A Dynamic Analysis of Food Waste: Implications for Waste Management of Local Government

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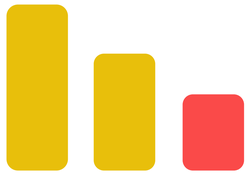
Introduction

- Research Background
  - About **one-third of food produced** for human consumption is lost or wasted globally, which has caused negative impacts on **economy and environment.**

<The world's third-largest greenhouse gas source>



Source: Food and Agricultural Organization

- Research Objectives

I. examines how local economic growth is associated with food waste across municipal areas and tests for the waste Kuznets hypothesis.

II. determines the extent to which environmental spending is related to waste management reduce food waste.

III. examines the relationship between socioeconomic factors and food waste.

IV. identifies the direct and indirect effects of local government expenditures on food waste, quantifying how much they reduce food waste directly and indirectly with local economic growth.

Data

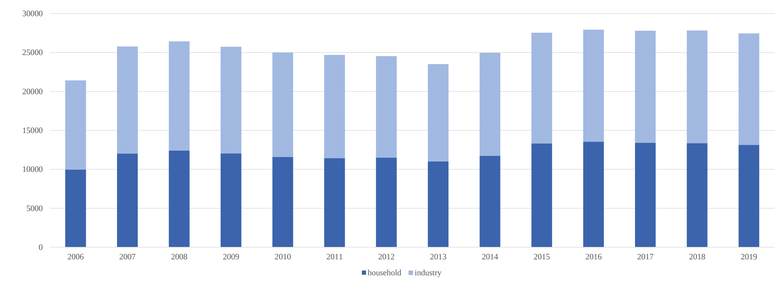
Table 1. Data Description

variable	definition	unit	Mean	Std. dev.	Min.	Max.
TFW	All food waste	kg/day/person	0.31	0.00038	0	3.35
HFW	Household food waste	kg/day/person	0.29	0.00037	0	3.29
IFW	Industry food waste	kg/day/person	0.02	0.00004	0	0.32
GRDP	Gross Regional Domestic Product	One million won/person	91.49	249.94	0.09	3993.60
NES	Non-environmental spending for waste management	One million won/person	4.56	5.25	0.03	65.11
ES	Environmental spending for waste management	One million won/person	0.69	0.81	0.00	8.18
K	Capital	The number of companies	67,475	238,886	458	4,402,949
L	Labor	The number of employees	72,137	90,345	1,581	679,288
OLD	Over 65 years old population	ratio	18.47	8.09	6.20	38.90
ONE	Single person household	ratio	25.10	42.22	0.08	396.37

Source: Korea Resource Recirculation Information System, Korea Statistical Information Service, Ministry of Environment.

Status of Food Waste

Figure 1. Trend of the amount of food waste (Unit: ton/day)



Sources: Korea Resource Recirculation Information System, Korea Statistical Information Service

Dynamic Panel Model

<First-stage>

$$\ln GRDP_{it} = \alpha_0 + \theta \ln GRDP_{it-1} + \alpha_1 \ln NES_{it} + \alpha_2 \ln ES_{it} + \alpha_3 \ln L_{it} + \alpha_4 \ln K_{it} + \alpha_5 \ln OLD_{it} + \alpha_6 \ln ONE_{it} + \varepsilon_{it}$$

<Second-stage>

$$\ln FW_{it} = \beta_0 + \theta \ln FW_{it-1} + \beta_1 \ln \widehat{GRDP}_{it} + \beta_2 \ln \widehat{GRDP}^2{}_{it} + \beta_3 \ln \mathrm{NES}_{it} + \beta_4 \ln ES_{it} + \beta_5 \ln L_{it} + \beta_6 \ln K_{it} + \beta_7 \ln OLD_{it} + \beta_8 \ln ONE_{it} + \varepsilon_{it}$$

Estimation Results

Table 2. First-stage Estimation Results

Variable	$\ln GRDP$
$l.\ln GRDP$	0.486***
	(0.022)
$\ln NES$	0.468***
	(0.049)
$\ln ES$	-0.159***
	(0.032)
$\ln L$	-0.051**
	(0.024)
$\ln K$	-0.010
	(0.025)
$\ln OLD$	-0.061
	(0.091)
$\ln ONE$	0.059**
	(0.026)
$Constant$	1.522***
	(0.543)

Notes: *** , ** and * denote the level of significance at 1%, 5% and 10% respectively; Numbers in parentheses are standard errors.

Estimation Results

Table 3. Second-stage Estimation Results

	All	Household	Industry
$l.\ln y_{it-1}$	0.527***	0.590***	0.385***
	(0.014)	(0.012)	(0.033)
$E.\ln GRDP$	0.207***	0.161***	0.409**
	(0.047)	(0.046)	(0.162)
$E.\ln GRDP2$	-0.031***	-0.024***	-0.063***
	(0.007)	(0.007)	(0.023)
$\ln NES$	0.435***	0.381***	0.534***
	(0.040)	(0.037)	(0.088)
$\ln ES$	-0.098***	-0.082***	-0.080
	(0.018)	(0.017)	(0.050)
$\ln L$	0.261***	0.220***	0.420***
	(0.018)	(0.019)	(0.057)
$\ln K$	0.008	0.002	-0.112***
	(0.010)	(0.010)	(0.038)
$\ln OLD$	-0.039	-0.039	0.089
	(0.068)	(0.057)	(0.130)
$\ln ONE$	0.019*	0.010	-0.098**
	(0.010)	(0.010)	(0.040)
$Constant$	-7.550***	-6.505***	-11.442***
	(0.393)	(0.332)	(1.176)

Notes: *** , ** and * denote the level of significance at 1%, 5% and 10% respectively; Numbers in parentheses are standard errors.

Table 4. Direct and Indirect Effects of Environmental Spending on Food Waste

<Short-run>				<Long-run>			
	All	Household	Industry		All	Household	Industry
Direct	-0.098***	-0.082***	-0.080	Direct	-0.207***	-0.200***	-0.130
	(0.018)	(0.017)	(0.050)		(0.037)	(0.041)	(0.081)
Indirect	-0.003***	-0.002***	-0.004***	Indirect	-0.011***	-0.007***	-0.012***
	(1.205e-6)	(1.103e-6)	(1.363e-5)		(4.319e-5)	(5.190e-5)	(2.799e-4)
Total	-0.101***	-0.084***	-0.084	Total	-0.218***	-0.208***	-0.142
	(0.018)	(0.017)	(0.050)		(0.037)	(0.042)	(0.081)

Conclusions

I. The findings hold for the waste Kuznets curve hypothesis. The nonlinear relationship between food waste and economic growth shows that food waste increases with economic growth and then decreases from a certain point in time.

II. The total amount of food waste increases as the number of workers and one-households increase.

III. Environmental spending is effective in reducing food waste. It is found to be effective directly, and the effect is found to be greater in the long term than in the short term.