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Do Economists Reach a Conclusion on Household and Municipal Recycling?

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Abstract

HOUSEHOLD RECYCLING CURRENTLY ENJOYS BROAD SUPPORT from the American public. Bailey (1995) reports that American households rate trash as the biggest environmental problem facing America with three-fourths identifying recycling as its solution. A more recent poll in 2004 by the Center for the American Dream found that 87 percent of respondents somewhat or strongly agreed: "We should be more focused on recycling, conserving energy and water and buying goods that are not over packaged in order to protect the environment" (21). Ninety-two percent of respondents in the same poll believe that recycling more bottles, cans and paper will help the environment.[1] Perhaps in response to this demand, the number of municipal recycling programs increases every year. In 2001 the Environmental Protection Agency calculated that 30 percent of American's solid waste was diverted from its landfills and recycled. As of 2002, the EPA reports that there are nearly 9,000 municipal recycling programs in the United States, which serve about half the citizenry.

When it comes to a specific public policy, expert economists and the public often arrive at different conclusions. So what do published economists conclude about household recycling?

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[1] Entire poll is available online: Link.

CRITERIA FOR INCLUSION

There are two specific criteria that a paper must meet for inclusion in my survey: It must reach a policy conclusion on household or municipal recycling, and at least one of the authors (if the paper has multiple authors) must be a credentialed economist. The first limitation excludes a large literature on industrial ecology and industrial waste recycling. These topics are outside the scope of my present analysis and are omitted from this paper.[2]

My second limitation further narrows the number of possible papers to those authored by at least one economist. For the purposes of this paper I define an economist as a person with at least one of the following two characteristics: Possession of an advanced degree in economics (either an MA or Ph.D.), or employment (past or present) in an economics department at a college or university. Since I am specifically looking at the policy conclusions of economists, papers published by credentialed economists that do not make a discernable policy conclusion are omitted. Admittedly, this involves some judgment on my part.

I cannot make the claim that all economists with published policy judgments on recycling are included in this paper. I do make the claim, however, that the following judgments represent the whole range of economic opinion on the matter. The papers and books I include in this survey were found using the EconLit database, the Google search engine, and the George Mason University library catalogue. I found several additional papers after examining the references of papers originally found using EconLit, Google, and the GMU catalogue. I did not make contact with any of the economists in this paper regarding their policy judgments. I base my conclusions only on my interpretation of the judgments they express in their published work. Several papers treated here are quite old and it is quite plausible that some economists, if asked, might endorse different policy recommendations today. If an economist has changed his mind on a policy proposal espoused in an earlier work, but has not expressed this change in any published work, it will not be reflected in my analysis.

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[2] A good general reference guide to industrial ecology from an economics perspective is van den Bergh and Janssen (2004). Also, see Baumgartner et al. (2001) for a recent overview of industrial waste recycling and the concept of joint production. Two older treatments of industrial waste recycling and joint production are Etheridge (1973) and Kurz (1986). I thank an anonymous referee for directing me to all four sources.

ECONOMISTS' POLICY JUDGMENTS

According to the famous free-market economist Julian Simon, "There are three ways society can organize waste disposal: (a) commanding, (b) guiding by tax and subsidy, and (c) leaving it to the individual and the market" (1996, 300). Economists' policy judgments are organized below according to Simon's typology. A number of them did not fit comfortably into any of these three categories and are placed in a fourth category. Also, note that my "unit of analysis" is the published work, not the author; for this reason an author may turn up in more than one category.

I. Command and Control Policies

Economists in the "command and control" category favor extensive government intervention in the market, usually in the form of mandatory regulations.

Frank Ackerman:

Ackerman (1997) rejects mainstream economic cost-benefit analysis as the primary tool for analyzing recycling programs. He suggests that markets cannot put an accurate price on the value that people receive from their participation in recycling and other environmental activities:

> One could sensibly claim that environmental goals embody essential, perhaps "ethereal," human experiences, which, like consensual sex, are corrupted by being bought and sold—or that environmental standards embody basic social norms which, like electoral participation, are undermined by being bought and sold. In either case, we as citizens have to decide on the limits within which we allow ourselves, as consumers, to buy and sell. The environmental objectives we pursue through recycling lie, in large part, outside those limits. (57)

Ackerman rejects both a free market and guided-market approach to recycling. He describes faith in the free market as a "system of secular belief" and dismisses those who advocate a laissez-faire policy in recycling:

> The "anti-recyclers," as they have been called, look at recycling from a purely economic point of view. They claim that the government should not set recycling targets or subsidize local recycling programs. Just get the prices right, allow unfettered competition, and the market will achieve the most efficient level of recycling, as with everything else. (11)

In his discussion of market-based incentives he concludes, "none of the market incentives for recycling here—unit pricing for waste disposal, elimination of virgin material subsidies, or advance disposal fees—accomplish much on their own" (42). Ackerman's overall assessment of recycling is that it's "almost always environmentally desirable, which is why it is worth doing even if it entails moderate cost increases" (83).

Allen Hershkowitz:

In a report for the Natural Resources Defense Council, Hershkowitz (1997) responds to a "small but potentially influential group of antirecycling voices attempting to disrupt environmental progress" (Introduction). His primary target is a 1996 article by John Tierney in *New York Times Magazine* entitled "Recycling is Garbage." Hershkowitz examines and rejects the anti-recycling arguments of Tierney and other recycling critics. According to Hershkowitz, "few public policies provide as many advantages as does recycling" (Introduction). He argues:

> • Using recycled paper, plastics and metals is better for the environment than using virgin resources (Chapter 1).
>
> • Recycling reduces the need for waste storage in toxic landfills and reduces the air pollution from burning wastes in incinerators (Chapter 2).
>
> • Recycling does "lose money," but notes "most government programs 'lose money' -- not only traditional garbage-collection programs, public schools, and police and fire departments, but also NASA, the military, and highway construction, to name just a few." He continues: "Compared with traditional garbage collection, expenditures on recycling efforts are invariably smaller and offer the

potential to generate their own revenue stream, even if they do not always break even" (Chapter 3).

- The billions in subsidies that benefit virgin resources extraction pale in comparison to the meager subsides that that recycling efforts receive, with the result that there is too much virgin resource extraction and not enough recycling (Chapter 3).

- Unit pricing of garbage only works when mandatory curbside recycling is in place. "With few exceptions, wherever you find pay-as-you-throw, you also find curbside collection and separation requirements" (Chapter 3).

- Manufactures of consumer products should be held responsible for the cost of disposing of the products they make (Chapter 3).

- Deposit-refund regulations on glass bottles are an effective way to reduce litter (Chapter 3).

In discussing future policy Hershkowitz notes that many European countries recycle a higher percentage of their garbage than does the United States, and concludes that "clear[ly] we could do better" (Chapter 4). Hershkowitz views state and local recycling programs as a positive development, noting "municipal officials from virtually every region in the United States were among the most vociferous *proponents* of recycling requirements" (Chapter 4, emphasis in original). In ending his report, Hershkowitz concludes: "[A]ll sectors of the polity would do well, materially and spiritually, to embrace and help advance the sustainable, community-building, natural harmony it [recycling] promotes" (Conclusion).

Anni Huhtala:

Using data collected from Helsinki Finland as inputs, Huhtala (1997) develops a model of waste disposal that includes the costs of recycling, the social costs associated with landfills, and the environmental preferences of consumers. She uses data collected from Helsinki, Finland as inputs into the model. She recommends a command and control mandate for achieving a certain percentage of municipal recycling:

> The analysis shows that when the social (environmental) costs of landfilling are taken into account, it becomes a

> more costly disposal option than others. The results of the study suggest that mandates for achieving 50% recycling in municipalities are not too far-fetched and are both economically and environmentally justified. (312)

Jeffrey Morris:

Morris (1996) discusses the competition in many localities between recycling and incineration as alternate means of waste disposal. He advocates government intervention in the recycling market to ensure that recycling can fairly compete with government supported virgin materials extraction.

> Governmental and institutionalized supports for virgin materials extraction and processing result in virgin materials being sold to manufacturers at prices lower than would prevail in the absence of these supports. At the same time, recycled materials in general cannot be sold for more than the virgin materials with which they compete. Therefore, there is, and will continue to be, a need for governmental support for collection, processing and marketing of recyclable and compostable materials to ensure that recycling can compete on an equal and fair basis with garbage collection and disposal and the concomitant continued acquisition of virgin materials. (IV. Competition for Government Support)

Examples of government support for virgin material extraction that Morris cites include "land and mining grants, oil depletion allowances, and subsidized access to resources on publicly-owned lands" (IV. Competition for Government Support). In addition to virgin materials extraction, Morris also notes unfair government support for virgin materials manufacturing, citing "virgin-content requirements in governmental purchasing specifications" as one such example (IV. Competition for Government Support).

Morris does not advocate eliminating virgin material supports, but wants to counter their effects with recycling subsidies. Perhaps he views new recycling subsidies as relatively easier to implement than the elimination of entrenched government support for virgin materials extraction and manufacturing.

Kazuhiko Nishimura

Nishimura (2001) offers a theoretical analysis of decentralized recycling systems. He suggests that "a decentralized and competitive economic system that includes recycling could be inefficient when the waste quality affects the strategic environment of the recycling agent" (206). Nishimura concludes that a "central planning authority that has complete access to private industry information" would be "difficult in practice" (207). Instead, he proposes that goods manufacturers be required to recycle because "the [negative] externalities could be internalized without further economic coordination, and it may also stabilize the system" (207-208).

II. Guided-market: Guiding by Tax and Subsidy

Economists in this category generally do not favor command and control policies. They advocate a guided-market approach wherein government intervenes to provide the right incentives to correct what are commonly called market failures—instances where the private market, if left to its own devices, will produce unsatisfactory results.

Paul Calcott and Margaret Walls:

Because most households are not paid for their recyclables, producers do not receive adequate signals to make their products more recyclable. Calcott and Walls (2000) conclude that waste-output taxes and recycling subsidies are not feasible because of high transactions and information costs. They advocate a "second-best" solution:

> This constrained optimal threshold balances the increase in production costs incurred when product recyclability is increased with the savings in recycling costs… In particular, a deposit-refund continues to be the instrument of choice, as it is in a first-best setting. Here, we show that with two different rates for the deposit, one that applies to recyclable products and one that applies to nonrecyclable products, the [modified] deposit-refund will yield the constrained optimum. (15)

After allowing for some imperfections in the recycling market (transactions costs and the imperfect sorting of materials) Calcott and Walls (2005) once again favor a deposit-refund scheme to arrive at a constrained optimum. They argue the refund encourages consumers to bring in products for recycling, mitigating the negative effects of the two market imperfections noted above. According to Calcott and Walls, producers should bear the social costs of non-recycled products that end up in the trash and should not get to retain unclaimed deposits, which would go to the state (290, 300-301). Regarding household waste disposal, they recommend a small disposal fee that is "set equal to the social costs of disposal less the difference between recycling costs (at the threshold) and the virgin materials cost (302)." They note that a small disposal fee will encourage "low-cost waste-reduction activities by households" while avoiding strong incentives for illegal dumping (302).

Don Fullerton and Thomas C. Kinnaman:

Fullerton and Kinnaman (1995) develop a model of waste disposal that allows for illicit burning or dumping in addition to the legal disposal options of recycling or garbage collection. They find that a price per unit of garbage is likely to lead to inefficient amounts of burning or dumping, and recommend subsidizing garbage collection. (By "subsidizing" they mean simply not charging a fee for collection.) "The optimal fee structure," according to Fullerton and Kinnaman, "is a deposit-refund system: a tax on all output plus a rebate on proper disposal either through recycling or garbage collection" (78).

Don Fullerton and Wenbo Wu:

Fullerton and Wu (1998) develop a general equilibrium model to analyze disposal content fees, subsidies for recycling design, unit pricing of household waste, deposit refund systems, and product "take back" requirements on manufacturers (131). Their model allows for various market failures including private collection firms that price waste to reflect private and not social costs; the aesthetic and health costs of landfills, incinerators, and trash collection trucks; and municipalities that charge a zero price for trash collection in order to avoid illegal dumping and administrative costs (resulting in excessive trash generation by residents).

Different policy options for different market failures, note Fullerton and Wu, can be used to reach the social optimum. If disposal

charges are aimed at consumers, "then consumers will induce firms to use less packaging and to design products for easier subsequent recycling" (146). If disposal charges are not feasible, then policies directed at the firm can produce the social optimum. In this scenario, they conclude: "the solution might involve either a subsidy to recycling . . . or if that is not possible, a subsidy to recyclability (146).

Ralph Gray:

Using three different examples, Gray (1972) makes the case for a deposit-refund system aimed at internalizing disposal costs of wastes. Gray recommends a deposit on cans and bottles "large enough to force consumers to get them into a reuse or reclamation channel" (48). He calculates that this deposit would need to be ten or eleven cents (about thirty-six cents in 2006 dollars).

In dealing with the problem of abandoned junk automobiles, Gray recommends:

> charging each buyer of a new car a deposit based on weight and current and projected price of scrap metal. The charge should be high enough that it would pay to have the vehicle hauled into a scrap yard even if the price of scrap were negative. (49)

If the costs of growing, manufacturing and disposing of paper is greater than the cost of recycling paper, Gray recommends that society encourage recycling through the use of a tax on newspapers. In the scheme he envisions:

> The householder can save his paper, periodically turn it into a vendor to receive a price per pound (which may be positive or negative), plus a refund of his deposit. Newsprint dealers can then sell their acquisitions to paper reclaimers, receive payments for the refunds they have made, and in turn the reclaimer would receive rebates from a federal trust fund. (50)

Gray specifically eschews the use of subsidies and regulation in regard to waste disposal. From an equity viewpoint, he believes that

subsidies are no different than "paying Willie Sutton a bounty not to rob banks." He notes:

> From the standpoint of allocative efficiency, a subsidy would replace the costs of disposal pollution borne by citizens and taxpayers with the costs of recycling to be borne by taxpayers rather than the consumers whose consumption makes necessary recycling activity. (51)

Gray views a regulatory approach to waste disposal as both more costly than a deposit refund system and a roadblock toward the discovery of more efficient recycling processes (51).

Thomas C. Kinnaman

In a concise yet comprehensive article Kinnaman (2006) summarizes the economic literature on recycling and waste management. Kinnaman argues that state mandates for recycling and garbage disposal should be replaced by a landfill tax. By setting the landfill tax equal to the external marginal cost of waste disposal, municipalities will adopt recycling programs only when it is efficient to do so (230-231). Kinnaman concludes that if the cost of garbage disposal were internalized, state mandated recycling goals could be eliminated.

> If the external costs of garbage disposal were to be internalized through the landfill tax, state mandates that require municipalities to adopt curbside recycling, to achieve a recycling target, or to implement unit-based fees for garbage pick-up would be unnecessary and could be eliminated. (231)

Marie Lynn Miranda, Jess W. Everett, Daniel Blume, Barbeau A. Roy, Jr.

Using data gathered from mail and telephone surveys in 21 cities, Miranda, et al. (1994) investigate the effects of unit based pricing of solid waste and recycling programs on the costs to municipalities of providing solid waste removal services. Though they stress that their results "are at best preliminary" (697), they find strong evidence that unit based pricing and recycling can lower costs and improve efficiency (681). Like other

economists who stress a guided-market approach to recycling policy, they find "[u]nit pricing may provide a financial incentive that is more cost effective in eliciting particular behaviors than command-and-control type government directives" (692). Unsurprisingly, they do not recommend mandatory recycling.

Glenn E. Morris and Duncan Holthausen, Jr.:

Morris and Holthausen (1994) develop a utility-maximizing model of managing household waste. Using a two-period model, they find that moving from a scenario with a fixed waste disposal fee, with no curbside recycling, and twice-a-week collection to a scenario with a unit price per pound of waste and a curbside recycling program can provide a significant utility increase for a typical household (228-233). As long as the new program is not significantly more costly than the old, the new program with a unit price and curbside recycling is welfare enhancing.

Talbot Page:

Page (1977) says that recycling in and of itself is not important, but that government policy (taxes, subsidies, regulations, etc.) should guide the economy toward economic efficiency (where price equals marginal cost). According to Page:

> There are four causes of market inefficiencies that are important for our purposes and that manifest themselves in imbalance between prices and marginal costs. These are (1) monopoly pricing power; (2) the market system's inability to include environmental and disposal costs in product prices; (3) distortions in the federal tax system; and (4) price systems, such as freight pricing, which discriminate among products on the basis of what the traffic will bear. (5)

Page does not see (1) monopoly pricing power in virgin materials extraction as a major concern for policymakers (5-6). Page notes that negative externalities of pollution including solid waste disposal, item (2), are not accounted for in a product's price, and concludes that society needs either effluent taxes or regulations to ensure that costs are internalized (p. 6). The efficiency criterion says that tax distortions, item (3), should be

minimal to ensure that a tax is as neutral as possible. "The simplest way to guarantee nonneutrality," according to Page, "is to tax one sector of the economy lightly and another sector heavily" (7). Page notes that many economists think that material extraction is taxed too lightly relative to other sectors, "leading to too much extraction, too much material and energy throughput, too much solid waste, and not enough recycling" (7). Page observes that scrap materials sometimes pay a higher rate than virgin materials for freight transportation, item (4), despite little or no cost differences. According to Page, "[i]f the efficiency criterion were applied, rates would be based on marginal costs, resulting in a more balanced flow of virgin and scrap materials" (7). For Page, "the focus [of policy] is on making the market work better. As the market becomes a better allocator of material uses, recycling, durability, and conservation will take care of themselves" (210).

Karen Palmer, Hilary Sigman, and Margaret Walls:

Palmer, Sigman, and Walls (1997) examine three popular market incentive policies for recycling and waste disposal and find, with relevant qualifications, that a deposit/refund system is best:

> In this study, we analyze the costs of three economic incentive policies for reducing disposal of municipal solid waste: deposit/refunds, recycling subsidies, and advance disposal fees [ADF]. We find that a deposit/refund is significantly less costly than either a recycling subsidy or an ADF. However, high administrative costs might alter this conclusion, making an ADF appear more attractive. (147)

Karen Palmer and Margaret Walls:

Palmer and Walls (1997) develop a model of consumer and producer behavior to examine whether mandatory recycled content standards found in a large number of states are more efficient than a deposit-refund system. They find that the mandatory content standards must be combined with other taxes on production inputs and outputs to achieve an efficient outcome, but that the information required to implement the efficient tax is too great in a real-life scenario. Therefore, they recommend a deposit-refund approach. They conclude: An "optimal deposit-refund consists of a

tax on production combined with a subsidy of recycled products both of which are equal to the marginal social cost of disposal" (204).

Palmer and Walls (1999) discuss which set of policies best conform to the principles of the Extended Producer Responsibility movement. According to Palmer and Walls, "Extended Product Responsibility embodies the notion that individuals along a product chain should share responsibility for the life-cycle environmental impacts of the product—i.e., the impacts from raw material extraction through manufacturing, distribution, consumption and ultimate waste disposal" (4). Extended Producer Responsibility is a slightly narrower concept that says producers should bear some portion of the responsibility and cost for discarded consumer products. Ultimately, Palmer and Walls find a tax and subsidy approach works best.

> We conclude that a UCTS [upstream combination tax/subsidy] policy coupled with increasing use of UBP [unit-based pricing] could lead to cost-effective reductions in waste disposal in the US and promote the goals of Extended Product Responsibility in a cost-effective manner. (9)

Further clarification is probably warranted on what exactly an upstream combination tax and subsidy (UCTS) and unit-based pricing (UBP) involve. An upstream combination tax/subsidy "combines a tax on produced intermediate goods such as aluminum ingot, rolls of a specific grade of paper, and sheets of steel, with a subsidy granted to collectors of recyclables such as used beverage cans, old newspapers, and so forth, who subsequently sell the goods for reprocessing" (3). A unit-based pricing program, advocated by several other economists treated in this paper, charges households a charge per bag or pound of trash instead of a flat fee. Through price incentives, a unit-based pricing program is thought to reduce the amount of trash households throw away while encouraging both recycling and more environmentally designed products that require less packaging.

Palmer and Walls (2002) reiterate their earlier conclusions for an incentive-based approach to recycling policy instead of reliance on either the voluntary decisions of private industry or "command and control" regulations. As in their previous paper, they favor an incentive-based approach, which "allow[s] firms and consumers the flexibility of not 'complying'—that is, not changing their behavior in response to the policy

instrument (be it an emissions tax, disposal fee, UCTS, or tradable recycling credit scheme)" (41). And unlike voluntary recycling programs, they point out firms would pay a penalty for non-compliance. Palmer and Walls (2002) stress the need for "flexibility across firms," which is why they suggest a tradable credit approach similar to the tradable emissions program that is popular among economists as an efficient way of reducing air pollution (41).

Karen Pittel, Jean-Pierre Amigues, and Thomas Kuhn:

Using an endogenous growth type model Pittel, Amigues and Kuhn (2005) examine whether a decentralized free market in recycling and virgin resource extraction reaches a socially optimum long-run path. They find that "[t]he deviation of the decentralized solution from the social optimum is due to a number of market failures" (3). One market failure is the absence of a market for unrecycled waste in laissez-faire environment. The other major market failure they identify is "virgin resource extractors and recycling firms [that] do not account for the effects of their output decision on the future availability of recycled waste." To correct these market failures Pittel, Amigues, and Kuhn recommend two government interventions: creation of a market for unrecycled waste, and subsidizing recycling and resource extraction (25).

Richard C. Porter:

A significant portion of Porter's book *The Economics of Waste* is devoted to recycling. After a discussion of the costs and benefits associated with recycling, Porter concludes: "recycling probably does not now pay off in social benefit-cost sense for the *average* municipality in the United States" (2002, 139). Porter recommends a decentralized approach that calls for each municipality to conduct a cost-benefit analysis before choosing what materials, and how much of each material, to recycle. He describes state mandated recycling goals that apply to all municipalities equally as "foolish" (2002, 139). Porter emphasizes that there is great variability in what should be recycled from one municipality to the next, but the rule of thumb should be that the social benefits outweigh the social costs.

Porter is against mandatory recycling (2002, 172) and in favor of a trash-collection charge. In the "scheme" that he believes would work the best,

> the advance disposal fee [ADF] on the manufacturer of a product equals the marginal net recycling cost of the product and package (i.e., collection and processing cost net of revenue earned on the recyclable materials), and the trash collection charge on the household equals the excess of the marginal landfill or incinerator disposal cost over the marginal net recycling cost (with all costs being social, not just private costs). (2002, 162)

Porter notes that this scheme "gives the correct incentive to reduce and recycle and gives some…incentive to reuse" (2002, 162). It also provides an incentive for manufactures to use more recyclable materials, can be managed without much difficulty, and does not require fees or subsidies (2002, 162).

Vernon Smith:

Smith (1972) proposes the use of Pigouvian taxes to encourage efficient use of resources and recycling:

> To economists the natural control device is a Pigouvian system of charges. The idea behind environmental "user" charges is to employ the pricing system to redirect resources in accordance with the reality of public costs associated with environmental use. (614)

The revenues from the taxes should then go towards crediting manufacturers that recycle old materials into a new product or to the municipality that disposes of the waste if it is not recycled (615).

Margaret Walls:

Walls (2003) discusses the emerging concept of Extended Producer Responsibility (EPR), mentioned earlier in Palmer and Walls (1999). In accordance with the goals of EPR, she recommends several policy maxims for policymakers. These include:

> Using EPR-based [Extended Producer Responsibility] instruments when either illegal disposal or poorly functioning recycling markets present themselves as

> problems; and recognizing and dealing with the fact that using policy to motivate DfE [Design for Environment] is always going to be difficult. With respect to the last maxim, it is important that policymakers not let the added cost of instituting a complex policy outweigh the added DfE benefits. (22)

The focus of the "Design for Environment" movement is to encourage producers to manufacture and package their products in an environmentally friendly way. Two examples include using less packing material and manufacturing a product so that is easier to recycle. The concept is closely linked to the notion of extended producer responsibility.

III. Other/Unclassified:

Economists in this section did not come to a specific conclusion that fit neatly into the command and control, guided-market, or free-market categories. Most economists in this section recommended a command or guided-market solution with about equal force.

Jared Creason and Michael Podolsky:

Creason and Podolsky (2001) investigate the economic impact of recycling by constructing a model using primarily state-level empirical data. By "economic impact," Creason and Podolsky do not mean the traditional cost-benefit test that many economists use when assessing the efficiency of government policy. In their description of economic impact analysis they note:

> Economic impact analysis does not "take sides" on this [cost-benefit] issue. Economic impact analysis emphasizes the distributive effects of a policy that, depending on the relative weight decision makers place on efficiency versus distribution, may influence the ultimate policy choice. (163)

Using the economic impact metric, Creason and Podolsky find that, for many states, spending on recycling "creates an important economic

stimulus for the processing and collection industries" that has "a small positive effect on economic development" (149-150).

Vijaya G. Duggal, Cynthia Saltzman, and Mary Williams:

In a discussion of glass and newspaper recycling, Duggal, Saltzman, and Williams (1991) argue that a laissez-faire system will not maximize social welfare and that society needs government intervention to achieve an optimal solution.

> Economic welfare analysis tells us that the amount of recycling undertaken by consumers will be less than optimal for two reasons. First, recycling creates a positive externality in that everyone benefits from my recycling efforts (saving landfill space and reducing landfill costs). In the absence of a one to one correspondence between those who make the effort and those who reap the benefit, many will not make the effort voluntarily. Second, recycling is an intergenerational public good. Our recycling efforts today will help to eliminate a potential problem in the future. Given the myopic time preference of most individuals, people will undervalue the current benefits of recycling. (352)

> The two above factors cause the private marginal benefit from recycling to be less than the social marginal benefit. From society's perspective, not enough recycling will be done by individuals because they cannot capture, or are uncompensated for, all of the benefits of their efforts. Therefore, any large scale recycling program must be government initiated either through mandatory regulations or economic incentives. (352)

Jannett Highfill and Michael McAsey:

In order to help planners decide when to implement a recycling program, Highfill and McAsey (1997) develop a model with two strategies for municipal waste disposal: dumping waste into a landfill or recycling it. They conclude:

> A municipality that recycles (i) will always simultaneously recycle and use its landfill for some time interval during which (ii) recycling is always increasing while landfill use is declining and (iii) there exists an upper bound on the length of this interval which is independent of the size of the landfill and the municipality's planning horizon. But the paper has also shown that beyond these conclusions, the specifics of a waste management program depend on the characteristics of the municipality in question, even, or perhaps especially, when the long-run is taken into account. Not only is no single recycling plan going to be optimal for all cities, even the barest outlines of the waste management program differs between communities. For example, cities of approximately the same size but different landfill endowments will begin recycling at different times (perhaps never recycle at all) or have different optimal "active lives" of their existing landfill. (135)

Thus, Highfill and McAsey recommend a decentralized recycling policy, leaving municipal planners with ample room for setting local policy using the appropriate cost-minimizing mix between landfills and recycling programs.

Highfill and McAsey (2001) reach a similar conclusion using a dynamic model of consumption and expenditures on waste with an income stream that is growing over time. Their analysis suggests that richer municipalities will have very high levels of recycling and rely less on landfills, while poorer municipalities will engage in less recycling and utilize their stock of landfill capacity. They conclude again that decentralized recycling policy works best, noting that a one-size-fits-all "recycling policy imposed on municipalities by other government bodies is almost surely going to be inappropriate for some municipalities" (49).

Robin R. Jenkins, Salvador A. Martinez, Karen Palmer, and Michael Podolsky:

Jenkins et al. (2003) find "[m]aking a curbside recycling program mandatory has no statistically discernable effect on intensity of recycling effort for any of the materials [in our study]" (311). They do not

recommend either a free-market or guided-market approach in their paper so I cannot satisfactorily place them in either category.

Rafael Lusky:

Lusky (1975) advocates centralized decision making to internalize and correct a sub-optimal amount of natural resource extraction in a laissez-faire environment. He notes that an alternative decentralized solution, employing taxes and subsidies, can achieve the same effect. Within the decentralized scheme, Lusky advocates subsidies to recycling firms, which are separate from the decentralized tax plan (327-28).

In a perfect market for refuse, Lusky (1976) says the government only needs to intervene "for the non-recyclable pollutant that has negative effects upon consumers' utilities" (101). Lusky cites the market for scrap metal and lesser developed markets for paper, aluminum cans, and glass bottles as evidence of a market for recyclables while cautioning that these may in fact be "ecologically motivated community actions rather than active markets for residues" (101). He concludes that when "refuse markets are not forthcoming" government should intervene to reduce pollution to its optimal level (101).

Thomas C. Kinnaman:

Kinnaman (2005) finds that municipal recycling programs are usually initiated because of state requirements or the demands of local residents for a recycling program and not because of careful cost-benefit calculations by policymakers. Kinnaman recommends elimination of three specific policies in which the costs will almost always exceed the benefits: banning certain materials from landfills, subsidizing recycling industries, and setting statewide recycling goals (21).

Margaret Walls and Karen Palmer:

Walls and Palmer (2001) construct a comprehensive model of production, consumption, and waste disposal, which incorporates a life-cycle product assessment. A life-cycle assessment of a product includes "enumerations of all of the resources used and pollutants emitted throughout the life-cycle of a product, from resource extraction through manufacturing and ultimately product disposal" (94). In this particular

paper, Walls and Palmer "look at how the existence of life-cycle environmental externalities affects the choice of optimal policy" (95).

Their conclusion hinges on the feasibility of Pigovian taxes:

> If taxing the upstream pollutants is feasible, then Pigovian emissions taxes along with a combined output tax and recycling subsidy will generate the social optimum. If Pigovian taxes are not feasible, then we find that there are alternate taxes that can achieve the optimum… Alternatively, we find that regulatory standards in combination with taxes can also achieve the first best. (96)

IV. The Free Market Works Best

Free-market economists see little or no need for government intervention in recycling markets. They agree that both command and control policies and guided-market taxes and subsidies usually waste resources and recommend their elimination.

Terry Anderson and Donald Leal:

Anderson and Leal (2001) argue recycling is only worthwhile when the value of the resources saved exceeds the resources used in the recycling process. They emphasize the importance of input prices, firms' desire to minimize costs, and the role of entrepreneurs in deciding the efficient amount of recycling. In short, they advocate a free market in recycling (125–126).

William Baumol:

Assuming no externalities, Baumol (1974) sees little need for government involvement in the market for recyclables.

> The first point to be made is obvious once stated. In the absence of externalities, competitive general equilibrium must produce an optimal quantity of recycling, as it does of every other economic activity. That is, in such a world the introduction of an exogenous inducement to recycling, would, if anything, decrease social welfare. The relative

> cost and quality of virgin and recycled materials would be taken into full account by the free market, and the appropriate decisions taken by it in the absence of outside interferences. (84)
>
> We have seen that in a competitive equilibrium without externalities, induced expansion of recycling will never be beneficial; and in the presence of externalities, the matter requires further investigation. (87)

Even after allowing for externalities, Baumol still warns that forced recycling may still be unwarranted since the recycling process also produces negative externalities. Baumol notes that further study is needed to conclude whether the negative externalities produced in a free market are greater than the externalities produced by the recycling process (85).

Daniel K. Benjamin:

Benjamin (2003) concludes that the free market, in most every case, is the proper mechanism for determining the correct amount of recycling.

> *Informed*, *voluntary* recycling conserves resources and raises our wealth, enabling us to achieve valued ends that would otherwise be impossible. In sharp contrast, however, *mandatory* recycling programs, in which people are directly or indirectly compelled to do what they know is not sensible, routinely make society worse off. Such programs force people to squander valuable resources in a quixotic quest to save what they would sensibly discard. On balance, mandatory recycling programs lower our wealth. (25, emphasis in original)
>
> Except in a few rare cases, the free market system is eminently capable of providing both disposal and recycling in an amount and mix that creates the greatest wealth for society. (26)

Julian Simon:

Julian Simon's position can be succinctly summarized with two brief quotes from his book, *The Ultimate Resource 2*.

> [T]here is no more economic warrant for coercing recycling than for coercing other sorts of personal behavior that are moral issues for some—whether people should eat high-fat diets, or pray three times a day, or tell ethnic jokes. (Simon 1996, 287)

> People voluntarily recycle valuable resources and throw away less valuable items that take more effort to recycle than they are worth. Coercive recycling is actually more wasteful than throwing things away. It wastes valuable labor and materials that could be put to better use—creating new life, new resources, a cleaner environment. (Simon 1996, 298)

Clark Wiseman:

Wiseman (1992) notes, "far from being a solution to the solid waste problem, the nation's massive recycling effort—sustained *and* expanded by subsidies, taxes, and government operation—is itself inherently wasteful" (443). Part of the problem, according to Wiseman, is the misinformation about the safety and capacity of our nation's landfills fuels wasteful recycling programs (444-445).

Wiseman suggests that garbage collectors (whether public or private) charge a per-unit fee. This charge would lead to an increase in voluntary recycling (455 and 458). To sum up his conclusions, Wiseman notes:

> There is ample evidence that recycling is being pushed beyond the economically efficient level as a result not only of the siting problem but also because of misperceptions of the environmental impact of landfills, overestimation of the benefits of recycling, and underestimation of the real costs of recycling which importantly include household time and effort (458).

NO CONSENSUS ON RECYCLING POLICY

After reviewing their judgments concerning household and municipal recycling, it seems clear that economists have yet to reach a consensus on desirable policy. But an analysis of economists' conclusions, and how they reach those conclusions, still yields some interesting results. Starting with the four categories from the previous section, I sorted the papers into one of four broad approaches undertaken by economists in their research. These four approaches are model-building, nonmathematical theory, empirical papers using quantitative data, and case studies based on different localities' experiences with recycling. The results are displayed in Table 1 below.

As Table 1 shows, most of the guided-market economists employ a model-building approach, although a significant number use some sort of non-mathematical theory as well. All of the free-market economists fall into the nonmathematical theory category. Of the five command and control papers, two take a model-building approach, two are case studies, and one is primarily nonmathematical theory. Classified in this way, it seems that an economist's policy conclusions and his approach are highly correlated.

Overall, a majority of economists favor a guided-market approach to recycling policy using the appropriate tax or subsidy to correct for market imperfections. While they agree that there is a market-failure problem, guided-market economists have yet to reach a consensus on the correct tax and subsidy scheme. Smaller subsets of economists favor laissez-faire and command and control policies. Based on their conclusions, economists do appear to be less enthusiastic about the benefits of recycling than the public, but most still see an important role for government in promoting what they concluded is an efficient amount of recycling.

Table 1

	Command and Control	Guided-market	Other/ Unclassified	Free Market
Primarily Model Building	Huhtala (1997) Nishimura (2001)	Calcott and Walls (2000), (2005) Fullerton and Kinnaman (1995) Fullerton and Wu (1998) Morris and Holthausen, Jr. (1994) Page (1997) Palmer, Sigman, and Walls (1997) Palmer and Walls (1997) Pittel, Amigues and Kuhn (2005) Smith (1972)	Creason and Podolsky (2001) Duggal, Saltzman, and Williams (1991) Highfill and McAsey (1997), (2001) Lusky (1975), (1976) Walls and Palmer (2001)	
Non-mathe-matical Theory	Ackerman (1997)	Gray (1972) Porter (2002) Palmer and Walls (1999) Walls (2003)		Anderson and Leal (2001) Baumol (1977) Benjamin (2003) Simon (1996) Wiseman (1992)
Primarily Quant./ Empirical		Miranda, Everett, Blume, Roy, Jr. (1994)	Jenkins, Martinez, Palmer, and Podolsky (2003) Kinnaman (2005)	
Case Studies	Hershkowitz (1997) Jeffrey Morris (1997)	Kinnaman (2006) Palmer and Walls (2002)		

MY TAKE:
A FREE-MARKET APPROACH TO HOUSEHOLD RECYCLING[3]

At this point we may ask the question: Why do economists lack a preponderant consensus in favor of laissez faire policy for household recycling and waste disposal? Perhaps the reason lies in their approach. Many of the interventionists see product disposal as an externality of production, but disposal can just as easily be viewed as a service that consumers value after they have consumed a product. A consumer knows when he purchases a product, that after he has consumed it, he will have to dispose of it in some way if he wants to be rid of it. In a free market scenario, a consumer might have three general options for legally disposing of his trash. He might pay another party to haul it away and deposit it into a landfill—option one. Option two might involve the consumer hauling his own garbage to another party's property where he will pay that party for the right to dispose of his trash. Some household waste, such as aluminum cans, is actually valuable to other parties who would be willing to pay the consumer for these trash items. Selling trash that another party finds valuable is option number three. None of these three potential transactions appears to impose externalities on any third parties. In a free-market setting for household waste, recycling will tend to occur when the benefits of recycling exceed the cost of an alternate option. As Daniel Benjamin notes above, the free market seems routinely capable of handling both waste disposal and recycling.

When governments decide to take over garbage disposal in a community, the situation changes. Private businesses have a strong incentive to please their customers, since more satisfaction usually leads to greater profits. If one firm in unable to provide good service at a reasonable cost, it tends to impel substitution. Government lacks strong incentives toward customer satisfaction. Government enterprises are often riddled with inefficiency and municipal recycling and waste management programs are no different. Economists usually advise against overly intrusive government intervention in private good markets with few third party externalities. So if waste disposal is a routine private good, why should it be treated any differently by economists? The answer seems to be what I

[3] The author wishes to thank Jane Shaw for several specific comments that greatly improved the quality of this section.

believe is the mistaken notion that trash disposal is a public responsibility and not a private good.

The private solution is not perfect. Having users pay for private trash disposal might create an incentive for them to dump trash illegally onto another's property. But this problem is local, bilateral, and diffuse. It is amenable to resolution or mitigation in particularistic ways—technological, practical, moral, and social, as well as legal. Also it is not necessarily mitigated by recycling programs. Public collection and requirements also imposes disposal costs on consumers: collection fees, the time cost of sorting trash for recycling, and all other requirements. And collection subsidies introduce all manner of rent-seeking and taxation inefficiencies. In my view, it would be better to salvage voluntary principles and junk the interventions.

REFERENCES

Ackerman, Frank. 1997. *Why Do We Recycle? Markets, Values, and Public Policy*. Washington D.C.: Island Press.

Anderson, Terry L. and Leal, Donald. 2001. *Free Market Environmentalism*. New York: Palgrave.

Baumgartner, Stefan; Dyckhoff, Harald; Faber, Malte; Proops, John and Schiller, Johannes. 2001. The Concept of Joint Production and Ecological Economics. *Ecological Economics* 36(3): 365-72.

Baumol, William J. 1977. On Recycling as a Moot Environmental Issue. *Journal of Environmental Economics and Management* 4(1): 83-87.

Benjamin, Daniel K. 2003. Eight Great Myths About Recycling. *PERC Policy Series* (PS-28). Link.

Calcott, Paul and Walls, Margaret. 2000. Policies to Encourage Recycling And "Design for Environment": What to Do When Markets Are Missing. Resources for the Future. Discussion paper 00-30, Link.

____. 2005. Waste, Recycling, And "Design for Environment": Roles for Markets and Policy Instruments. *Resource and Energy Economics* 27(4): 287-305.

Creason, Jared and Podolsky, Michael J. 2001. Economic Impacts of Municipal Recycling. *The Review of Regional Studies* 31(2): 149-164.

Duggal, Vijaya G.; Saltzman, Cynthia and Williams, Mary L. 1991.

Recycling: An Economic Analysis. *Eastern Economic Journal* XVII(3): 351-358.

Eichner, Thomas and Pethig, Rudiger. 2001. Product Design and Efficient Management of Recycling and Waste Treatment. *Journal of Environmental Economics and Management* 41(1): 109-134.

Ethridge, Don. 1973. The Inclusion of Wastes in the Theory of the Firm. *Journal of Political Economy* 81(6): 1430-1441.

Fullerton, Don and Kinnaman, Thomas C. 1995. Garbage, Recycling, and Illicit Burning or Dumping. *Journal of Environmental Economics and Management* 29(7): 78-91.

Fullerton, Don and Wu, Wenbo. 1998. Policies for Green Design. *Journal of Environmental Economics and Management* 36(2): 131-148.

Gray, Ralph. 1972. The Economics of Disposal Pollution and Recycling. *Quarterly Review of Economics and Business* 12(1): 43-51.

Hershkowitz, Allen. 1997. Too Good to Throw Away: Recycling's Proven Record. National Resources Defense Council. Link.

Highfill, Jannett and McAsey, Michael. 2001. Landfilling Versus "Backstop" Recycling When Income Is Growing. *Environmental and Resource Economics* 19(1): 37-52.

____. 1997. Municipal Waste Management: Recycling and Landfill Space Constraints. *Journal of Urban Economics* 41(1): 118-136.

Huhtala, Anni. 1997. A Post-Consumer Waste Management Model for Determining Optimal Levels of Recycling and Landfilling. *Environmental and Resource Economics* 10(3): 301-314.

Jenkins, Robin R.; Martinez, Salvador A.; Palmer, Karen and Podolsky, Michael J. 2003. The Determinants of Household Recycling: A Material-Specific Analysis of Recycling Program Features and Unit-Pricing. *Journal of Environmental Economics and Management* 45(2): 294-318.

Kinnaman, Thomas C. 2005. Why do Municipalities Recycle? *B.E. Journals in Economic Analysis and Policy: Topics in Economic Analysis & Policy:* 1-23.

Kinnaman, Thomas C. 2006. Policy Watch: Examining the Justification for Residential Recycling. *Journal of Economic Perspectives* 20(4): 219-232.

Kurz, Heinz D. 1986. Classical and Early Neoclassical Economists on Joint Production. *Metroeconomica* 38(1): 1-37.

Lusky, Rafael. 1976. A Model of Recycling and Pollution Control. *The Canadian Journal of Economics* 9(1): 91-101.

____. 1975. Optimal Taxation Policies for Conservation and Recycling. *Journal of Economic Theory* 11(3): 315-328.

Miranda, Marie Lynn; Everett, Jess W.; Blume, Daniel and Barbreau A. Roy, Jr. 1994. Market-Based Incentives and Residential Municipal Solid Waste. *Journal of Policy Analysis and Management* 13(4): 681-698.

Morris, Glenn E. and Holthausen, Jr., Duncan M. 1994. The Economics of Household Solid Waste Generation and Disposal. *Journal of Environmental Economics and Management* 26(3): 215-234.

Morris, Jeffrey. 1996. Competition between Recycling and Incineration. Economics Sound Resource Management. Link.

Nishimura, Kazuhiko. 2001. On Inefficiency and Instability in Decentralized Recycling Systems. *Environmental Economics and Policy Studies* 4(3): 191-210.

Page, Talbot. 1977. *Conservation and Economic Efficiency: An Approach to Materials Policy*. Baltimore: Johns Hopkins University Press.

Palmer, Karen; Sigman, Hillary and Walls, Margaret. 1997. The Cost of Reducing Municipal Solid Waste. *Journal of Environmental Economics and Management* 33(2): 128-150.

Palmer, Karen and Walls, Margaret. 1999. Extended Product Responsibility: An Economic Assessment of Alternative Policies. Resources for the Future. Discussion Paper 99-12. Link.

____. 1997. Optimal Policies for Solid Waste Disposal Taxes, Subsidies and Standards. *Journal of Public Economics* 65(8): 193-205.

____. 2002. The Product Stewardship Movement: Understanding Costs, Effectiveness, and the Role for Policy. Washington D.C.: Resources for the Future. Link.

Pittlel, Karen; Amigues, Jean-Pierre and Kuhn, Thomas. 2005. Endogenous Growth and Recycling: A Material Balance Approach. Institute of Economic Research (WIF), Swiss Federal Institute of Technology Zurich (ETH). 2005. Link.

Porter, Richard C. 2002. *The Economics of Waste*. Washington D.C.: Resources for the Future Press.

Simon, Julian L. 1996. *The Ultimate Resource 2*. Princeton: Princeton University Press.

Smith, Vernon L. 1972. Dynamics of Waste Accumulation: Disposal Versus Recycling. *The Quarterly Journal of Economics* 86(4): 600-616.

van der Bergh, Jeroen C.J.M. and Janssen, Marco A. 2004. *Economics of Industrial Ecology. Materials, Structural Change, and Spatial Scales.* Cambridge: The MIT Press.

Walls, Margaret. 2003. The Role of Economics in Extended Producer Responsibility: Making Policy Choices and Setting Policy Goals. Resources for the Future. Discussion paper 03-11. Link.

Walls, Margaret and Palmer, Karen. 2001. Upstream Pollution, Downstream Waste Disposal, and the Design of Comprehensive Environmental Policies. *Journal of Environmental Economics and Management* 41(I): 94-108.

Wiseman, Clark. 1992. Government and Recycling: Are We Promoting Waste? *Cato Journal* 12(2): 443-460.

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