inefficiencies. There are exceptions, of course. The main exception is when the residents' willingness to pay for parking exceeds the willingness to pay by other users. Then, this type of policy will hardly distort the market outcome for parking. So, the first motivation of the current paper is to estimate the residents' willingness to pay for parking permits and to compare it to the on-street parking tariff, the price faced by other users.

In the economic literature, the importance of cruising for on-street parking has come to the fore (e.g., Glazer and Niskanen, 1992; Calthrop, 2002; Anderson and De Palma, 2004; Arnott and Inci, 2006; Shoup, 2005, 2006). It is generally believed that in downtown areas of large cities, due to underpricing of parking space, cruising for parking implies substantial welfare losses.[1] However, there are no empirical estimates of the costs associated with cruising. Therefore, the second motivation of this paper is to estimate the residents' private costs of cruising. This estimate is useful as an indicator of the welfare loss due to cruising time, because there is a strong link between the private and external costs of cruising. Arnott and Inci (2006) show that given the assumption that car drivers know the cruising time before finding the parking space, the external costs of cruising in a city are *equal* to the private costs of cruising.[2] Cruising may also induce additional congestion, noise, stench, dust particles and CO_2-emission and therefore will increase societal costs of travel. These external costs are *not* included in our welfare loss estimates.

In order to identify the residents' cost of cruising, we employ the idea that residents' use of private parking spaces does not require cruising, whereas the use of on-street parking may require cruising. We focus on capitalisation of private parking spaces into house prices in Amsterdam.[3] To be more precise, we focus on *outside* private parking space, because garage parking may not resemble on-street parking in many aspects (e.g., safety of the car). Furthermore, we focus on paid-parking districts, where parking permits are issued only to residents without private parking. In these districts, private parking spaces are seldom used for other purposes than for car parking (whereas this condition may not hold in other districts, where residents use their garage for storage and park their car on the street). Residents with private

[1] Traffic experts do not know what proportion of cars on downtown city streets are cruising for parking (see Arnott and Inci, 2006). Studies such as Shoup (2005) suggest that in the US the average share of traffic cruising for parking is 30 percent and the average cruising time just under 8 minutes.

[2] This result does not hold in models such as Anderson and de Palma (2004), which assume that the *expected* search time, rather than the *actual* time, is known.

[3] We make standard competitive-market assumptions about the housing market (Rosen, 1974). In a number of empirical hedonic housing price studies, the presence of private parking is included, but interpretation of the estimated effects in terms of cruising costs is not possible (e.g., Wenya and Wachs, 1998; Stevenson, 2004; Goodman and Tibodeau, 2003).

parking have no access to parking permits. A resident occupying a residence without private parking receives maximally *one* parking permit.[4] Employing information about the economic value of outside private parking in paid-parking districts allows one to estimate the residents' cost of cruising, given the assumption that residents are indifferent between the *use of* outside private parking and on-street parking (after finding a place).[5]

Using the same methodology, so using information on the effect of outside private parking on house prices, we also aim to estimate the residents' willingness to pay for parking permits. This is possible in (paid-parking) districts where eligible residents have to wait for parking permits. We emphasise that a permit offers the opportunity to park at a reduced price but does not guarantee parking space, so permit holders still have to cruise, whereas private parking owners don’t have to cruise. So, in waiting-list districts, the willingness to pay for a parking permit is equal to the economic value of a private parking space minus the cruising costs.

The outline of the paper is as follows. In Section 2, we describe the institutional environment, the data and descriptives. In Section 3 the empirical results are provided. Section 4 concludes our paper.

2. Institutional environment, data and descriptives

In Amsterdam, 9 percent of owned residences have a private parking space. Despite the small number of private parking spaces, 79 percent of residence owners own a car (calculated using the

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[4] Given the structure of parking tariffs, one may expect that the share of households with two cars in Amsterdam is less than one may expect based on characteristics of households. This has been supported by empirical evidence (see Van de Coevering et al., 2008).

[5] Ceteris paribus, some households will prefer off-street parking (e.g., those with expensive cars), whereas other households will prefer on-street parking (e.g., those who may make many trips per day). The theoretical literature on the decision between on-street and off-street (commercial) parking either assumes that car drivers are indifferent (e.g., Arnott, 2006) or assumes that drivers prefer on-street parking (Calthrop, 2001), suggesting that our estimates of cruising are conservative (too low).

Dutch Housing Survey, WBO, 2002).[6] So, the large majority of residents rely on on-street car parking and essentially all residences with private parking are occupied by car owners.

About 70 percent of residences are located in paid-parking districts. In these districts, a resident may apply for *one* parking permit (a lump-sum parking tariff), which costs on average € 0.40 per day.[7] On-street parking tariffs are much higher and are, on average, € 2.30 per hour during day time.[8] In contrast to many other cities in the world (e.g. London, Paris), there are essentially no permit-only parking areas, so on-street parking space is also available to persons without permits.

The city of Amsterdam distinguishes between 9 paid-parking districts. In these districts, on average, between 69 to 80 percent of parking spaces are occupied by residents with permits (Gemeente Amsterdam, 2005). Amsterdam policy aims to supply parking permits such that (minimally) 10 percent of parking spaces are unoccupied *during the day* (from 09.00 to 19.00), see Gemeente Amsterdam (2000). However, the proportion unoccupied spaces is frequently much lower in specific areas. Furthermore, the proportion of unoccupied parking spaces is usually far below 10% *in the evenings* (Gemeente Amsterdam, 2004), which particularly affects residents that arrive after work and have to cruise for parking.

Our empirical approach is estimating a hedonic housing pricing function. Information about house prices is provided by the Dutch association of real estate agents, NVM (see Gautier et al., 2009, for a similar application). In Amsterdam, the NVM is involved in approximately 90

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[6] The car ownership rate is comparable to cities such as London, Paris and Berlin.

[7] The permit is valid in the area directly surrounding the residence, so it is predominantly used for residence parking and seldomly for other purposes. Application of a permit requires one to have a registered address in the district for which the permit is issued and requires car ownership. In only a few streets, either households do not receive any permit or may apply for two permits.

[8] On-street parking charges are high compared to the rest of the world. In fact, it seems that only in the City and West End of London parking charges are higher. Total tax revenues from parking policy in Amsterdam mount to € 131 million, about € 570 per residence in paid-parking districts.

percent of all housing transactions. The original dataset received by NVM contains 29,606 housing transactions that took place between January 2004 and December 2008. In Amsterdam, there are about 90,000 (owned) houses, so our dataset contains approximately one third of all (owned) housing stock.

We know the *exact* location of each house (the street and house number) and a large number of detailed housing attributes (e.g., garden, the number of rooms), which we use as control variables. Importantly for the current paper, the data allow us to distinguish between five types of private parking spaces: an *outside* parking space, a carport, a garage (for one car), a combined carport and garage (for two cars), and a large garage (for two cars).

In the analysis, we allow for effects of these five types of parking. These effects are allowed to depend on the type of parking regime (paid parking without waiting list; paid parking and waiting list; no paid parking). We focus on the effect of outside parking space. We do not have information about the size of the outside parking space. This lack of information is not problematic, because in the areas we focus on, outside parking spaces are seldom large enough to contain more than one car, except maybe for a small proportion of single-family dwellings, which we exclude from the analysis. We also exclude observations that are extreme outliers.[9] The analysis is based on 24,804 observations. The average house price is € 251,159.

In the Netherlands, the most detailed administrative neighbourhood unit is defined by the 6-digit zip code. Six digit zip code areas are small, and typically include 12 residences (that are on the same side of a street). The average distance between houses *within* a zip code area is merely 28 metres. In the analysis, we apply zip code area fixed effects, avoiding arguments that

[9] More specifically, we exclude observations with a price of less than € 30,000 or more than € 4,000,000, which have less than 20 square metres or more than 10 rooms and a-typical types of accommodations, such as houseboats.

our findings are due to unobserved spatial heterogeneity (local congestion, presence of shops, scarcity of on-street parking). This is relevant, because the residents' value derived from parking depends strongly on local circumstances.[10] For example, it is not uncommon that in one block parking is saturated, whereas a few blocks further away parking places are vacant. In our sample, we distinguish between 6,241 zip code areas, so the mean number of observations per area is about 4. Even within these small areas, unobserved spatial heterogeneity may be present, so we also control for the distance to the city centre, to the nearest railway station and to the nearest highway ramp. To deal with variation in housing demand over space *and* time, we have included four additional controls that interact the year of observation with the distance to the city centre.

In addition, to the above variables, we control for time-variation in parking tariffs. From several offices of the municipality of Amsterdam, we have obtained information about the presence of paid parking as well as information about parking tariff per street. With few exceptions, annual changes in tariffs are identical each year, except when paid parking is newly introduced, which occurs for a limited number of observations.[11] The lack of variation in changes in parking prices makes it difficult, or maybe even impossible, to estimate the causal effect of parking prices on house prices. In the results shown, we will only distinguish between paid parking and no paid parking, but our results are robust with respect to the assumed functional form of the effect of parking prices. For example, if we distinguish between low tariffs (below € 2.50) and high tariffs (more than € 2.50), we get essentially identical results.

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[10] We have re-estimated all models selecting only residences for which the within-area average distance is less than hundred metres (about 95 percent of the sample). The average within-area distance is then only 22 metres. The results are almost identical to the results discussed in the current paper.

[11] Since 2000, in established paid-parking districts, the tariff increases *each year* by either € 0.10 or € 0.20, where the latter applies to districts in the centre (mainly areas built before 1900), see Gemeente Amsterdam (2000). In only a few streets, the tariff was decreased or increased by a more substantial amount.

We have also obtained information regarding the (expected) length of waiting-lists for parking permits per district. About 37 percent of residences in paid-parking areas are in a district with a waiting list for parking permits.[12] The average waiting time for obtaining a parking permit is 39 months. Waiting times are not based on standardised administrative data (which are not available), but are derived by us based on information using a combination of measures (e.g., recent waiting times, number of parking permits issued over a certain period combined with number of households waiting). Waiting time is therefore measured with substantial measurement error, so annual changes in waiting times are likely unreliable. So, rather than using waiting time as a control variable, we will use a dummy indicator of the presence of a waiting list.[13] This dummy indicator does not have any measurement error (the presence of a waiting list is officially published and is public knowledge).

Table 1 provides basic information about the average house price, the percentage of residences in a waiting-list area and the percentage of residences with private parking. It indicates, for example, that 17 percent of residences in areas with a tariff below € 3.50 are situated in a waiting list district, that 9.7 percent of residences have a private parking space, and that 3.2 have percent an outside private parking space.

[12] In these districts, the number of households on a waiting-list is estimated by us to be about 30 percent of the number of households with a parking permit (using the ratio of the average residence and waiting time durations).

[13] For a small number of observations, the waiting time is less than 4 weeks. We assume that the waiting time for these observations is zero.

3. Empirical results

3.1 Main results

Table 2 provides the results of the hedonic price analysis. We follow the literature and assume a log-linear specification, so we use the logarithm of the house price as a dependent variable. The reported standard errors allow for clustering based on area as recommended by Moulton (1990).

Our first main result is that in areas *with paid-parking but not in a waiting-list district*, an outside parking space increases the house price by about 5.8 percent (see column (1) in Table 2).[14] The second main result is that if the house is located *in a waiting-list district*, then the presence of an outside parking space increases the house price by about 12.3 percent. Because houses in Amsterdam are old and built before paid-parking and waiting lists for parking permits were introduced, it is reasonable to interpret these effects as causal effects through demand.

The first main result allows us to derive the cost of cruising for parking. The average housing price in a paid-parking area is € 279,593. The 5.8 percent result implies then that the capitalised cruising cost is € 16,216. Interpretation of this estimate is not so straightforward, so we have derived the daily cruising costs. One has to assume a discount rate and take into account that mortgage interest expenses are deductible from labour income. Assuming a 50 percent marginal income tax rate[15] and a 5 percent annual discount rate, the annual cruising cost is € 405, implying a daily cruising cost of € 1.11. This cost entails the private time cost of searching for parking, any additional walking time (Arnott and Rowse, 1999), and the cost of uncertainty involved in searching. As this is the first study to measure this cost, we cannot benchmark this result by comparing it to other studies, but this result seems reasonable to us. For example, if the

[14] We follow the convention that for small coefficients, the effects of dummy indicators on logarithmic variables can be interpreted as percentage changes.

[15] A 52-percent-level applies to annual incomes exceeding € 54,776, a 42-percent-level applies to annual incomes ranging from € 17,878 to € 54,775.

resident's value of travel time (including uncertainty) ranges from € 10 to € 20 per hour, then the average implied cruising time per day is 3 to 6 minutes.

The theoretical model introduced by Arnott and Inci (2006) implies that the average welfare loss of cruising per resident is equal to the average *private* cruising cost.[16] Household income of home owners in the paid-parking area of Amsterdam is about € 70,000 per year, indicating that the welfare loss per resident for cruising is 0.6 percent of income. Clearly, the loss of cruising is substantial.

To estimate the households' willingness to pay (WTP) for parking permits, we focus on the second main result which shows that in waiting-list districts a parking space increases the house price by 12.3 percent. In these districts, the average housing price is € 321,324. Hence, the average economic value of a private parking space in a waiting list district is € 39,523. This value is the sum of the WTP for a parking permit and the cruising costs that private parking space owners are able to avoid.

To calculate the WTP for a parking permit, one has to know the cruising costs applicable *to the waiting list district*. We emphasise that the above estimate of the cruising costs (the first main result) only applies to districts *without* waiting lists. The cruising costs applicable to the waiting-list districts can be derived however given an additional assumption on the relationship between *average* cruising costs per zip code area and *average* house prices per zip code area. We will make two different assumptions on the relationship between these two variables (proportional; unrelated) and then proceed by testing these assumptions. [17]

[16] To be more precise, it is an underestimate, because it ignores cruising by non-residents.
[17] We will also show the results of an alternative method where we estimate the same model as discussed above but we also control for a measure that captures average cruising time per district.

Given the assumption that cruising costs are proportional to the average house price in a zip code area (conditional on control variables included in the analysis), the households' WTP for a parking permit is 6.5 (12.3-5.8) percent of € 321,324, so it is € 18,637. Given the assumption that cruising costs are not related to the average house price in an area, the WTP for a parking permit is € 39,523-€ 16,215 = € 23,307.

To test these assumptions, one may use additional information (not yet used in the hedonic analysis) about the proportion of vacant parking spaces, which can be used as a proxy for cruising time losses. This information is available at the district level (9 districts) up to the year 2002, so we use information for this year (Gemeente Amsterdam, 2003).[18] At the level of the district, the occupancy rate, v, varies between 0.75 and 0.94. We assume that the loss of cruising time is proportional to the variable τ, which is equal to $1/(1-v)$. This variable can be interpreted as the expected number of parking spaces one has to visit given random sampling of parking spaces before finding a vacant space.[19] In our data, τ varies between 4 and 16.

The proportionality assumption can now be tested by regressing the estimated values of the 6,241 area fixed effects of log house prices (estimated in the hedonic analysis presented in Table 2) on the log of τ. The proportionality assumption implies that the effect of log of τ on average house prices is one. It turns out that the coefficient is equal to 0.25 (with a standard error of 0.20[20]), far below one. So, the relationship between log house price and log of τ is likely

[18] We use information for the evening, because residents are particularly confronted with a lack of vacant spaces during the evening.
[19] One advantage of using τ rather than v is that it captures the idea that cruising costs are strongly increasing when the vacancy rate approaches zero.
[20] We allow for clustering based on district level.

positive, but it is less than proportional, implying that the WTP for a parking permit is between €18,637 and €23,307.[21]

One alternative method is to control for the average cruising time losses per district. We do so by adding the interaction of the presence of (outside) private parking with τ as an additional control variable in the hedonic price analysis. It appears that the estimated effect of (outside) private parking on house prices hardly changes: it is only slightly higher. The additional interaction control variable has a slight negative, but statistically insignificant effect (-0.0011; s.e. 0.0014). These results are in line with the above result that the relationship between housing price and cruising costs is positive but less than proportional. Hence, all evidence implies that the € 18,637 is the most conservative estimate for the WTP of a permit.

We will proceed now by using this estimate. Again we have to take into account that mortgage interest payments are tax-deductible, so the capitalised willingness to pay (given a 50 percent marginal income tax rate) implies a value of € 9,319. The average waiting time is 1,170 days (39 months), so the households' average WTP for a parking permit is € 7.96 per day.

The households' average WTP for a parking permit, about €8 per day, far exceeds the on-street parking permit tariff (€ 0.40 per day). Furthermore, the households' WTP is much *lower* than the daily on-street parking tariff faced by other users, which is on average € 20.[22] This suggests inefficient use of parking space. [23]

[21] A quadratic specification in log of τ suggests that the effect of τ is negative when τ exceeds 8.5, suggesting that the WTP may exceed € 23,307, so our estimate of the WTP is conservative.

[22] This tariff has been calculated given the assumption that during weekdays only evening parking is required by residents, otherwise it is substantially higher.

[23] If the households' willingness to pay exceeds the parking tariff, then the willingness to pay *as measured by us* would be equal to the parking tariff. This makes it plausible that the estimated WTP for a parking permit is not an one-to-one function of the on-street parking tariff, but measures the WTP for parking given the alternative choices available to avoid on street parking (e.g., in a private operator garage).

3.2 Other results

Our results support our specification that allows for different effects of private parking depending on the parking regime. We find that in areas without paid parking, residents attach much less value to private parking than in areas with paid parking. The most obvious explanation is that residents in areas without paid parking are able to park on the street for free, so the marginal benefit of a parking space in these areas is less than in paid-parking areas. Furthermore, we find that, in case of paid-parking, residents seem to be rather indifferent to owning an outside parking space, carport or a single garage, indicating that the benefit derived from a private parking space is captured by its use for parking, in line with our assumption that in paid-parking areas, residents use parking spaces exclusively for *car* parking, and not for storage etc.

The results further suggest that the introduction of paid-parking reduces house prices by 1.3 percent, but this may be due to unobserved variables not controlled for. It does not hold in other specifications. We also do not find that the introduction of a waiting-list for parking permits affects house prices (the point estimate is -0.6 percent, but statistically insignificant). Note that the latter effect is entirely identified using changes over time in the presence of waiting lists, so it is likely that we will need a longer period with more pronounced changes in the presence (or the length of the) waiting lists to identify this effect appropriately.

3.3 Sensitivity analyses

We have re-estimated the model by excluding the interaction effect of distance-to-centre and year of observation (see column (2) of Table 2). The main results are essentially the same, but for some control variables. In contrast to the results of column (1), it appears that the effect of paid parking is not statistically significant, so this specific effect is not robust with specification.

One may object that our specification of a large number of different types of parking spaces is too flexible, because the number of observations per variable is limited. As a consequence, standard errors are quite large, so interpretation of the point estimates may not be appropriate. We have therefore estimated a third specification (see column (3) of Table 2), where we restrict the coefficients of parking spaces of identical size to be equal to each other. Essentially, the results do not change.

Another objection to the above specification is that we impose that the coefficients of all explanatory variables except those related to parking are imposed to be the same for each parking regime. So, we have re-estimated the specifications (1) and (3) based on separate samples for the three types of parking regimes. It appears that the results are robust (see Table 3).[24]

4. Conclusion

In the growing economic literature on downtown parking, the importance of cruising, searching for a parking space, has come to the fore (e.g., Arnott and Inci, 2006). This paper is the first to examine emp irically the private cost of cruising. To be more precise, we focus on the cost of cruising for *residents* in Amsterdam, the Netherlands. In most large cities in the world, parking for residents is directly or indirectly subsidised, but policies largely differ in detail. In

[24] We have also re-estimated specifications controlling for short (less than one year) and long (more than one year) waiting lists, as well as for high and low parking tariffs. The results are essentially identical and can be received upon request.

Amsterdam, in large parts of the city, on-street parking does not come cheap: parking tariffs are among the highest in the world. Despite these high parking tariffs, cruising for on-street parking spaces is still common in many areas of Amsterdam, particularly in the evenings, because many residents have access to residential parking permits, which are provided at a nominal sum.

In the current paper, we have identified the residents' private costs of cruising based on the difference in selling prices of residences with and without (outside) private parking places. These costs are estimated to be about € 1 per day, about 0.6 percent of income. Given the assumption that car drivers have complete information about their cruising times, these private costs can be interpreted as the welfare loss per resident due to cruising (Arnott and Inci, 2006).

In areas with paid parking, households that own residences without private parking may obtain on-street parking permits, but in some areas of Amsterdam, residents have to queue for on-street parking permits with average waiting times of more than 3 years. We have demonstrated that the costs of waiting for parking permits are capitalised into housing prices, which allows us to derive the residents' willingness to pay for on-street parking permits. We demonstrate that the average residents' willingness to pay for a parking permit is about € 8 per day, which far exceeds the residents' parking permit's tariff, but which is far below the on-street tariff faced by other users. This suggests large efficiency losses of parking policy regarding the use of on-street parking space. If the on-street parking tariff is a good indicator of the economic costs of parking, then this suggests that the welfare costs of policies that offer parking permits to residents are substantial, in line with suggestions by theoretical economists (see, for example, Arnott and Inci, 2006) as well as numerical simulation models (Calthrop et al., 2000; Proost and van Dender, 2008).

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Table 1 Descriptives

	Tariff = 0	0 < Tariff ≤ 2.2	2.2 < Tariff ≤ 3.5	Tariff > 3.5	Total
Average transaction price	181,281	256,387	284,106	365,482	251,159
Number of observations	7,545	11,962	2,130	3,209	24,805
Residences in waiting-list areas (percent)	0.00	17.18	16.62	100.00	22.90
Private parking (percent)	13.81	7.95	7.37	8.53	9.67
Outside private parking (percent)	6.48	1.92	1.78	2.34	3.28
Garage (percent)	2.15	2.22	1.60	1.30	2.02
Carport (percent)	4.54	3.33	3.57	4.00	3.78
Carport and garage (percent)	0.18	0.20	0.14	0.22	0.19
Double garage (percent)	0.46	0.27	0.28	0.01	0.38

Table 2. Hedonic House Price Analysis

	(1)	(2)	(3)
Paid parking; no parking permit waiting-list			
Parking spot (outside)	0.058 (0.014)	0.056 (0.014)	
Carport	0.059 (0.011)	0.058 (0.011)	0.060 (0.010)
Garage	0.063 (0.015)	0.061 (0.016)	
Carport and garage	0.098 (0.025)	0.104 (0.026)	
Double garage	0.159 (0.033)	0.157 (0.034)	0.131 (0.022)
Paid parking and parking permit waiting-list			
Parking spot (outside)	0.123 (0.024)	0.125 (0.026)	
Carport	0.107 (0.017)	0.098 (0.017)	0.114 (0.014)
Garage	0.116 (0.023)	0.115 (0.024)	
Carport and garage	0.137 (0.029)	0.142 (0.030)	
Double garage	0.226 (0.050)	0.229 (0.052)	0.190 (0.036)
No paid parking			
Parking spot (outside)	0.001 (0.009)	0.009 (0.010)	
Carport	0.022 (0.010)	0.032 (0.011)	0.023 (0.008)
Garage	0.024 (0.011)	0.051 (0.011)	
Carport and garage	0.076 (0.030)	0.086 (0.026)	
Double garage	0.082 (0.046)	0.088 (0.049)	0.074 (0.032)
Parking area characteristics			
Paid parking	-0.013 (0.006)	-0.000 (0.006)	-0.013 (0.006)
Waiting-list for parking permit	-0.006 (0.015)	-0.004 (0.015)	-0.005 (0.015)
Housing characteristics			
log(square metres)	0.740 (0.009)	0.742 (0.009)	0.741 (0.009)
Number of rooms	0.011 (0.002)	0.010 (0.002)	0.011 (0.002)
Central heating	0.050 (0.004)	0.051 (0.004)	0.050 (0.004)
Garden	0.033 (0.005)	0.031 (0.005)	0.033 (0.005)
Well maintained garden	0.046 (0.007)	0.044 (0.007)	0.047 (0.007)
Building period (10 dummies)	yes	yes	yes
Housing type controls (e.g., apartment, flat)	yes	yes	yes
Locational characteristics			
Distance to CBD (100 m)	0.001 (0.001)	0.001 (0.001)	0.001 (0.002)
Nearest train station < 200 m	0.041 (0.046)	0.053 (0.042)	0.053 (0.042)
200 m < Nearest train station < 800 m	0.020 (0.017)	0.020 (0.016)	0.020 (0.016)
Nearest highway ramp < 200 m	0.019 (0.044)	0.020 (0.043)	0.020 (0.043)
200 m < Nearest highway ramp < 800 m	0.024 (0.024)	0.025 (0.024)	0.025 (0.024)
Interaction terms between year and distance to CBD	yes	no	yes
Year controls	yes	yes	yes
Area controls	yes	yes	yes
Number of areas	6,241	6,241	6,241
Number of observations	24,804	24,804	24,804

note: Robust standard errors allowing for area clustering are in parentheses

Table 3. Hedonic House Price Analysis: Selected Samples

	(i)		(ii)		(iii)	
	paid parking no waiting list		paid parking waiting list		no paid parking	
Parking spot (outside)	0.063 (0.016)		0.114 (0.024)		0.006 (0.009)	
Carport	0.066 (0.012)	0.066 (0.011)	0.095 (0.016)	0.101 (0.015)	0.012 (0.011)	0.017 (0.009)
Garage	0.066 (0.017)		0.096 (0.024)		0.047 (0.012)	
Carport and garage	0.106 (0.027)		0.119 (0.028)		0.082 (0.034)	
Double garage	0.159 (0.035)	0.134 (0.024)	0.199 (0.048)	0.167 (0.035)	0.088 (0.057)	0.077 (0.039)
Number of areas	3,140	3,140	1,652	1,652	1,899	1,899
Number of observations	11,667	11,667	5,592	5,592	7,545	7,545

Note: Same controls as in Table 2.