

The Role of Economic Analysis in Local Government Decisions: The Case of Solid Waste Management

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The issue of solid waste management has risen to national prominence in the last decade, fueled by increasing waste disposal costs and changing public attitudes. This situation presents a major opportunity for economists to use their applied microeconomics skills to assist state and local governments manage waste in a cost effective fashion. While findings from formal research efforts may ultimately make their way into the decision-making process, perhaps economists can play an even more significant role in emphasizing the importance of the most basic economic concepts and principles for sound decision making in solid waste management or the many other areas in which local public choices are made. These areas would include at least the following: opportunity cost, marginal analysis of costs and benefits, and the role of economic incentives.

Shifts in the structure of much of the U.S. economy away from agriculture have resulted in a concurrent shift in the research and service focus of many agricultural economics departments. It is no coincidence that in New England, only one of the six land grant schools has preserved the word "agricultural" in its departmental title, while many other land grant universities have added adjectives such as "applied" to departmental names to acknowledge the expanded foci of the profession.¹ While issues in production agriculture, price analysis, and marketing will continue to occupy important positions in the field of agricultural economics, the past three decades have seen exceptional growth in subdisciplines such as rural development and environmental economics.

One area of opportunity where economists have employed their applied microeconomics tools is in state and local government infrastructure and finance decisions. Perhaps as never before, local governments are experiencing fiscal stress exacerbated by declining federal and state support and

local property tax bases which are already heavily burdened. In addition, while local public services are often characterized by economies of scale that would make large-scale (i.e., multicommunity) provision of services like road services and waste management cheaper, there is currently a trend toward "devolution" which emphasizes local autonomy. To further complicate the matter, many cities and towns in the United States jealously guard their position of "home rule" (Deller and Halstead) and may view regional approaches to service delivery with suspicion.

In this article, we propose a number of areas where economists can make a substantial contribution to policy formation and service provision at the local level, using the issue of solid waste management as a case study. The first section of the paper provides an overview of the solid waste problem and a brief review of economists' contributions to date. The second section of the paper proposes areas where economists could make useful contributions to the debate. Potential contributions range from relatively straightforward applications of standard tools such as system cost analysis to more complex issues like the resolution of siting issues or regionalization of service provision. Particular attention is paid to the issue of regionalization of service provision. It is our contention that the issues discussed in this paper transcend the matter of waste management and are applicable to a much wider range of local problems.

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¹ This name amendment is also intended in many cases to attract more undergraduate majors.

Historical Overview

The issue of waste management has risen to prominence in recent years, because of both the increased cost of waste management to local governments and the increased environmental awareness on the part of the general public, which has led to an increase in demand for waste management alternatives such as recycling. The United States produces 200–300 million tons of trash per year, most of which is paper and paper products (40%); other major “growth” areas are plastics and yard waste. While some of this growth can be attributed to population, much of it stems from increased affluence and changes in consumption habits toward convenience products.

Traditional disposal methods have relied upon isolation and burial of trash; landfilling still accounts for nearly two-thirds of all disposal today. However, since 1988, 45% of the landfills in the United States have closed, and by the year 2006, an additional 35% will close (Steuteville). States in the northeastern United States have suffered a disproportionate number of landfill closures. This decline in the supply of landfill space—coupled with increased waste production and stricter environmental regulations like Federal Subtitle D—has led to a concurrent increase in disposal fees.² Average per ton disposal costs nationally have increased steeply since the mid 1980s, from a few dollars per ton to over \$100 per ton in some regions. While average tipping fees vary widely by state—for example, average tipping fees are \$75 per ton in Vermont and New Jersey, but \$10 or less per ton in Nevada, Wyoming, and New Mexico (Steuteville)—waste disposal now rivals education as a share of local government budgets. A recent report noted that waste management costs account for 3.7% of local tax rates in New Hampshire (in some communities as much as 21%); when school and county taxes are excluded, waste management accounts for an average of 16.7% of local tax rates (New Hampshire Department of Environmental Services).

The Search for Alternatives

The U.S. Environmental Protection Agency (EPA) has developed a hierarchy of preferred disposal alternatives: source reduction, recycling (including

composting), incineration, and landfilling. While landfills are the lowest priority, they continue to be the most widely used alternative. However, various problems have historically been associated with landfills, principally relating to externalities generated by the facilities, including ground water contamination, blowing trash, odor, and increased traffic. Consequently, many landfills have been closed and the few new landfills sited have employed state-of-the-art pollution control technology; in effect, these factors shift the supply of waste disposal in. This supply shift, along with increased demand, is responsible for increases in disposal costs.

A second alternative widely adopted in recent years is incineration, usually in conjunction with energy production. While nationally just over 10% of our municipal solid waste (MSW) is incinerated, in landfill-poor sections of the country like New England, over 40% is disposed of in waste-to-energy and other plants that burn waste. While considered an integral part of the solid waste management system, incineration is no cure-all. For example, plants must be relatively large to achieve the economies of scale available; in sparsely populated areas such as northern New England or the Great Plains, there may not be sufficient quantities of waste generated. In addition, incineration is a waste *reduction*, not disposal, technique, and the incinerator ash must be disposed of in specially designed landfills. Finally, these plants represent a substantial capital investment; accurate forecasts of future demand for waste disposal are necessary to ensure cost effective waste management.

Landfills and incinerators often fall victim to the NIMBY (“not in my backyard”) syndrome, making them the object of substantial community opposition. Thus the second option on the EPA hierarchy, recycling, has been acclaimed by some as a panacea to the waste problem. The national recycling rate is now over 20%, and rates in certain areas of the country are much higher. These high recycling rates are inspired largely by the high cost of disposal substitutes.

While recycling is widely hailed these days, it too has many problems. Designing and implementing recycling programs can be extremely difficult. Communities initiating recycling programs face a number of questions, including what materials (paper, aluminum, plastics, etc.) to include in the program, what type of collection system to employ (curbside pickup, community “dropoff” centers, or other options), how to process the material, and whether to run the programs themselves or to contract with private firms. Unfortunately, many communities rushed headlong into recycling in the late

² Steuteville notes that there do not appear to be national capacity problems—only three states and the District of Columbia have reported overall problems with capacity—since many of the remaining landfills are large facilities. However, the same survey noted that sixteen states have reported local disposal capacity problems.

1980s without an accurate forecast of either the costs of system operation or the expected revenues from the sale of recyclables; the end result was that some of these communities substantially *increased* their waste disposal costs. Nonetheless, many states have set ambitious recycling goals, ranging as high as the challenging 70% target set by Rhode Island.

Recent data indicate that recycling as a disposal method may be becoming more cost effective. This is probably because better technologies are being developed, participation is increasing, more emphasis is being placed on production processes using recyclable materials, and traditional methods such as landfilling are becoming more expensive or nonexistent. An interesting question is whether these changes in demand for recycled inputs would have occurred without the recent focus on increasing recycling at the local level.

The Role of Economists

While economics can play a major role in waste management decisions, political and other considerations will also influence the choice of each community's solid waste management system. The recent history of waste management reveals many areas where economics could have made valuable contributions to the policy process. For example, local governments are clearly in need of cost analyses of alternative recycling systems, while dynamic programming could be applied to issues of landfill use (since landfills are something of a "depletable" resource). In addition, economics can play a valuable—though partial—role in addressing the NIMBY syndrome.

A review of professional journals over the past two decades reveals that economists have published relatively little in the area of waste management, with most publications occurring in the past five years.³ Several studies have dealt with internal and external costs of landfill operation (Ready and Ready; Roberts, Douglas, and Park; Strathman, Rufolo, and Mildner), while Simonsen examined the cost structures of waste-to-energy facilities.

Beierlein, McSweeney, and Woodruff addressed the use of chopped newsprint as bedding for farm animals.

General modeling approaches have included modeling international trade in waste products and disposal services (Copeland), dynamic optimization modeling to allocate solvent disposal between landfills and incinerators (Eiswerth), comparative economics of energy recovery versus other options (Keeler and Renkow), and input-output analysis applied to regional solid waste management (Huang, Anderson, and Baetz). Policy options examined have included optimal taxation/deposit systems for trash and recycling (Fullerton and Kinnaman), taxes on virgin materials, recycling subsidies, recycled content standards, and investment tax credits (Palmer and Walls), and subsidy and enforcement options for hazardous waste disposal (Sullivan).

At least two early studies examined factors influencing household waste composition and disposal behavior (Richardson and Havlicek; Wertz); subsequent papers have further explored these matters (Morris and Holthausen; Epp and Mauger). Other studies have focused on the siting issue, both directly and indirectly (Nelson, Genereux, and Genereux; Halstead, Luloff, and Myers; Kiel and McClain; Kunreuther et al.).

In all, a literature search revealed twenty articles on waste management in "mainstream" economics journals over the past twenty years. While this may seem to indicate that economists have been paying scant attention to the issue of solid waste management, it must be pointed out that trade journals and publications, as well as popular publications, research reports, and consultants' reports, may be providing outlets for economic analyses needed by managers. However, it is also true that the type of analyses needed by local managers—cost comparisons, economic-engineering studies, etc.—may be considered mundane from a professional standpoint, and thus "unpublishable."

Perhaps the most interesting and difficult issue in local government is regionalization of service provision. As previously mentioned, many towns and cities would like to reap the benefits of economies of scale in provision of roads, education, solid waste, and other services, but they are sometimes reluctant to cede their autonomy to any larger cooperative. However, it is important to make the distinction between *provision* and *production* of public services. *Provision* refers to collective choices made regarding what services to provide at what levels, while *production* refers to purely technical issues in providing the service (Cigler; Oakerson; Deller and Halstead). Thus, it

³ Journals reviewed were the *American Journal of Agricultural Economics*, *Journal of Environmental Economics and Management*, *Land Economics*, *Journal of the Community Development Society*, *Journal of Agricultural and Resource Economics*/*Western Journal of Agricultural Economics*, *Journal of Environmental Management*, *Rural Sociology*, *Review of Agricultural Economics*/*North Central Journal of Agricultural Economics*, *Southern Journal of Agricultural Economics*, *Agricultural and Resource Economics Review*/*Northeastern Journal of Agricultural and Resource Economics*, and the *Journal of Soil and Water Conservation*.

is possible for a community to retain control of the provision decision while collaborating with other communities in a joint regional production effort. The following section examines some of these issues in regionalization, and the institutional changes that might be necessary for regionalization to occur.

Changes in the Institutional Structure of Rural Communities: Home Rule versus Economies of Scale

A key feature of recent challenges facing rural communities with regard to solid waste management is that effective responses often require marked institutional changes. Moreover, these institutional changes may run against the grain of traditional rural culture and values. Most notable among these challenges is the economic pressure for regional (i.e., multicounty or multicomunity) cooperation that has resulted from federal landfill regulations that have dramatically increased the absolute cost level and economies of scale for landfill disposal (Halbach; Joyce; Dooley et al.). In addition, state policies and often local sentiments have required or at least strongly encouraged rural communities to implement recycling or other waste reduction activities that also are characterized by steep economies of scale. Numerous studies have been done by university researchers and private consultants documenting the often large potential cost savings from regional cooperation for solid waste management in rural areas. However, the real problem is moving "from here to there" institutionally, that is, establishing sustainable intergovernmental contracts, an authority or district, or some other vehicle. The role of transactions costs and the necessary administrative and legal activities that must be undertaken are critical elements in this process. Solid waste management, of course, is just one of many public services for which regional cooperation is an issue, given the continuing changes in the structure of the rural sector. It would seem that much could be learned from the historical and continuing process of rural school consolidation.

Some may eschew analysis of this issue of regional cooperation in rural areas, believing it is too often dominated by high school football rivalries or the personalities of local political leaders. Surely, though, we as applied economists have something to offer toward understanding the key factors, including local "public choices," in this area and providing guidelines to state or regional policymakers regarding strategies to facilitate re-

gional cooperation where the overall cost savings to society are substantial. Getting at this issue, however, will require a broader conceptual perspective than we might be inclined to take. While basic neoclassical concepts from regional and welfare economics are useful in defining the problem, concepts from collective choice literature would appear to be quite useful as well. In particular, though solid waste management services are not pure public goods, in the context of regional cooperation they do have characteristics that make them amenable to analysis as club goods (Sandler and Tschirhart). A recent application of the Tiebout model to the decision to regionalize in the provision of education services provides a good example (Miceli). Game theory models of clubs may also offer a framework that captures many of the key characteristics of the decision process of forming new institutional arrangements for regional cooperation.

The need for a broader perspective on the issue of regional cooperation among rural jurisdictions transcends our discipline, however, extending to the several social or behavioral sciences that also explore such issues. A more general argument to this end was forcefully made by Zilberman in an invited paper at the 1994 annual meetings of the Southern Agricultural Economics Association. Rural sociologists, public administration specialists within the field of political science, and planners contributed heavily to a recent conference on the subject of multicomunity collaboration as a strategy for rural revitalization (Korsching, Borich, and Stewart). Political scientists interested in intergovernmental relationships have emphasized the distinction between the provision and the production of public goods and services in relation to cooperative arrangement and the role of the private sector (Advisory Commission on Intergovernmental Relations; Galal and Shirley). Students of organizational behavior and public policy also offer insights regarding dynamic elements in the process of cooperation or collaboration that are complementary to the traditional economic perspective (Weiss; Gray).

Additional Opportunities

Other critical challenges facing rural communities with regard to solid waste management relate to (1) the need to finance the inevitably higher costs that will be associated with transportation and disposal under the new federal regulations, as well as the enhanced collection systems for solid waste and recyclable materials required under recent legisla-

tion in many states, and (2) the desire to encourage residents to engage in recycling and source reduction activities and thus reduce the amount of solid waste requiring disposal. Most economists would be quick to point out the obvious solution to both of these problems—implement a user fee system based on the volume or weight of solid waste generated by each household or business. The efficiency and equity arguments for such an approach to financing solid waste management seem compelling. A few studies have sought to estimate the impact of such “unit pricing” approaches on the generation of solid waste and recyclables (see, for example, Miranda). In addition, several guidebooks for planning and implementation of such approaches have been published (U.S. Environmental Protection Agency 1994). However, the focus of efforts to date in this area has been on the urban, curbside collection context. Little attention has been paid to the rural, dropoff collection setting, perhaps because residents have more convenient, if inappropriate, options for disposal in response to imposition of user fees.

Historically, solid waste management has been financed with general property tax revenues in most rural areas, with the costs somewhat hidden and the service appearing to be free. Shifting the burden for financing solid waste management from the general property tax to a user fee thus represents a significant institutional change. Gaining political acceptance may require careful planning with regard to administration of the user fee system, including enforcement strategies, as well as the transition from one financing source to the other. Here again, while basic economic logic and some straightforward quantitative analysis can be employed to make a strong case for such an institutional change, a broader institutional perspective is needed to provide insights into how to accomplish it, given the political and social culture of rural communities and people.

There are a number of other potentially fruitful areas of research for agricultural and resource economists related to the issue of solid waste management that draw on more traditional methods or are related to traditional problems addressed by the profession. Because of space limitations, only a brief description of each can be provided. First, there is a strong emphasis on planning for integrated solid waste management systems, that is, identifying the most cost effective set of activities for dealing with a given flow of solid waste from households and businesses. Clearly, this type of problem is amenable to mathematical programming approaches that are regularly employed in our discipline. In particular, the increasing impor-

tance of transportation activities and costs, given the economic pressure for regional systems, suggest that our traditional transportation models could be quite useful. Second, with the emphasis on composting part or all of the organic fraction of the solid waste stream, our traditional approach to analysis of the economics of livestock manure management and land application of municipal sewage sludge would seem highly applicable. Third, with the substantial changes taking place in the cost and control of solid waste management (i.e., local versus regional, public versus private), consideration of the significance of solid waste management system characteristics in location decisions of business and industry would be a useful undertaking. Fourth, there are a number of issues surrounding solid waste management in which nonmarket values are important considerations. Perhaps the most obvious are the perceived external costs associated with landfills, incinerators, or other facilities. While a few studies have attempted to estimate these external costs or to identify the key factors influencing their magnitude, there is room for additional work. On the other side of the ledger, it seems clear that many people derive utility from participation in recycling, typically incurring time and resource costs for no monetary reward. In addition, few recycling programs have been cost effective relative to disposal options in a short-term, fiscal budget context. Thus estimates of residents' willingness to pay to maintain a recycling program may well provide valuable information to local decision makers. Fifth, the inclusion of recyclable materials on the Chicago Board of Trade signals that these materials have truly become “commodities,” and that markets for these materials have matured rapidly over the last few years. Therefore, the time appears ripe for using the traditional tools of our trade to analyze the characteristics of these markets. Related to this is the dramatic increase in international trade of recyclable materials, which may suggest researchable questions for some in our discipline.

Conclusions

The issue of solid waste management has risen to national prominence in the last decade, fueled by increasing waste disposal costs and changing public attitudes. This issue presents a major opportunity for economists to use their applied microeconomics skills to assist state and local governments manage waste in a cost effective fashion. While economists have made many contributions to the debate, many opportunities remain. Many standard

tools from agricultural economics historically used for farm management can be applied to waste management; for example, the problem of where to site milk processing facilities, solved via mathematical programming models, is analogous to that faced by states seeking the optimal location for regional landfills or incinerators. While the issue of regionalization in service provision goes beyond economics, economists can play a role in demonstrating to communities what they have to gain or lose by adopting home rule management strategies versus regional approaches to solving solid waste, transportation, or education problems.

One final perspective centers on our potential extension or outreach role with regard to solid waste management decision making in rural areas. While findings from formal research efforts may ultimately make their way into the decision making process, perhaps we can play an even more significant role in emphasizing the importance of the most basic economic concepts and principles for sound decision making in solid waste management or the many other areas in which local public choices are made. These areas would include at least the following: opportunity cost, marginal analysis of costs and benefits, and the role of economic incentives. The challenges that rural communities are facing today have created a more receptive atmosphere than ever, it would appear, for guidance along these lines.

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