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A TECHNICAL NOTE ON AIRCRAFT NOISE AND ITS COST TO SOCIETY

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I. INTRODUCTION

The purpose of this paper is to summarize the main findings of recent literature* on the impact of aircraft noise on property values. In general, the results of these studies can be used to assess the impact of changes in flight activity on the surrounding community. The literature is considered to be recent if it was published after the year 1990. The empirical estimates of the cost of aircraft noise, expressed as a percentage of property value, vary from study to study.

II. LITERATURE REVIEW

Aircraft noise disturbance is considered the most important concern for people who live or work close to an airport. During recent years, air traffic has been growing rapidly and this growth was accompanied by rising concerns about aircraft noise pollution in residential areas. Numerous aircraft noise studies have emerged as a result of an increased need for a greater understanding of the social costs of aircraft noise disturbances. Aircraft noise disturbance costs are most commonly expressed as a percentage change in residential property values per decibel of noise exposure. The reviewed literature points out a few important issues to be considered when estimating the costs that aircraft noise imposes on society.

* For a list of reviewed literature, please refer to Attachment A

Schipper, Nijkamp and Rietveld (1998) [2] produced an influential study of aircraft noise impact using a meta-analysis of 30 previously completed hedonic price studies. The use of this study lies in the possibility of value transfer. Hedonic price studies are costly to conduct as well as time consuming making a value transfer from previous study results to new locations an attractive option. However, considering that there is a significant variation of the estimated noise depreciation index (NDI) values between studies, a meta-analysis is especially useful in preventing the selection of "extreme" values that would cause overestimating or underestimating costs and benefits that would be used in policy planning. The mean NDI based on results from 30 previous studies was estimated to be 0.83.

Schipper, et al[2] also concluded that studies using samples with higher relative average house prices obtained higher noise depreciation indices implying that peace and quiet are luxury goods (i.e. the impact in percentage terms is bigger for more valuable properties). The finding was supported by the results of Booz-Allen & Hamilton, Inc (1994)[6] and Uyeno et al (1993) [1].

Levesque (1994)[5] took a unique approach to estimating the aircraft noise impacts by decomposing the noise effects into loudness and event frequency. He concluded that while the NDI is about 1.3 percent, the NDI for the number of events is much smaller implying that adding more flights is less noticeable than raising average loudness. The NDI for the number of events varies from –0.2 to –0.1 as the number of events increases from 80 to 400. The results further suggested that variability in the background level of noise is preferred to a constant noise level.

Uyeno, Hamiltion and Biggs (1993)[1] show that, when estimating the percent change in property value per unit of sound exposure, it is important to differentiate between the different property types. Three types of property were considered: vacant land, detached houses and multiunit residential condominiums. The distinction was made between detached houses and condominiums because it was assumed that aircraft nose would have less effect on the residents of condominiums since they are generally more mobile and discount less for the noise effect and since condominiums are usually better soundproofed. It was estimated that percent change in property value per one decibel increase in noise level for detached houses, condominiums and vacant land is 0.65 percent, 0.90 percent, and 0.16 percent respectively. The research site for this study was Canada's Vancouver International Airport.

Collins and Evans (1994)[**] demonstrate the powerful pattern recognition ability of artificial neural networks (ANN) and their applicability to noise disturbance estimates. ANNs are useful in an economic analysis because they are capable of learning linear and non-linear functions operating in multi-dimensional space. They should be used as an addition to rather than a substitute for other economic analyses.

Navrud (2002)[7] states that the cut-off point for valuing noise by transportation authorities in Europe and North America is generally 55 decibels. However, evidence suggests that noise annoyance is high even at noise levels below the cut-off point and in order to avoid underestimating the benefits of noise reduction the cut off point should

[**] Collins and Evans, 1994 study is one of the studies analyzed by Stale Navrud in a Final Report to European Commission,"A State-Of-The-Art on Economic Valuation of Noise".

be lowered to at least 50dB. This point is well demonstrated by Brian Pearce and David Pearce (2000)[3] who show that when background noise target is reduced from 55 dB to 50dB, total noise nuisance cost at London's Heathrow airport is increased from £37.4 to £66.2 million per year.

Feitelson, et al (1996)[4] examined the effects of aircraft noise on willingness to pay for local residents using the contingent valuation method. The results of this study imply a willingness to pay between 2.4 and 4.2 percent of house prices by homeowners and from 1.8 to 3.0 percent of housing rents for a one-decibel reduction in noise. The large difference in results between hedonic regression and contingent valuation methods is that the latter includes loss of use value while the former identifies only market premiums.

III. CONCLUSION

There is plethora of literature on the impact of aircraft noise on property values. They vary based on research methods employed, geographic areas studied, and based on research implications.

Most of the studies use one of the three methods in estimating the impacts of aircraft noise: hedonic price method, meta-analysis or contingent valuation method (based on the willingness to pay). Of the three methods, hedonic price method is the most often used in the existing studies. Although it is the most accepted valuation method for aircraft impact studies, NDSI (Noise Depreciation Sensitivity Index) estimates from hedonic price studies are hard to transfer from one location to another or

from one time period to another. Meta-analysis alleviates some of the value transfer problems by eliminating a possibility of using extreme values. The literature reviewed did not focus on a particular geographic area but are rather an agglomeration of studies in United States, Canada and Europe.

The empirical estimates of the impact of aircraft noise range from about 0.6 percent to more than 1.0 percent decrease in property values per one dB increase in noise levels. As such, while the use of any estimate should reflect the variability in prior research about the costs of aircraft noise, a decline in property value of about one percent per one dB increase in noise would be a reasonable economic value.

ATTACHMENT A

1. "Density of Residential Land Use and the Impact of Aircraft Noise" by Dean Uyeno, Stanley W. Hamilton, and Andrew J.G. Biggs. Journal of Transport Economics and Policy, Vol. XXVII No. 1, January 1993.

2. "Why do Aircraft Noise Estimates Differ? A Meta-Analysis" by Youdi Schipper, Peter Nijkamp, Piet Rietveld. Journal of Air Transport Management 4: 117-124, April 1998.

3. "Setting Environmental Taxes for Aircraft: A Case Study of the UK" by Brian Pearce and David Pearce. 2000.

4. "The Impact of Aircraft Noise on Willingness to Pay for Residences" by Eran I. Feitelson, Robert E. Hurd, and Richard R. Mudge. Transportation Research Vol.1 No. 1 pp. 1-14, 1996.

5. "Modeling the Effects of Airport Noise on Residential Housing Markets" by Terrence J. Levesque. Journal of Transport Economics and Policy, May 1994.

6. "The Effects of Airport Noise on Housing Values: A Summary Report" by Booz-Allen & Hamilton, Inc. Prepared for Federal Aviation Administration, 1994.

7. "A State-Of-The-Art on Economic Valuation of Noise" by Stale Navrud. Final Report to European Commission DG Environment, April 2002.