

The Impact of Solid Waste Collection, Pricing and Recycling Policies on Residential Solid Waste

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Thesis Abstract

Most large cities have waste crises at some time or other. MSW (municipal solid waste) is a major component of the waste stream of cities, the bulk of which derives from residents (households) rather than businesses. Since MSW is an increasing function of per capita GDP, MSW typically grows with development, and many cities in the fastest-growing economies have had to find ways to regulate the solid waste generated by households. This thesis set up a household waste disposal model in order to evaluate the scope for MSW management using instruments that change household waste disposal decisions. The model is estimated by a panel of data on MSW disposal in 18 cities in Taiwan and Japan. The estimations are then used to test the effectiveness of a number of policy options.

The model shows that households elect to trade off storing/composting waste against the three main waste discarding options: legal dumping, illegal dumping and recycling. It is also shown that the household's decision to discard a unit of waste is based on each disposal option's marginal cost, including tariff, labour and disutility for storing/composting waste. The study confirms that the higher the frequency of non-recyclables collection, the less recycling and more waste dumping would be. This may be caused by a reduction in the marginal cost of dumping. For cities with garbage collection more than 5 times per week, decreasing the garbage collection frequency increases recycling and decreases garbage dumped.

It is also shown that the higher the price of non-recyclables collection (price of unit-pricing) the higher the recycling rate would reach. The short run price elasticity of non-recyclable collection demand is estimated to be 0.069. In the long run, at higher unit-prices, the price elasticity is estimated to rise to 0.346. Applying a penalty on illegal dumping (fine) can prevent illegal dumping from increasing after unit-pricing is adopted. In Taiwan, the prosecuted penalty (fine) per 1000 residents has a significant positive effect on the dumping of non-recyclables. This is because the penalty decreases illegal dumping, which may increase non-recyclables.

Mandatory recycling policy is also shown to increase recycling and to decrease non-recyclables. The adoption of a transparent garbage bag policy also helps to increase recycling by lowering inspection costs. This has the effect of increasing paper recycling and decreasing non-recyclables. Because all Taiwanese cities now have both on-time collection and mandatory recycling, they should consider requiring residents to use transparent bags for garbage collection, which can become enforcement for mandatory recycling.

Cities that have not adopted unit-pricing or mandatory recycling should consider adopting unit-pricing, with the price being no less than 0.086 USD/10litres which has higher social benefits than costs. Cities in Taiwan should consider a unit-price of no less than 0.144 USD/10litres which can fully cover the cost of treatment. It is argued that the unit-pricing policy provides waste management authorities with more options than mandatory recycling which has only one-off effects.

The models in thesis show that some troublesome waste, such as kitchen waste, involved a high disutility of storage may become a household's first choice of illegal dumping if composting and recycling aren't available. Besides, the more kerbside recycling materials (recycling categories) increases recycling and the categories are increased by materials entered kerbside recycling later, such as kitchen waste recycling for public compost in Taiwan. Cities that haven't provided kerbside paper, plastics and kitchen waste should consider doing so.

Finally, it is shown that population density increases all kinds of recyclables. This is probably because the marginal cost of illegal dumping (expected fine) rises in high density areas. Greater population density also significantly decreases non-recyclables, which might be because households in high population density areas possess fewer commodities and generate less waste.