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Summary:

Housing prices - Impacts of exposure to road traffic and location

This study uses a hedonic price approach to estimate the effects of different variables on the market value of housing properties in Oslo. The main focus is on exposure to road traffic as measured by outdoor noise levels and on location in terms of distance from the city centre. However, the contribution of a number of additional variables are estimated at the same time.

Three datasets are used:

1. Flats and terraced houses belonging to the co-operative housing society (OBOS)

2. Owner occupied flats (FLATS)

3. Owner occupied single family, semidetached and terraced houses (HOUSES)

The first dataset comprises all sales handled by OBOS in 1995, but with some deletion of observations due to incomplete or suspect information. FLATS and HOUSES covers the period 1988-1995 and consist of units that have been sold at least twice during this period. These two datasets were originally compiled with the purpose of monitoring the development of housing prices over time. In these datasets we also deleted records with incomplete or suspect information. In the analysis we treat each transaction as an independent observation, even though the same flat or house appear two or more times. To adjust for the large fluctuations in the price level in the period 1988-1995 we apply dummy variables for transactions within each 6-month period.

Hedonic prices are estimated by standard regression technique. Ln(price) is used as the dependant variable and other variables are used either on logarithmic or linear form. The original datasets contained only variables that describe the flat and housing property. Variables describing traffic and noise were obtained from an environmental database operated by the City of Oslo and appended to the records. We also appended codes for the location in different subareas. These were later combined and in the final analysis we used dummy variables to differentiate between three sectors which, in the housing market, appears as more or less attractive. In Oslo there is for

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instance a very clear east-west dichotomy in the housing market that can mainly be attributed to social status. Using the transport modelling system EMME/2 we also added variables for the distance to the city centre and generalised travel time by public transport.

Table A: Estimated parameters

Dependent Variable.. LN(PRICE)						
---------- Variables in the Equation ----------						
	OBOS		**FLATS**		**HOUSES**	
Variable	Coeff.	T- value	Coeff.	T- value	Coeff.	T- value
Noise (dBA)	-0.0024	-7.02	-0.0048	-19.12	-0.0054	-8.22
Ln(floorspace)	0.8638	72.94	0.5671	75.24	0.3278	26.33
Age of building	-0.0009	-2.77	-0.0012	-10.13	-0.0030	-13.75
Distance to city centre	-0.0442	-19.56	-0.0124	-7.88	-0.0164	-5.91
Ln(lot size)	-		0.0333	10.28	0.2248	29.23
Ln(units per dekar)[1)]	-0.0325	-6.73	-		-	
ETG_dum	-0.1240	-14.50	-		-	
PTservice	-0.0157	-7.63	-		-	
HOUSE_dum	0.3219	26.82	-		-	
REHAB_dum	0.0966	13.65	-		-	
PARKING_dum	0.0671	6.29	-		-	
NS_dum	-0.2362	-15.98	-0.1730	-24.72	-0.1411	-9.75
GØ_dum	-0.4138	-30.82	-0.3375	-41.55	-0.3625	-23.16
S 2/88	-		-0.0693	-4.97	-	
S 1/89	-		-0.1382	-9.36	-0.0844	-3.62
S 2/89	-		-0.1511	-10.71	-0.1255	-5.78
S 1/90	-		-0.2277	-14.88	-0.1508	-6.10
S 2/90	-		-0.2478	-17.07	-0.2035	-8.57
S 1/91	-		-0.3204	-19.20	-0.2138	-7.50
S 2/91	-		-0.3727	-24.53	-0.3401	-14.09
S 1/92	-		-0.4672	-27.74	-0.2195	-7.66
S 2/92	-		-0.4742	-29.26	-0.3847	-13.59
S 1/93	-		-0.5272	-30.98	-0.3186	-10.40
S 2/93	-		-0.3746	-25.13	-0.2224	-9.22
S 1/94	-		-0.2395	-16.02	-0.1568	-5.70
S 2/94	-		-0.2251	-16.41	-0.0561	-2.48
S 1/95	-		-0.2129	-14.10	-0.0781	-2.96
S 2/95	-		-0.1761	-10.75	-	
Constant	10.1871	158.09	10.9351	261.68	11.5178	179.03
Adj. R^2	0.778		0.550		0.604	
N	3,892		12,287		3,398	

1) Number of units per 1000 m^2 of land.

One disadvantage of the FLATS dataset is that an exact measure of floor space is missing. The variable used as a substitute is the total floor space of the building divided by the number of flats in the building. This means that we also have an «error in variables» problem.

In general the OBOS dataset has the best and most accurate information and it was for this dataset that we obtained the best results in terms of explanatory power.

As we see from the Table A all variables are highly significant. Measured by adjusted R^2 we obtain fairly high explanatory power, especially for OBOS. Not unexpected, the FLATS datasets has the poorest performance in this respect.

The effect of estimated noise levels (dBA) are very similar and not significantly different for FLATS and HOUSES. It should be safe to conclude that the prices decrease by 0.5 per cent for every 1 dBA increase in noise level. However, in our datasets we must expect that other disamenities caused by road traffic are strongly correlated with the noise level and that the estimated coefficients may capture a combined effect that also includes air pollution, impaired traffic safety, visual intrusions and barrier effects of roads. In this respect it is interesting to compare with the noise coefficient estimated for OBOS which is also highly significant, but has a much lower value. One possible reason for a systematic difference in the noise coefficient is that properties in OBOS are fairly large and usually include outdoor areas that are often quite undisturbed by road traffic. This means the environmental impacts of road traffic in general are smaller even though one side of many buildings may be exposed to fairly high noise levels. Owner occupied houses and flats are - on the other hand - to a far greater extent located in areas with a dense road network and are more exposed to all disamenities caused by road traffic. If this interpretation of the difference in coefficients is correct, the lower coefficient for OBOS may be a more accurate estimate for the partial effect of noise as experienced indoor.

In the OBOS dataset we find that prices decrease by 4.4 per cent per kilometre driving distance from the city centre. The corresponding coefficient for FLATS and HOUSES is significantly smaller. There is no obvious explanation for this difference, but it may have something to do with income levels and car ownership. Although we have no information on buyers in the different market segments, an informed guess is that the average income and level of car ownership are higher in owner occupied housing than in the housing co-operatives. This may translate into a higher willingness to pay (in relative terms) for locations closer to the city centre. The same phenomenon may account for a significant coefficient for the level of public transport services as measured by generalised travel time (in minutes) per kilometre distance from the city centre (PTservice). This variable was insignificant and had the wrong sign for FLATS and HOUSES and was deleted in the final runs reported in Table A.

8.6 per cent of the records in the OBOS data set consisted of terraced units. A dummy variable (HOUSE_dum) for these units show that they sell for a

premium of approximately 38 per cent. On the other hand, flats on 4th floor and above (ETG_dum) have a price penalty of approximately 12 per cent. Density, as measured by number of units per 1000 m^2 of land [ln(units per dekar)], has a negative coefficient. This result combined with the fact that variables like HOUSE_dum and ETG_dum also are correlated with density, may be taken as a clear evidence of preferences for low density housing.

The coefficient for ln(floorspace) must be interpreted as an elasticity. Not unexpectedly this is the most significant variable in all three datasets. For FLATS the coefficient is probably underestimated due to the «error in variables» problem. Other evidence and the result for OBOS indicate that the «correct» elasticity might be between 0.8 and 0.9.

Depreciation related to the age of buildings seems a minor, but significant effect on the market price, ranging from 0.09 to 0.3 per cent per year. Some of the co-operatives included in OBOS are 30 - 40 years old and the buildings have been rehabilitated and modernised. The coefficient for the variable REHAB_dum indicate the rehabilitation gives price premium of 10 per cent. The variable PARKING_dum indicate that a reserved parking space follows the unit and this gives a price premium of approximately 7 per cent.

For all three datasets the sectoral dummies (NS_dum and GØ_dum) are highly significant and important variables. The western sector is the base.

The seasonal dummies (S n/y) show that the price level of houses reached a low point in the second half of 1992 when the price level was 32 per cent below the level in the first half of 1988. By the second half of 1995 the prices of houses had recovered to the level of 1988. FLATS reached the lowest point in the first half of 1993 when prices had decreased by 41 per cent and had still not recovered to the 1988 level by the second half of 1995.