

APPENDIX A: EFFECTS OF SOUNDING LOCOMOTIVE HORNS ON PROPERTY VALUES

Research shows that residential property markets are influenced by a variety of factors including structural features of the property, local fiscal conditions, and neighborhood characteristics. Hedonic housing price models treat a property as a bundle of characteristics, with each individual characteristic generating an influence on the price of the property. For example, additional structural characteristics such as bathrooms, bedrooms, interior or exterior square footage increase the value of residential properties. Likewise, neighborhood characteristics are expected to influence property prices. For example, homes that are in relatively close proximity to noxious activities such as hazardous waste sites, incinerators, etc. have been shown to have lower values, other things equal.

A carefully designed hedonic model can be used to implicitly value locational attributes that have no explicit market price. Deriving market signals of these prices is especially useful when attempting to address concerns of property owners, especially those related to phenomena that are highly localized and subjective. Instead of relying on what homeowners believe will be the influence of a change in a locational attribute such as the lifting of a whistle ban, this influence could be statistically measured. Past hedonic studies that derive actual measures of locational influences have generated a number of important insights.

- Proximity to local disamenities, such as crime and congestion, and proximity to noxious activity, such as incinerator activity, do lower property values.
- The property value influence of undesirable activities is highly localized and appears to decay relatively quickly with distance from the activities.
- Property impacts frequently decline over time, as highly sensitive homeowners relocate away from the activity, and are replaced by homeowners who are less concerned with the activity.

Hedonic housing price techniques can be used to analyze the effects of lifting train whistle bans. To apply such techniques, various factors related to the sounding of locomotive horns at crossings must be controlled. These include proximity of the home to the tracks, proximity to an intersection, frequency of train traffic, time of day in which whistles are blown, and dBA level of the whistle.

The effects of the sounding of locomotive horns on property values have been studied recently in response to the Federal Railroad Administration Use of Locomotive Horns at Highway-Rail Grade Crossings rulemaking. Initial results are available. Unfortunately these results are not conclusive. FRA is aware of two studies issued in 2000. David E. Clark performed one for the FRA and Schwieterman and Baden of the Chaddick Institute performed the other. According to Clark, the study performed for FRA was “just a first step in understanding how train whistles influence local property values.” Schwieterman and Baden of the Chaddick Institute emphasize that their “report is a preliminary assessment of a complex issue. Some of our findings are speculative in nature.” Those who have studied the issue agree that further study is needed to reach a better understanding of the true effects of locomotive horn sounding on property values.

David E. Clark, Associate Professor of Economics, Marquette University and Argonne National Laboratory, Decision and Information Sciences Division performed a study for FRA entitled *Ignoring Whistle Bans and Residential Property Values: An Hedonic Housing Price Analysis*. In 1991, Consolidated Rail Corporation (Conrail), one of the largest railroads in North America at the time¹², began ignoring whistle bans that had been enacted by local communities along its rail lines. Clark studied the effects of this action on property values in three counties (two in Ohio and one in Massachusetts) where Conrail began sounding locomotive horns. The counties were selected based on the presence of Conrail service, whistle bans ignored by Conrail, and availability of relevant real estate data. Train traffic levels in these communities were moderate to low during the period of study. Some lines carry less than ten trains per day. Middlesex County, Massachusetts was the only community with more than 50 daily trains. Because more precise information regarding train traffic for these communities for the period of study was not available, Clark did not consider train traffic levels in his study. Other characteristics influencing sale prices of residences were controlled for in the study.

Originally, the Clark study included only the two counties in Ohio. When FRA developed the Environmental Impact Statement and Regulatory Evaluation of the NPRM, preliminary results were available for Butler and Trumbull Counties in Ohio. The results were mixed and in some cases not statistically significant¹³. According to the author, "These findings provide only weak evidence of negative impacts on residential property markets resulting from the policy action taken by Conrail in October 1991." The study found that having an additional rail line within a quarter mile decreased property values in Butler County by 2.1 percent and in Trumbull County by 2.8 percent. Being within a half mile of a Conrail crossing (while locomotive horns were being sounded) decreased property values in Butler County by 6.2 percent and in Trumbull County by 17.4 percent. The decrease in property values in Trumbull County was temporary and disappeared completely in three to four years. Being within a half mile of a non-Conrail crossing with a whistle ban decreased property values in Butler County by 7.8 percent and in Trumbull County by 8.4 percent. In Butler County, there is weak evidence that property values were 4.5 percent higher at the outer edge of the audible noise range for locomotive horn sounding after Conrail began ignoring whistle bans.

Given the lack of precision and mixed nature of the initial results, Clark made recommendations for further study. Among other things, he recommended (1) studying a wider geographic area to remove any regional effects that may not have been accounted for and (2) getting more precise geocoding to eliminate some of the bias introduced by using the zip+4 centroid instead of precise

¹² Most of Conrail's railroad assets have since been sold to Norfolk Southern Corporation and CSX Transportation.

¹³ Statistical significance for purposes of this study is established at the generally accepted 95 percent confidence interval.

street addresses. On January 31, 2000, a final version of the study incorporated these two recommendations. The study included the Middlesex County, Massachusetts and used street level geocoding.

The final study used hedonic pricing techniques and a linear regression model to analyze data for more than 21,000 single-family residential home sales between 1987 and 1997 in the three communities and found:

- In Trumbull County, Ohio, the decision to ignore the whistle ban had no statistically significant influence on residential housing prices.
- In Middlesex County, Massachusetts, the decision to ignore the whistle ban had no statistically significant influence on residential housing prices. Note that there is a significant level of commuter rail traffic and stations very near crossings in Middlesex County. Property values near commuter rail stations are usually higher due to the added convenience for those who use the service. Since commuter rail service hours usually do not overlap with the core sleep hours, residents may not be as disturbed by the sounding of commuter locomotive horns. The commuter rail station effect may have counterbalanced the effect of the locomotive horn on property values near crossings or otherwise significantly affected the findings for Middlesex County.
- In Butler County, Ohio, the decision to ignore the whistle ban had a statistically significant influence on residential housing prices. Between 1/4 mile and 1/2 mile of Conrail crossings, there was a 6.7 percent reduction in sale prices immediately following the Conrail action. However, property values in this area increased annually by 2.4 percent¹⁴, implying that the detrimental influence may have been eliminated less than three years later. On net, five years after the horns began to sound, the premium for a location an additional 100 feet from the crossing was approximately 0.4 percent (or a total of 9.7 percent difference between a location directly adjacent to the crossing and a distance of 2,320¹⁵ feet from the crossing).
- The study concludes that there is little indication that the decision by Conrail to ignore whistle bans had any permanent and appreciable influence on the housing values in the three communities analyzed.

Clark offers two explanations for the lack of effect on property values. First, those buying property within the audible range of a highway-rail grade crossing likely consider the possibility that train whistles may be sounded at the crossing in the future. When Conrail began ignoring the whistle bans, their suspicions were confirmed. Second, the Conrail action generated dynamic changes in

¹⁴ This increase uses time trend variables to take into account general real estate trends in the area.

¹⁵ The audible range for a locomotive horn sound is approximately 2,320 feet.

the composition of residents that served to mitigate the initial impact of the action. Residents most sensitive to the sounding of locomotive horns moved away and were replaced with those less sensitive to such sounding.

Clark also cautions that the findings of the study are not representative for communities with greater train activity or with different regional characteristics. Annoyance levels should increase with train activity. Furthermore, in moderate climates, residents are more likely to spend more time outdoors and be more affected by the sounding of horns. Clark's study also did not distinguish between day and nighttime train traffic levels which may greatly influence the degree of disturbance caused by locomotive horn sounding and therefore the effect on property values.

The Chaddick Institute study, *Alternatives to the Whistle: The Role of Public Education and Enforcement in Promoting Highway-Rail Grade Safety in Metropolitan Chicago*¹⁶, evaluates the probable costs of the noise generated by locomotive horns at grade crossings in the Chicago area¹⁷ from implementation of the rule as proposed in the NPRM. The study's "results show that the region would experience significant losses in property value from sounding of horns at grade crossings currently subject to whistle bans. If budget constraints prevent the creation of quiet zones in an appreciable number of communities, the losses would likely be in the range of \$616 million to \$1.0 billion." The study also concludes that "Even if property values do not fall, homeowners that are forced to move away may incur other real economic costs."

This study also estimates the effects of noise pollution on property values using a hedonic analysis. Schwieterman and Baden pick up on Clark's scenario of noise-sensitive people moving away from crossings and the need to sell their homes, possibly at a discount. It also examines six studies of highway and airport related noise pollution property damage which estimate property value losses per decibel. Applying the average property value loss per decibel to homes in the Chicago area between one-fourth and one-half mile from the crossings would mean that property values would decline by \$8,100 to \$13,200 (per residence); those within one-fourth mile would decline by \$11,500 to \$17,500 (per residence).

For the reasons discussed below, it is not likely that the overall costs associated with sounding locomotive horns at crossings in the Chicago area where they do not currently sound will be as high as the Chaddick Institute study concludes.

Dataset for Chicago has changed: The Chaddick Institute study was based on information regarding at-grade crossings in Chicago that was available at that time. Unfortunately, the data for the City of Chicago crossings available to Schwieterman and Baden was not current. The Chaddick Institute based its analysis on a dataset prepared by the Chicago Area Transportation Study, which in turn was based in large part on the DOT Grade Crossing Inventory. The mean age

¹⁶ Joseph P. Schwieterman, PH.D. and Brett Baden, Chaddick Institute For Metropolitan Development, De Paul University, Working Paper 09-00, September 25, 2000.

¹⁷ The Chicago area encompasses Cook, Du Page, Kane, Lake, Mc Henry, and Will counties.

of the inventory in January 2000 was 11 years and the median 13 years. According to the data used, train horns were not being sounded at 780 grade crossings in the Chicago area. The DOT inventory did not reflect entire line segment abandonments or other at-grade crossing eliminations in the City of Chicago. Since then, FRA has identified over 100 whistle ban grade crossing abandonments, closings, or changes to over- or under-passes in the City of Chicago. Since many of the crossings that were included in the Chaddick Institute study are not active at-grade crossings now, fewer residents in the City of Chicago may be potentially affected by the sounding of locomotive horns than was estimated in the study.

Credit for implementation of safety measures made prior to rule: The final rule allows certain formal or informal whistle bans that were in place as of October 9, 1996 to continue without any changes. Pre-Rule Quiet Zones that have severity weighed risk indexes that fall below a national threshold (established by taking the national average risk index for gated crossings without whistle bans) may continue for as long as their risk indexes remain within the permissible range. Pre-Rule Quiet Zones that had no collisions potentially preventable by sounding the locomotive horn in the previous five years and have average risk indexes below twice the national threshold may also continue for as long as they meet these criteria. Since such exemptions were not contained in the NPRM, their impacts were not considered in the Chaddick Institute's study. Many communities in the Chicago area will be able to take advantage of these exemptions. In total, approximately 285 crossings are expected to be included in Chicago area quiet zones that would not require additional safety measures under the final rule. Fewer crossings and residents should be affected by this rulemaking than the Chaddick Institute study estimates.

Costs of Photo Enforcement: The Chaddick Institute's study estimates that many communities will not be able to afford implementation of photo-enforcement at crossings. The Chaddick Institute estimates that photo-enforcement systems cost an average of \$200,000 to \$300,000 per crossing. However, these cost estimates are based on the assumption that crossings will not share cameras. Both the NPRM and the final rule permit up to four crossings to share cameras. FRA estimates that sharing equipment can cut per crossings costs by approximately two thirds. According to the Chaddick Institute study, costs could drop to \$80,000 per crossing if cameras and other hardware are shared. The authors also indicate that a reasonable target for the Chicago area would be to implement photo-enforcement at 25 or more crossings over the next three years. Eventually, if communities find that photo-enforcement is paying for itself, they may certainly choose to increase the active camera to crossing ratio so they can issue more violations and earn higher revenues to offset costs.

Sharing cameras certainly makes photo-enforcement a more viable option. Considering the reduced costs associated with such sharing, it is likely that more crossings will be equipped with photo-enforcement equipment than the Chaddick Institute estimated. This should further reduce the number of affected residents affected by locomotive horns and losses associated with decreasing property values due to locomotive horns sounding.

Use of Median Strips: The Chaddick Institute also bases its cost estimates on the proposed requirements that median strips used as SSMs to be a minimum of 60 feet in length. However both the NPRM and the final rule also permit localities to file for alternative standards. FRA will consider shorter lengths for those crossings where it would be impractical to have 60-foot long medians. Therefore, it is likely that more communities will add medians to retain quiet zones than the Chaddick Institute assumed and fewer residents will be affected by the sound of horns.

Additional Time for Implementation: The final rule allows more time for implementation of safety measures than was proposed in the NPRM. The NPRM had a 3-year implementation period, the final rule allows communities with existing whistle bans up to 8 years for implementation. More time for implementation will give communities more time to evaluate SSMs and ASMs and secure the funding needed to implement the safety measures required to retain whistle bans. This will probably result in fewer communities actually opting to have locomotive horns sounded at crossings where they have been silent for years.

Funding Available for Certain Upgrades: Certain communities may not be able to afford the safety improvements required to retain whistle bans. State and Federal program funds are available to assist these communities under certain circumstances. The Transportation Equity Act for the 21st Century (TEA-21) provides funding flexibility that may be used to some extent to pay for some or all of the costs for communities that cannot afford the entire cost.

While Congress provided no specific authorization of funds for the creation of quiet zones, highway safety infrastructure improvements are eligible for a variety of Federal Highway Administration administered Surface Transportation Program (STP) and National Highway System (NHS) funds. Eligible projects may qualify for funds under Sections 130 and 152 of the STP, as well as the Optional Safety Category of funds associated with those programs. Determinations about which projects could receive funds are usually made by State Departments of Transportation or Public Utility Commissions, which must base decisions about the same on an objective analysis of the relative safety risks associated with each public highway-rail crossing in accordance with 23 CFR Part 924. Therefore, the use of Section 130 funds for the purpose of creating quiet zones would be appropriate only if the safety gains associated with the improvements would justify the project's priority ranking compared to other competing highway-rail crossing improvement projects.

STP funding beyond the 10 percent safety set-aside may also be employed at the discretion of the state without regard to the priority ranking system required for the safety set-aside programs. The same would be true of National Highway System (NHS) funds for those crossings which remain on the NHS. Elimination of at-grade crossings on the NHS is specifically enumerated as a specific goal under the 1994 U.S. DOT Action Plan for Rail-Highway Grade Crossing Safety. Use of Federal-aid funds for these projects would be based on need, and the availability of funds as determined by individual states. While infrastructure safety improvements for Supplemental

Safety Measures will generally be eligible for federal funding, states have the ultimate authority to determine whether such funds will be made available.

The availability of other funding sources for certain upgrades may allow more communities to retain their whistle bans than estimated by the Chaddick Institute. Again, fewer residents should be affected than the Chaddick Institute estimated.

Transferability of Airport and Highway Hedonic Property Value Studies' Results to Grade Crossings: The types of noise experienced by residents near highways and airports can be different from that experienced by residents near highway-rail grade crossings. Highways and airports where noise is an issue have higher daily volumes of motor vehicle and aircraft traffic than grade crossings with whistle bans. The noise produced by locomotive horns at crossings is also generally more intermittent than that produced at airports and highways.

The effect of highways and airports on nearby property values can also be very different than that of highway-rail at-grade crossings on nearby property values. For instance, airports are a source of employment for residents in the community. Although airport employees may not desire to reside in properties immediately adjacent to airports, they probably want to reside relatively close by. Few highway users desire to reside in properties immediately adjacent to highways, however many probably want to reside close enough to have easy access to highways. Such situations may greatly influence the magnitude of difference between property values of residences immediately adjacent to highways and airports compared to property values of residences that are still very close to highways and airports yet not adjacent. Since there generally is no incentive to residing near highway-rail at-grade crossings (unless there happens to be a commuter rail station nearby) the difference in property values between residences immediately adjacent to grade crossings and those a little further away is probably not as great.

Studies of airport and highway noise compare property values of residences adjacent to source of noise to property values of residences that are near but not adjacent to the source of noise. To isolate the effect of the noise itself, the effect of the incentive for residing nearby, versus adjacent to, should be removed from the studies of airport and highway noise. Given the differences in (1) types of noise produced by highway vehicles and aircraft versus locomotive horns and (2) effects of highways and airports on nearby property values versus effects of grade crossings on property values, FRA believes that results from hedonic studies of airport and highway noises on property values are not directly transferable to locomotive horn noise effects on property values.