Evaluation of the social optimum for the landfill levy in Western Australia

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Abstract

The key purpose of the Landfill Levy in Western Australia is to set the price of landfill so that alternatives such as recycling are more cost competitive. The Landfill Levy is at its most effective when it includes all of the social and environmental costs of landfill (otherwise known as landfill externalities). The objective of this project was to determine the value of landfill externalities in the Perth Metropolitan Region. These were calculated using a technique known as 'benefits transfer', which was used to convert externality values from previous studies to estimates for the Perth Metropolitan Region. The project found that the Landfill Levy does not cover the total externality cost and should be raised in combination with a number of other policy measures. By determining the optimum level of the Landfill Levy, this project will help the WA Waste Authority to ensure that waste management policy in Western Australia is conducted efficiently and the social and environmental impact of landfill is minimised.

1. Introduction

Population growth and rising affluence in an economy generally lead to an increase in the volume of waste generated. Therefore, the issue of how to deal with this waste has become an increasingly important policy issue in industrialised countries. According to a 2008 report prepared by Cardno (WA) Pty Ltd, the current waste infrastructure in the Perth region can accommodate the increased levels of landfill and recycling material until about 2020. However, in the decade after 2020, the waste infrastructure could potentially be strained unless there is a decrease in the proportion of waste that ends up at landfill.

Aside from taking up scarce space in waste facilities, waste to landfill also causes a number of environmental and social externalities. Externalities are defined as the unintended costs and benefits of an activity that are experienced by people or organisations other than those directly involved in that activity. An often used example of an externality is 'when a firm pollutes a river but does not compensate downstream river-users for this damage' (Gorecki et al. 2010). Landfill externalities include greenhouse gas emissions, emissions to water and soil (leachate), and disamenity effects such as odours, wind-blown litter, vermin, visual intrusion, noise and traffic. These social and environmental costs are 'external' because they are not covered by the market price of landfill disposal.

Furthermore, in many cases sending waste to landfill is undesirable as several items have the potential to be reused or recycled. Re-using products prevents excessive consumption and waste generation. Recycling materials so that they can be used to make new goods can offset energy intensive mining and primary production processes (Government of Western Australia 2003).

1.1 Background

The Department of Environment and Conservation (DEC) develops waste management strategy in collaboration with the WA Waste Authority. The Waste Authority was established by the Waste Avoidance and Resource Recovery Act 2007. The act requires that the Waste Authority develops a long term waste strategy for Western Australia based on the following waste management hierarchy:

a. avoidance of unnecessary consumption
b. resource recovery (including reuse, reprocessing, recycling and energy recovery)
c. disposal

Because disposal is the least preferred option for dealing with waste, the Waste Authority states that 'prices for residual wastes should reflect the full social and environmental costs so that disposal does not compete unfairly with resource recovery' (Waste Authority 2009). A landfill levy is a common method of ensuring the price of landfill includes social and environmental costs.

The WA Landfill Levy was introduced in 1998 and applies to wastes sent to landfill sites in Metropolitan Perth. The levy has two functions: to increase the comparative price of landfill so that recycling is more cost-competitive and to provide resources for the state government to strategically invest in recycling initiatives (Blyth 2007).

When introduced, the levy was originally \$3 a tonne for putrescible waste and \$1 a tonne for inert waste. In 2006 the Government of Western Australia announced a plan to progressively raise the levy to \$9 a tonne for putrescible waste and \$9 a cubic metre for inert waste. However, these plans were not fully realised due to a change in government in 2008. From January 2010 the levy increased to \$28 a tonne for putrescible waste and \$12 a cubic metre for inert waste[1].

Landfill levies have been used in many countries and are used widely in Europe. The use of levies in European countries has often coincided with an increase in the proportion of waste that is recycled. It is difficult to determine how much of this effect was caused by landfill levies as the levies usually operate in combination with other policy tools. However, there is also a tendency for reductions in waste to landfill to be smaller when the landfill levy is set at relatively low levels (Hyder Consulting 2007).

1.2 Key findings of literature review

A number of key findings from the literature are important for this project. Estimates of disamenity effects from previous studies have generally decreased over time due to improvements in landfill design and the more remote nature of the sites (BDA Group and Econsearch 2004). Landfills have increasingly been located away from cities due to higher

[1] The conversion factor for inert waste is 1.3 tonnes per cubic metre. Therefore, on a per tonne basis, the levy for inert waste is approximately \$9.23.

urban land values and increased community resistance to having landfills near residential areas.

Tighter regulation and improved landfill designs also affect externality estimates. Landfills that capture methane gas cause less greenhouse gas emissions. Landfill sites that use clay and/or plastic liners dramatically reduce the risk of leachate escaping and contaminating local soil and ground water (Productivity Commission 2006).

Externality estimates from the literature vary substantially. However, there is usually agreement that greenhouse gas emissions from landfills comprise the most significant proportion of the total externality cost. Other air emissions also cause externality costs, but these are often considered to be a very small component of total costs. Similarly, there is almost universal agreement that leachate costs are negligible, with several studies assuming that the lining of modern landfills reduces these costs to zero (Gorecki et al. 2010).

Reviewing the externality literature was also useful for determining which externality costs should and should not be considered in the context of a landfill levy. For example, some people have argued that environmental costs caused by the use of virgin rather than recycled materials should be included in the landfill levy. However, most of the landfill externality literature does not consider these costs in their estimates. This is because these externalities result from mining activities, not from the use of landfill. Therefore, the most appropriate policy response is to tax or regulate the environmental impacts of mining directly. Intervention in 'downstream' activities such as landfill will be inappropriate and is an inefficient way of minimising the environmental costs of using virgin materials (Productivity Commission 2006).

2. Estimation of Perth landfill externality costs

This project involved the economic valuation of externalities. This can be considered an attempt to estimate the values that individuals place on goods that have no observable market price. The method used to value these externalities was the 'benefits transfer' (BT) method. BT is a tool for transferring existing estimates of non-market values (benefit or damage) from one site (the study site) to a new different study (the policy site). The BT process is a method of estimating the value of environmental goods that is cheaper and less time consuming than conducting an original study (Eshet et al. 2005).

A 'benefits transfer function' was used to estimate the cost of greenhouse gas externalities. This function involved determining three key elements: (1) the methane emissions per tonne of waste, (2) the amount of greenhouse gases that are recovered by the waste facility through either flaring or electricity generation, and (3) the value of the damage caused by the emissions (otherwise known as the 'social cost of carbon' or SCC).

The disamenity externalities of landfill can be valued using the hedonic price method (HPM). HPM derives the value individuals place on environmental characteristics, such as air quality in the vicinity of a landfill, from differences in house prices at various distances from the site (Eshet et al. 2005). A recent study applying HPM to landfills in the UK found that, on average, house prices fell by 7% within 0.4 kilometres of a landfill and by 2% at a distance of 0.4 to 0.8 kilometres. Beyond a distance of 0.8 kilometres there was no evidence of a statistically significant disamenity impact (Cambridge Econometrics 2003).

A benefits transfer function was used to determine the disamenity costs of Perth landfills by applying values from the Cambridge Econometrics study. Median housing values and housing density statistics for the suburbs located near landfills were combined with the house price reductions predicted by the Cambridge Econometrics study to provide a measure of the total fixed disamenity cost caused by landfill. This total cost was then divided by the sum of the projected waste flow over the period of expected remaining capacity for Perth's current landfill sites, resulting in an estimate of the disamenity cost per tonne of waste.

Although some Australian disamenity estimates have been presented in the literature, none were as suitable for use in this project as the Cambridge Econometrics study. The estimates from Australian studies were either outdated or did not use a suitable methodology. In contrast, the Cambridge Econometrics study had the advantages of being relatively recent, using a sound and transparent methodology, and being very comprehensive – the study used data on 11,300 landfill sites and 592,000 housing transactions.

3. Results and Discussion

Table 1 indicates the results of using the benefits transfer method to derive estimated externality costs for Perth landfills. As with a number of previous studies, the cost of greenhouse gas emissions is the largest component of total externality costs (BDA Group 2009).

Externality	**Municipal waste**	**Commercial and Industrial waste**	**Construction and Demolition waste**
Greenhouse gas emissions	29.79	32.77	22.34
Other air emissions	1.00	1.00	0.50
Leachate	0.00	0.00	0.01
Disamenity	3.77	3.77	3.77
Total externality cost	**34.56**	**37.54**	**26.62**

Table 1 Estimated externality costs per tonne of waste for Perth landfills (2010 $A)

These results have a number of implications for the Perth landfill levy. The estimates indicate that the current levy does not cover the full cost of externalities, particularly in the case of Construction and Demolition waste. However, it is also important that any increases to the levy are 'phased in' slowly. This phased approach has been used in a number of Australian and international jurisdictions and has the advantage of giving households and businesses time to adjust to the increased expense and the opportunity to use other waste options as they gradually become available. Alternatively, if large increases in the levy are introduced too quickly, and viable alternatives to landfill are not available, this increases the risk of waste being dumped illegally.

Table 1 does not include estimates of the external benefits of Municipal and Commercial and Industrial waste. The external benefits of landfilling these types of waste arise from capturing landfill gas for electricity generation, which displaces the use of fossil fuels elsewhere in the economy. If these external benefits were included, the net externality cost may be similar, or less than, the current levy for these waste streams.

The reason external benefits have been omitted from the results of table 1 is that they relate to a different policy objective than the landfill levy. The purpose of the levy is to capture the costs of landfill that are not reflected in the market. Recognition of the use of landfill gas for electricity generation relates to a different policy area – encouraging alternatives to the use of fossil fuels. A subsidy to landfills according the amount of electricity they generate would be an appropriate policy response as it would encourage landfills to install modern systems and capture landfill gas efficiently.

The current levy differs according to the type of waste sent to landfill. The argument for a differentiated levy by waste stream is that inert waste causes less environmental impact than putrescible waste. The externality estimates for Construction and Demolition waste in table 1 suggest that this argument is correct. However, the externality costs for putrescible and inert waste are more similar than the current landfill levies suggest. Furthermore, there are sound arguments for having the same levy across all waste streams: the system would be simpler with lower administrative costs and there would be less incentive to dispose of waste at unsuitable landfills (Hyder Consulting 2007). The current differentiated levy means there is an incentive to dispose of putrescible waste at inert landfills, which causes greater environmental damage due to the less stringent regulations at these sites.

The levy currently only applies to waste that is sent to metropolitan landfills. This aspect of the levy also creates perverse incentives, with some metropolitan waste being transported to regional landfills that are not subject to the levy. This causes an increase in the environmental impacts the levy is intended to lessen – for example, the transportation of waste over long distances results in greater greenhouse gas emissions. Furthermore, the environmental controls at regional landfills are usually not as effective as those in metropolitan landfills.

Some consideration should therefore be given to applying the levy to sites in regional WA. Although the disamenity impact of these landfills is lower than metropolitan landfills due to lower population densities, the greenhouse gas impact of regional landfills is higher due to the low incidence of landfill gas capture systems. But while there is a need to account for the environmental impact of these sites, this should be balanced against the capacity of regional communities to pay for increased waste disposal and also the greater opportunities to dispose of waste illegally in rural locations (Hyder Consulting 2007). In South Australia, the levy for non-metropolitan sites is set at 50 per cent of the metropolitan levy. Such a compromise might be effective in WA, where it would at least capture some of the environmental externalities from regional landfills while still providing a disincentive to dispose of metropolitan waste at these sites.

A further policy consideration is the extent to which increases in the levy are passed on to waste producers. In the case of municipal waste, the price signal to households is often weak, with a flat waste disposal fee (as a component of annual rates) providing little incentive to decrease waste volumes or make greater use of recycling (Bartelings et al. 2005). Some local governments in WA have responded to the increasing costs of landfill by providing households with a choice of collection bin sizes at different prices. Greater use of this system would ensure that most of the increasing cost of landfill is appropriately passed on to the households that cause the most waste.

4. Conclusions and Future Work

This project has provided an economic valuation of the externality costs of landfill. These estimates suggest the current landfill levy does not fully capture the value of total landfill externality costs. These findings suggest the landfill levy needs to be raised slowly and that the same levy rate should apply to all waste streams. A number of complementary policy measures that would enhance the application of the levy were also discussed, including encouraging landfill electricity generation with subsidies, applying the levy to regional landfills and greater use of pricing systems that provide an incentive for households to recycle more.

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