

# Variable charging on residential solid waste and illegal dumping (家庭ごみの有料化と不法投棄問題)

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# Background of the charging systems in Germany and Japan (日独の有料化の背景にあるもの)

## Comparison of the ratio of charge revenue between Germany and Japan (日独の手数料負担率の比較)

Ratio = charge revenue / total waste management costs

Country	Year	1990	1992	1994	1996
	Germany		90.7	89.1	82.0
Japan		4.5	4.1	4.1	5.0

(%)

construction costs  
of treatment plant \$

waste collection  
costs

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Benefit principle  
(受益者負担原則)

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Comparison  
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Flat charges  
(定額手数料制) → Variable charges  
(従量手数料制)

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Comparison  
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eigener Wirkungskreis  
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(市町村の固有事務)

Public service  
(公共財的特性)

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(%)

Comparison  
of the ratio of charge revenue  
between Germany and Japan  
(日独の手数料負担率の比較)

Increase of amount of waste & costs of disposal

Necessity for waste reduction

Low enough to be accepted by residents,  
but to reduce waste

Japan	4.5	4.1	4.1	5.0
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(%)

## Illegal dumping in municipalities due to introduction of variable charging: factors influencing illegal dumping problems

(有料化導入自治体における  
不法投棄の実態とその影響要因)

## Background

In the 1990s, many municipalities introduced variable charging in Japan.



Waste reduction

Illegal dumping problems ?

- Japanese Environment Agency (1993)  
Illegal dumping: 34% (Japan)
- Skumatz et al. (1997)  
Illegal dumping: 27% (U.S.)



- 1 . To reveal the actual situation of illegal dumping in municipalities with variable charging
- 2 . To demonstrate factors influencing illegal dumping in municipalities with variable charging

## Survey Outline

### Objectives

To collect data about the situation of illegal dumping and features of waste collection systems

### Population

All cities, including the Metropolis of Tokyo that have introduced variable charging on residential combustible waste

### Method

Requests made by phone and questionnaires sent by mail

### Survey period

From Dec. 6th, 1999 to Feb. 29th, 2000

### Respondent rate

219 / 327 municipalities (67.0%)

## Survey Outline

### Population

All cities, including the Metropolis of Tokyo that have introduced variable charging on residential combustible waste



- 1) Systems to impose a charge for waste disposal on trash bags or stickers (手数料制)
- 2) Systems where the municipality designates the use of certain types of trash bags with obligation from residents to purchase the designated bags (指定袋制)

### Method

Requests made by phone and questionnaires sent by mail

### Survey period

From Dec. 6th, 1999 to Feb. 29th, 2000

### Response rate

219 / 327 municipalities (67.0%)

## Illegal dumping problems in the first year of introducing variable charging

	1)Very serious	2)Moderately serious	3)Not very serious	4)Other	N.A.	Total
No.	5	48	89	5	11	158
Percentage of 1) ~ 3)	4%      34%      63%					

38%

## Present situation of illegal dumping

	1) Continuously a problem	2) Improved, but still a problem	3) Not a problem	4) Other	N.A.	Total
No.	29	16	4	3	1	53
Percentage of 1) ~ 3)	59%	33%	8%			

Note: Only municipalities reporting illegal dumping problems after introduction of variable charging are analyzed

## Characteristics of illegally dumped sites

Site	Rate
Rivers and a dry riverbeds	70%
Roadsides	70%
Woods and forests	87%
Farmlands	28%
Vacant lots	74%
Garbage collection stations in other communities	25%
Garbage stations within the city	57%
Parks	38%
Dumpsters at offices and train stations	11%
Others	9%
Total number of responses	53

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## Types of illegally dumped garbage

Garbage type	Ratio
Garbage in bags	77%
Vegetables	21%
Bottles and cans	81%
Remains of lunch	72%
Plastic bags	53%
Paper waste	36%
Others	60%
Bulky waste	55%
Total number of responses	53

Note: Only municipalities reporting illegal dumping problems after introduction of variable charging are analyzed

## Factors influencing illegal dumping Literature

Blume (1992) analyzed factors with data from 14 cities

- Socioeconomic characteristics: not related to illegal dumping
- Location: a possible factor
- Alternative disposal mechanisms: may be important in minimizing dumping

Some other important relations such as to prices etc. were not analyzed

## Hypotheses about causative factors

Illegal dumping problems before introducing variable charging  
(有料化以前の不法投棄状況)

Economic incentives  
(経済的インセンティブ)

Briefing sessions (説明会)

Anti-dumping measures  
(不法投棄対策の実施)

Changes in other waste collection systems  
(他の収集制度の変更)

Increase of illegal dumping problems  
(有料化時の不法投棄増加の問題)

## Hypotheses about causative factors

Illegal dumping problems before introducing variable charging  
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Old custom  
Less psychological resistance to dumping at already established dumping sites.

Economic incentives

Briefing sessions

Anti-dumping measure

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Economic incentives  
(経済的インセンティブ)

Price of garbage bags(袋価格)  
two-tier pricing(一定量無料制)

Charging system where residents must pay for waste disposal after they used up free bags or stickers that municipalities issued in advance.

Briefing session

Anti-dumping measure

Changes in other waste collection systems

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## Hypotheses about causative factors

Illegal dumping problems before introducing variable charging

Economic incentives

Briefing sessions (説明会)

Anti-dumping measure  
(不法投棄対策)

Patrolling and clean-up(監視・回収対策)  
PR and display of signboards(啓発・掲示対策)

Changes in other waste collection systems

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Economic incentives

Briefing sessions

Anti-dumping measure

Changes in other waste collection systems (他の収集制度の変更)

Increase of illegal dumping problems (有料化時の不法投棄増加の問題)

Change in source separation system(分別の変更)

Introduction of variable charging on bulky waste(粗大ごみ有料化の導入)

Introduction of designated trash bags for commercial waste(事業系指定袋等の導入)

## Relationship between the degree of seriousness before and after the introduction of variable charging

Problem before introduction	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
1)Very serious	9 69%	4 31%	5	18
2)Moderately serious	31 45%	38 55%	5	74
3)Not very serious	2 4%	44 96%	6	52
Other & N.A.	0 0%	3 100%	11	14
Total	42 32%	89 68%	27	158

(df=2,  $\chi^2 = 29.321$ ,  $p < 0.001$ , excluding Other & N.A.)

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"Very serious"+"Moderately serious"

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## Relationship between price of trash bags and illegal dumping problem

Rate (Yen/45L)	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
0 ~ 20	8 38%	13 62%	3	24
20 ~ 40	3 30%	7 70%	2	12
40 ~ 60	6 67%	3 33%	2	11
60 ~	6 50%	6 50%	0	12
N.A.	17 57%	13 43%	3	33
Total	40 49%	42 51%	10	92

( df=3,  $\chi^2 = 3.140$ , n.s., excluding Other & N.A. )

Only municipalities that answered "Very serious" or "Moderately serious" about illegal dumping before variable charging were analyzed

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## Relationship between two-tier pricing and illegal dumping problems

Type of program	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
Two-tier pricing	10 63%	6 38%	3	19
Single pricing	30 45%	36 55%	7	73
Total	40 49%	42 51%	10	92

(df=1,  $\chi^2=1.498$ , n.s. excluding Other & N.A.)

## Relationship to briefing sessions

Briefing sessions held	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
For residents	30 49%	31 51%	9	70
For representatives of residents	5 50%	5 50%	1	11
No sessions held	1 20%	4 80%	0	5
N.A.	4 67%	2 33%	0	6
Total	40 49%	42 51%	10	92

(df=2,  $\chi^2=1.135$ , n.s. excluding Other & N.A.)

## Relationship between anti-dumping measures and illegal dumping problems

Anti-dumping measure	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
Patrolling and Clean-up activities	10 71%	4 29%	1	15
Public relations and signboards display	10 77%	3 23%	3	16
No measures implemented	19 37%	33 63%	6	58
N.A.	1 33%	2 67%	0	3
<b>Total</b>	<b>40 49%</b>	<b>42 51%</b>	<b>10</b>	<b>92</b>

(df=2,  $\chi^2=10.099, p<0.01$ , excluding Other & N.A. )

## Relationship between change in the separation system and illegal dumping problems

Change in separation	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
Yes	25 63%	15 38%	2	42
No	14 35%	26 65%	8	48
N.A.	1 50%	1 50%	0	2
<b>Total</b>	<b>40 49%</b>	<b>42 51%</b>	<b>10</b>	<b>92</b>

(df=1,  $\chi^2= 6.054, p<0.05$ , excluding Other & N.A. )

## Relationship between charging on bulky waste collection and illegal dumping problems

Charging bulky waste collection	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
Rates introduced before combustible waste	5 45%	6 55%	2	13
Rates introduced simultaneously	11 50%	11 50%	2	24
No charging of bulky waste	20 47%	23 53%	5	48
N.A.	4 67%	2 33%	1	7
<b>Total</b>	<b>40 49%</b>	<b>42 51%</b>	<b>10</b>	<b>92</b>

(df=2,  $\chi^2=0.090, n.s.$ , excluding Other & N.A. )

## Relationship between designated bag system for commercial waste and illegal dumping problems

Designated bag system for commercial waste	Problem after variable rates			Total
	1) Yes	2) No	Other & N.A.	
System introduced before charging combustible waste	0	0	0	0
System introduced simultaneously	7 50%	7 50%	4	18
No bag system for commercial waste	29 47%	33 53%	6	68
N.A.	4 67%	2 33%	0	6
<b>Total</b>	<b>40 49%</b>	<b>42 51%</b>	<b>10</b>	<b>92</b>

(df=1,  $\chi^2=0.048, n.s.$ , excluding Other & N.A. )

## Conclusion

- About 40% of such cities experienced an increase in illegal dumping and about 90% of these cities had this as an ongoing problem. But cities encountering serious dumping problems represented only 4 %.
- We further found the presence of illegal dumping before introducing variable charging was a significant factor affecting illegal dumping at the time of introduction of variable charging.
- In addition, among municipalities that experienced an illegal dumping problems prior to introduction of variable rates, those that introduced separate collection systems at the same time tended to see a rise in illegal dumping.
- The incidence of illegal dumping was also higher in municipalities where the price of waste bags was higher. However, this factor was not statistically significant.