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Per-Unit Garbage Charges

In a recent article in this journal, Thomas Kinnaman ("Examining the Justification for Residential Recycling," Fall 2006, pp. 219–232) claims that "the promise of a curbside garbage tax is false." He argues that virtually all municipalities charging user fees had already established a curbside recycling program, and so many households were already recycling voluntarily before the user fee was implemented. In addition, he argues that when administrative costs and the possibility of illegal dumping are taken into account, net benefits are small and could be negative.

In his central example, Kinnaman uses private marginal costs for garbage collection and disposal of $80 per ton and external marginal cost of garbage collection and disposal of $5 per ton. He estimates that increasing the curbside price of garbage from zero to 85 cents (per 20-pound bag) will reduce the weekly household garbage from about 30 pounds to 20 pounds—a reduction of one-third. His estimate is that this reduces deadweight loss by 25.5 cents a week per household. However, we believe that these calculations systematically understate the benefits and overstate the costs of a program that combines per-unit garbage charges with curbside recycling programs, for four reasons.

First, Kinnaman's estimated private disposal costs of $80 per ton, taken from a 1992 study, are extremely low compared with estimates in the current literature. For example, Dutch private marginal costs for garbage collection and disposal are currently around $209 per ton Dijkgraaf and Gradus (forthcoming). In part, these higher costs arise because regulatory rules about garbage disposal have become more stringent.

Second, the external costs used by Kinnaman of $5 per ton are also much lower than values commonly used in the literature. In OECD (2006, p. 72), for example, external costs of the most used option of incineration are $39 per ton; for landfill, the OECD uses a cost estimate of $14. Thus, total costs are about $248. Even if landfill is the option, total costs are about $172 per ton (private costs are about $158).

Third, the analysis of Kinnaman is based on average household waste production of 30 pounds per week. However, in 2005 the household waste production is 43 pounds per week in the Netherlands for municipalities without unit-based pricing. In a recent comparison of recycling behaviors in Norway and the United States, Kipperberg (2007, p. 217) shows that based on statistics from the Environmental Protection Agency, "the daily US production of waste per capita is 2.5–3 pounds," which implies weekly household production is of 43–52 pounds of garbage.

We reran Kinnaman's basic calculation with what we view as our more realistic estimates. With a greater reduction in garbage (because households originally produce more garbage) and greater private and social costs of garbage disposal avoided, we arrive at a welfare gain per household of $1.07 per week and $56 per year. This estimate is calculated by multiplication of Kinnaman's reduction in deadweight loss (25.5 cents) with the increase in total costs (248/85 = 292 percent due to higher private and external costs) and the greater reduction of quantities (43/30 = 143 percent). This es-

timate is admittedly rough, but it is more than four times (292 percent x 143 percent = 418 percent) as high as Kinnaman calculates.

Moreover, this revised calculation is still biased downward. It follows Kinnaman's approach of calculating the deadweight loss of marginal pricing by using a linear demand curve, but this approach implicitly assumes that without unit-based pricing, marginal costs are zero. Of course, even if the marginal price is zero, marginal costs are still present, and taking this factor into account makes the welfare gain higher. The welfare gains would double to $2.14 per week and $112 per year if unit-based-pricing total marginal costs are internalized. In addition, the calculation ignores the external benefits associated with the shift from solid waste to recycling, as unit-based pricing results not only in less waste, but also in better sorted waste (Dijkgraaf and Gradus, 2004).

About 4,000 U.S.-municipalities (25 percent of the total) require households to purchase a special can, bag, tag, or sticker for each unit of garbage presented for collection (Miranda and Byrum, 1999). In 2005, 31 percent of the Dutch municipalities had implemented such a system, while every municipality has to implement a curbside recycling program for glass, paper, and textile irrespective of the implementation of unit-based pricing. In other European Union countries—Austria, Belgium, Finland, Germany, Italy, and Luxembourg—the use of unit-based pricing is widespread (EU, 2002). Korea has now implemented compulsory unit-based pricing systems, too (OECD, 2006). The willingness of municipalities around the world to choose a combination of unit-based garbage pricing and curbside recycling suggests that the gains are substantially higher than Kinnaman calculates.

Elbert Dijkgraaf and Raymond Gradus
Erasmus Competition and Regulation Institute
Rotterdam, The Netherlands

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Response from Thomas Kinnaman

Elbert Dijkgraaf and Raymond Gradus suggest the net welfare gains from unit-pricing are much higher than calculated in my article "Examining the Justification for Residential Recycling" (Fall 2006, pp. 219–232). Their claim, based on four points and two unfortunate conceptual errors, seems only applicable to the Netherlands and perhaps other western European countries.

First, using data in the Netherlands, Dijkgraaf and Gradus very recently estimated the private marginal cost of waste collection and disposal at $209 per ton. My original paper used a figure of $80 based upon U.S. data. This disparity is explained by differing fuel prices ($2.78 per gallon in the United States versus $7.08 in the Netherlands in 2006) and waste tipping fees ($30–65 per ton in the United States versus $250–300 per ton for landfill disposal and $500 per ton for incineration in the Netherlands). If the constant private marginal cost in the United States was $209, then a household generating 50 pounds of waste per week would pay $5.23 just to cover variable costs of garbage collection. For anecdotal perspective, all residents in my area pay $3.46 per week for garbage collection, enough to cover both variable and fixed costs.

Dijkgraaf and Gradus then cite a 2006 OECD report that estimates the external marginal cost at $14 per ton for landfill disposal and $39 per ton for incineration, rather than the $5 per ton for landfills used in my original paper (which is also based on European data—I am aware of no such recent estimate in the United States). Although the OECD report provides little detail

for how these estimates were developed, I'll assume they are credible. The estimate for landfills is more appropriate in the United States where incineration rates have decreased to less that 10 percent of all disposed waste. That leaves us with two credible estimates of the external marginal costs of waste disposal: $5 and $14.

Regarding the third point, weekly per-household waste production totals are likely in the 40–50 pound range suggested by Dijkgraaf and Gradus rather than the 30 pounds mentioned in my original paper. But Dijkgraaf and Gradus make an unfortunate error when interpreting why this matters. I referred to the 30 pound figure only parenthetically to provide readers with some perspective for the 12 pound reduction in waste attributable to a $1 user fee. The estimate was not included in my calculations of the net benefits, nor was it needed. Dijkgraaf and Gradus carry this mistake into their "more realistic estimate" of the net benefits of unit-pricing. That estimate therefore has no meaning and should be disregarded.

The table below provides estimated net benefits in dollars per household per year assuming 1) households reduce waste by 12 pounds, or 0.6 20-pound bags, for every $1 curbside cost of collection, 2) the curbside fee is set equal to the social marginal cost (which is equal to the sum of the private marginal cost (PMC) and the external marginal cost (EMC), each converted so that they apply to 20-pound bags), and 3) the administrative costs of operating unit-pricing are $10.22 per household per year. Net benefits are found by solving for the area of the deadweight loss triangle above the linear demand curve and below the constant social marginal cost curve, as is done in most of the literature.

The estimate in the top left hand (in bold) recovers the result from my original paper. Increasing external marginal cost from $5 to $14 adds a mere $1.40 to the estimated benefits. Net benefits of unit pricing in the Netherlands are $28.47 for incineration, not $56 as mistakenly suggested by Dijkgraaf and Gradus.

Returning to the private marginal cost, it is important to consider that private waste collectors can price their collection services any way they want. Virtually all in the United States have chosen to provide households unmeasured access to their collection services for a fixed monthly fee to avoid the hassle of monitoring each household's waste. We can strongly suspect therefore that the private benefits of unit pricing (the triangle above the demand curve but below the private marginal cost line, not the social marginal cost line) are exceeded by the administrative costs of $10.22. Again applying assumptions 1, 2, and 3 from above, the private marginal cost of waste disposal must be less than $0.81 per bag, or $81 per ton to satisfy this condition. My original use of $80 per ton is near this upper bound.

Dijkgraaf and Gradus make a second error in their fourth point. The household's marginal cost to prepare waste for collection either remains constant or increases with the implementation of unit pricing. Including these household costs would therefore either not affect or reduce the social net benefits of unit pricing. Dijkgraaf and Gradus's unsupported suggestion that "welfare gains would double" if household costs were considered is entirely off base and should be ignored. That calculation is based on a misunderstanding of how to estimate benefits.

In conclusion, the new data brought forth by Dijkgraaf and Gradus suggest unit-pricing might indeed be appropriate in the Netherlands and other western European countries due largely to the very high private marginal cost of waste collection and disposal in that country. But two conceptual errors cause Dijkgraaf and Gradus to grossly exaggerate the magnitude of these benefits. Unless private and external costs of waste collection and disposal in the United States rise to levels observed in the Netherlands, the promise of a curbside garbage tax in the United States remains dubious. Social net benefits are scant.

Table 1
Estimated Net Benefits

	Landfill (EMC = $5 to $14)	*Incineration (EMC = $39)*
U.S. (PMC = $80)	**$3.04 to** $4.44	$8.34
Netherlands (PMC = $209)	$23.16 to $24.57	**$28.47**

Correction

Due to an editor's error, in the Winter 2008 issue of this journal, an incorrect affiliation was given for Kevin J. Stiroh on the first page of the article, "A Retrospective Look at the U.S. Productivity Growth Resurgence." On page 3, the line, "Kevin J. Stiroh is Vice-President and Head of the Banking Studies Function, Federal Reserve Bank of New York, New York, New York" should say "Kevin J. Stiroh works in the private sector in New York City." The change is indicated on the online version of the paper.