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Review

Is bigger better? An empirical analysis of waste management in New South Wales

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ABSTRACT

Across the world, rising demand for municipal solid waste services has seen an ongoing increase in the costs of providing these services. Moreover, municipal waste services have typically been provided through natural or legal monopolies, where few incentives exist to reduce costs. It is thus vital to examine empirically the cost structure of these services in order to develop effective public policies which can make these services more cost efficient. Accordingly, this paper considers economies of size and economies of output density in the municipal waste collection sector in the New South Wales (NSW) local government system in an effort to identify the optimal size of utilities from the perspective of cost efficiency. Our results show that – as presently constituted – NSW municipal waste services are not efficient in terms of costs, thereby demonstrating that 'bigger is not better.' The optimal size of waste utilities is estimated to fall in the range 12,000–20,000 inhabitants. However, significant economies of output density for unsorted (residual) municipal waste collection and recycling waste collection were found, which means it is advantageous to increase the amount of waste collected, but maintaining constant the number of customers and the intervention area.

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1. Introduction

Rising living standards in many regions of the world has led to a growing demanding for municipal solid waste (MSW) services. This has led to the allocation of ever greater resources to collect and treat this waste which has put into question the long-run sustainability of these services (Santibañez-Aguilar et al., 2013; Broitman et al., 2012). At the same time, environmental concerns have stimulated the growing reuse and recycling of MSW, thereby sparking a further rise in the costs of MSW collection and treatment services. To make matters worse, these services have usually been provided in the form of natural or legal monopolies (Callan and Thomas, 2001), which has mitigated the reduction of costs associated with MSW services as a whole. Taken together, this

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makes the empirical analysis of the cost structure of these services, including economies of size (ESize) and economies of scope, vital to the formulation of effective public policies to make these services more cost efficient. ESize are a measure that reflects the cost reaction due to a proportional increase in all outputs as well as other variables which characterize the dimension of the outputs (like the number of customers and the size of the intervention area, in the case of the waste sector). This measure is greater than one when the unit (average) cost of production falls to a proportional increase in the amount of outputs, number of customers and area size, which means that in these circumstances it is advantageous to increase, in this case, the intervention area of MSW services supply. Otherwise, if ESize are smaller than one, it means that it is more advantageous to decrease the area of MSW services supply, and it is said that diseconomies of size occur. In the literature ESize are often called "economies of scale" erroneously. Although these two concepts are related, they only coincide under certain circumstances. While ESize refer to how costs respond to increases in outputs, economies of scale refer to how outputs respond to increases in all inputs together (Chambers, 1988). In addition to ESize, in industries such as the waste collection sector, it is also possible to investigate economies of output density (EOD). EOD is a quantity that (unlike ESize) measures the reaction of costs relative to the increase in the only one of the outputs (or several outputs), maintaining constant the number of customers and the sized of the intervention area. And finally economies of scope are related to the fact of whether or not the joint production of different goods or services is more advantageous. When there are economies of scope it means that joint production is more advantageous, otherwise it is said that there are diseconomies of scope.

With growing concerns about the sustainability of waste services, a number of studies have focused on their cost structure. Early work began to emerge in the 1960s in the U.S. For example, Hirsch (1965) examined the cost structure of the refuse collection services provided by 24 municipalities in the St. Louis City – County area, corresponding to a population of about one million residents. He found no significant evidence of the existence of economies of scale. In a similar vein, Hall and Jones (1973) investigated 22 local communities of Texas and found economies of scale for a community size up to 9600 inhabitants. Stevens (1978) evaluated the refuse collection services of firms that operated in 340 North American cities: constant returns to scale were found for towns with populations greater than 50,000 people. Folz (1999) studied the cost structure of municipal recycling in American cities with less than 50,000 inhabitants and found economies of scale. Callan and Thomas (2001) analyzed the costs of the waste services in 110 Massachusetts cities and towns. They found EOD for the provision of recycling services and EOD and constant returns to scale for refuse collection and disposal services, as well as economies of scope in joint recycling and disposal services.

In Europe most empirical research originated somewhat later. For instance, Antonioli and Filippini (2002) studied 30 Italian refuse collection firms which served municipalities and found EOD and economies of scale for most output levels, but diseconomies of scale for large firms. More recently, Abrate et al. (2012) examined economies of scale and economies of scope in 529 Italian municipalities. They found constant returns to scale in the refuse collection for populations of about 42,500 inhabitants, but overall diseconomies of scale in municipalities with greater than 100,000 inhabitants, as well as economies of scope in the joint provision of disposal and recycling services. In Spain, a study carried out by Bel and Fageda (2010) found economies of scale for Galician municipalities with less than 50,000 inhabitants. Simões et al. (2010) analyzed 29 Portuguese utilities that provided urban waste disposal services and identified an optimal size for utilities at around 300,000 inhabitants. More recently, Carvalho and Marques (2014) analyzed the selective collection and recycling services in Portugal. They found significant EOD in recycling (especially for glass and paper), where optimal size corresponded to about 400/550,000 inhabitants, and where smaller utilities displayed economies of size and larger utilities diseconomies of size.

Given this body of empirical literature, it seems reasonable to conclude that modest optimal sizes of around 10,000–50,000 inhabitants exist for collection services, while disposal services show higher optimal sizes. The bulk of studies also report considerable EOD for collection services, especially for small utilities, as well as economies of scope in the joint provision of disposal and recycling services.

In this paper we seek to empirically assess economies of size (ESize), EOD and economies of scope in the waste collection sector in New South Wales (NSW) local government and identify the optimal size of utilities in terms of lower average unit costs. To this end, we applied the Stochastic Frontier Analysis methodology (SFA) to estimate the cost function of waste collection services. Our paper attempts to augment an existing embryonic Australian empirical literature on waste collection and disposal services (see, for instance, Worthington and Dollery, 2001; Woodbury et al., 2003) by seeking – for the first time – to examine the impact of waste market structure in Australia.

The paper is divided into five main parts. Section 2 describes the MSW sector in NSW local government. Section 3 outlines the empirical methodology applied in the paper. Section 4 presents the sample and the model employed, whereas Section 5 discusses the empirical findings of the study. The paper ends with some brief concluding remarks in Section 6.

2. Municipal solid waste sector in New South Wales

In NSW local authorities bear statutory responsibility for the provision of domestic (municipal) waste management services (as regulated by the NSW Local Government Act 1993), including waste collection, recycling and landfill disposal. This Act enables local councils to levy a charge for the provision of these services. Although domestic recycling services are not mandatory for municipalities, its environmental benefits, together with community expectations, as well as the existence of a waste and environment levy, make domestic recycling services a priority for local governments (DECCW, 2010). The diversion target from landfilling to other process options imposed by the Department of Environment, Climate Change and Water (DECCW) for municipal waste was set at 66% to 2014. Municipal waste includes household garbage, recycling and organics using kerbside and clean-up collections and drop-off facilities and other materials collected in municipal parks and gardens, street sweepings, waste from public places and from council operations. The regular waste stream corresponds to about 59% of mixed residual waste, 26% sorted for recycling (paper and cardboard, glass, plastic and metal) and 15% sorted organics (food and garden waste) (DLG, 2013). The waste collection service in NSW is provided by 151 councils.

In practice, the process of waste collection and disposal by local authorities typically means that household municipal waste is collected by commercial contractors using automated vehicles once a week. Households must place municipal waste in prescribed wheeled containers – termed 'wheelie-bins' – and place these at the side of the road, together with two boxes for recyclable material: one for glass, metal, plastic and other material and the other box for paper material. Some local authorities are more prescriptive than others regarding the nature of recyclable material. Every second week, a separate wheelie-bin must be used for organic waste, sometimes referred to as 'garden garbage'. Should households wish to dispose of additional municipal waste or recyclable