RESPONSES TO TRAFFIC NOISE: THE VALUE OF QUIET

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Introduction Following the WHO (Berglund et al. 1999), around 40% of the population in the European Union is exposed to road traffic noise exceeding 55 dB(A) Leq (daytime), and approximately 20% are exposed to noise levels above 65 dB(A). Road traffic noise is often cited as the major cause of annoyance in urban areas such as Lisbon, and thus it contributes to significant social costs that stand outside the market.
Various studies provided estimates of the total willingness-to-pay for quiet/noise (WTP) for Portugal, but all these studies were based on indirect estimation techniques since the necessary disaggregated data was not available. The INFRAS/IWW (2000) study, for example, estimated a total WTP for noise of 416 Million of Euros per year for Portugal (68% of these costs are due to annoyance effects and the other part due to health effects as cardic infractions). This paper reports the former values of quiet/noise obtained in Portugal by using a disaggregated data collected at the community level. A computer model was developed for the purpose of valuing individuals' preferences for quiet (stated on the simulated market and revealed through the housing market sample). The context set for valuation was when households are indoors. This paper presents some values of quiet derived from Mixed Logit specifications using stated preference data.

Methods As part of a research study at the Institute for Transport Studies (UK), it was developed a methodology to obtain monetary valuation of noise in the residential context, considering individuals' responses to noise. For this purpose, an integrated noise computer model was built comprising several related parts: a) codification of block and apartment; b) household/respondent general description; c) information on housing tenure (housing market); d) familiarity with characteristics of the apartments; e) location choice factors in the block/lot/residential area; f) length of residence and life style; g) individual's perceptions of the levels of noise indoors; h) awareness of the negative impacts of noise on health; i) household sensitivity to noise; j) behavioral actions; l) simulated apartment choices (Stated Preference or Choice Experiment); m) Contingent Valuation (WTP questions); n) annoyance during the day and night; o) socio-economic information on the household. The wide range of variables collected was the result of an extensive review work on studies of community reactions to noise (Fields, 1991, 2001).
The overall data collection methodology in Lisbon comprised several steps: a) Information to potential respondents on the planned computer survey; b) Computer aided personal interviews at the home (more than 400 households living in high-rise buildings in the vicinity of major roads); c) Noise measurements at the apartment situations; d) Traffic and noise data collection outdoors. Although the model had used internally individual's perceptions of the noise levels indoors, these were related to the real physical noise measures (Leq dB(A)) collected.
In the stated preference module, households were expected to express their preferences towards several apartment options in the same building/lot they were living. The attributes selected were four (with four levels each): view, sun exposure, noise and a monthly housing service charge which was a familiar payment to all individuals in the housing market segment referred. Lower and upper floors and their general exposure to traffic noise (fronting the main road or located at the exterior façade) played a key role in the experimental design. All environmental

attributes were presented as the levels perceived by the respondent in that specific situation (e.g. as levels as you perceive in *1T*, where *1* means floor one and *T* means at the Back/quieter façade). This conveyed a great level of realism to the experimental market.

Results Considering the data collected, several types of models were estimated using the stated preference, revealed preference and the willingness-to-pay data. Marginal cost estimates attached to reduction in the levels of noise (environmental improvement), and to avoid increases in the levels of noise (environmental degradation) were estimated. As an example, Table I shows the marginal values of quiet per unit of perceived improvement (as rated by respondents), considering several situations experienced (base levels of noise in the current apartment), size of the improvement, for two classes of income per person per household. One unit of perceived gain in quiet (as rated) was found to be equivalent to 2.9 dB(A).

Table I: Marginal Value of Quiet per Unit of Perceived Improvement estimated using stated preference data: Mixed Logit model specification (Arsenio 2002).

Marginal Values of Quiet (Euros per individual of the household per month)					
Adjusted Income per person in household per month (Euros)	**Experienced Noise Level (Current Apartment)**	**Chosen Quiet Level**	**Improvement Size**	**Flat exp. Fronting main road**	**Flat exp. quieter façade (back)**
149,6	60	70	10	1,3	3,7
	60	80	20	1,1	3,4
	40	50	10	1,4	3,7
	40	60	20	1,2	3,5
299,3	60	70	10	2,2	5,9
	60	*80*	*20*	*1,7*	*5,5*
	40	50	10	2,2	6,0
	40	*60*	*20*	*1,9*	*5,7*

Values in Italic: Sample mode; Number of people per household (sample mean): 3.14.

Discussion The modeling work conducted is novel in considering householders' heterogeneity (nature and extent) of preferences on the marginal valuations of traffic noise. The models based on perceptions and the physical noise measures indoors have captured the most influential effects on the marginal values of quiet, but the former outperformed statistically the latter. This finding showed the importance of non-acoustical factors besides the physical measures in explaining individual's preferences for quiet. The range of influential variables were: household income (adjusted per person), exposure to traffic noise (fronting the main road or at the back/quieter façade), deterioration or improvement in the levels, number of years living at the site, size of the simulated change in the levels of noise, floor of the respondent (lower or upper), base noise level experienced in the current apartment, gender (this variable was found to be correlated with average number of hours spent home) and the current monthly payment as housing service charge.

Keywords: Computer Survey; Marginal Value of Quiet; Traffic Noise; Residential Area; External Costs; Economic Valuation of Noise; Stated Preference; Mixed logit.