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Measuring externalities of waste transfer stations in Israel using hedonic pricing

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Abstract

This study estimates the economic value of externalities related to waste transfer stations in Israel. Most externalities are associated with local disamenities experienced by residents living in close proximity to transfer stations – including noise, odor, litter, vermin, visual intrusion and any associated perceived discomfort. Following the mapping of all active transfer stations in Israel, problematic sites near residential areas were identified. Four of these sites were selected for detailed examination. The study involved estimating the economic value of disamenities using the Hedonic Price Method, which examines the impact of disamenities on property values. The results indicate that the maximum spatial extent of the impact occurs about 2.8 km away from a transfer station with an increase of about $5000 in housing price for each additional km away from the site. Alternatively, an increase of 1% in the average distance of a house from the local transfer station is associated with a 0.06% rise in the price of the average house. These figures, representing the relationship between changes in environmental quality and property prices, indicate that transfer stations create externalities that should be taken into account in location and clean-up policies for transfer stations as well as in potential compensation policies.

1. Introduction

Waste transfer stations play an important role in a community's waste management system, serving as a link between a community's solid-waste collection scheme and final waste disposal facilities such as landfills, incinerators, material recovery facilities and recycling plants.

This study estimates the economic values of externalities related to waste transfer stations in Israel. Most externalities are associated with local disamenities experienced by residents living in close proximity to transfer stations – including noise (of trucks traveling back and forth), odor, litter, vermin, visual intrusion and any associated perceived discomfort. Some of these arise from the mere existence of the transfer stations, and others are associated with the amount and type of waste, transportation method and the operation of the facilities. The disamenities vary with the size of the sites, as well as the amount and type of waste they receive (e.g., inert, biodegradable). Practically, all of these factors are often reflected in the NIMBY (Not In My Back Yard) phenomenon and activism intensity, due to the levels of the disamenities.

The principal question considered in the study is whether proximity to a transfer station, because of its environmental impact, has an effect on housing prices. Our hypothesis, as in earlier theory and practice that regards the impacts of waste facilities, is that, *ceteris paribus*, dwelling units located farther away from transfer stations would have higher values. We also examine the hypothesis that the effect of disamenities from a transfer station does not decrease linearly with respect to distance. These hypotheses are investigated in this study regarding transfer stations in four cities in Israel.

This study involves estimating the economic value of disamenities using the Hedonic Price Method (HPM),

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which examines the impact of disamenities on property value. The method has been used in several studies that estimated disamenity costs of landfill and incineration (e.g., Keil and McClain, 1995), as well as in other subjects associated with the environment – air pollution, noise, odor, etc. (e.g., Batalhone and Nogueira, 2002). As far as we know, this is the first study that evaluates disamenities associated with waste transfer stations.

In order to apply the HPM, a database was constructed, including real-estate 'asking prices' (the price asked by owners) in the selected cities, distances of the properties away from the transfer stations, and characteristics of the houses and related neighborhoods. The data was obtained from the Israeli Central Bureau of Statistics (CBS), real-estate databases and GIS (Geographical Information System) databases.

2. Municipal solid waste and transfer stations

2.1. Transfer stations

A transfer station is a facility located close to a residential or commercial area that is used to receive and hold waste from collection vehicles (such as municipal collection trucks) until it can be moved to larger transfer vehicles (usually after compacting to reduce volume) for transport to distant landfills, processing centers (such as waste-to-energy plants) or composting facilities. Occasionally, transfer stations also provide waste sorting and recycling services (Kirka and Erkip, 1988; Massam, 1991; USEPA, 2004).

It is generally less expensive to deliver collected municipal solid waste (MSW) to transfer stations where it can be consolidated into large loads that can be transported by trailer trucks, rail cars, or barges to large-scale management facilities than transporting the same amount of MSW in substantially smaller vehicles. The latter increases fuel consumption and number of trips needed to transfer waste to final disposal (Bartone et al., 1990). Transfer stations have environmental advantages. Since the use of transfer stations enables a reduction in the number of vehicles traveling to the treatment center, it results in a reduction of road traffic and air pollution (Boulanger, 1999). Additionally, using transfer stations allows a reduction in the number of landfills and facilitates siting them in remote locations, avoiding environmental impacts generated by landfills that are more significant than those of transfer stations.

Siting of waste disposal facilities is a major issue in waste management, as the facilities should meet economic and environmental requirements. Incineration plants are usually placed near or in large cities, close to the potential consumers of recovered energy, whereas recycling plants are usually located in industrial areas and landfills are located as far away as possible from residential areas. Transfer stations, as noted above, are located close to a residential or commercial area.

Planning and locating transfer stations involve a variety of issues, such as geographical circumstances, daily waste volume, local transportation infrastructure and easy access to local utilities. Regarding the interests of this study, note that locating transfer stations near MSW generators helps to lower hauling costs per ton of MSW, but these savings must be traded off against community and environmental protests (NIMBY effect), especially where transfer stations are being operated in open facilities. Objections may be appeased by designing enclosed transfer stations to reduce odors and the possibility that wind may blow trash out of the facility, and by careful monitoring to ensure that waste does not accumulate at the facility for more than several hours (Tchobanoglous et al., 1993; Parker, 1999; USEPA, 2004). An aesthetical building that is integrated in the surrounding environment will help the facility to be accepted by nearby residents.

2.2. Externalities related to transfer stations

Externalities are defined as costs and benefits that arise when the social or economic activities of one group of actors (people/firms) affect another group of actors, and the market fails to account fully for their impact (ExternE, 1995; Krewitt et al., 1998). All alternative strategies of waste disposal result in externalities in various forms and levels. These externalities are influenced by the composition of the waste, treatment process (e.g., landfilling, incineration, recycling), characteristics of the facility involved (e.g., location, age of site, technology), and the regulations imposed. Modern transfer stations that are operated by strict regulations and managed with proper facility design and operation procedures are not supposed to create externalities at all, except for limited traffic impacts.However, many substandard facilities worldwide, and in Israel as well, still exist. The key externalities are described below.

Traffic impacts are a major issue because the activity of a transfer station results in an increase in daily road traffic. Environmental impacts of traffic are associated mostly with larger waste transfer stations. This is particularly true for stations in urban and suburban areas where traffic congestion is often already a significant problem for the local community. On the one hand, using transfer stations for centralized shipments of MSW to disposal sites would reduce damage from traffic in the cities and on highways. On the other hand, the negative impacts of hauling traffic to and from transfer stations might be concentrated in the immediate vicinity of the transfer stations, affecting residents nearby. These could include among other air quality and health concerns (especially due to particulates), damage to roads and buildings, noise (especially from the noisy reverse siren which is a safety device obligatory for trucks), congestion and accidents (USEPA, 2004).

Odors can develop in transfer stations because of anaerobic decomposition, when solid wastes are stored for long periods of time on-site between collections. It is more significant in warm or wet weather and when waste contains