



Economies of scale and scope in Australian urban water utilities



Andrew C. Worthington^{*}, Helen Higgs

Department of Accounting, Finance and Economics, Griffith University, QLD 4111, Brisbane, Australia

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ABSTRACT

This paper estimates economies of scale and scope for 55 major Australian urban utilities over the period 2005/06 to 2008/09. The models used specify operating and capital costs as a function of chemical and microbiological compliance, water losses, water quality and service, water main breaks, total connected properties, and urban water supplied. The input variables used to help determine water utility costs include the density of properties served and the sourcing of water from bulk suppliers, groundwater, recycling and surface water. In terms of economies of scale, the evidence suggests strong economies of scale at relatively low levels of output (50–75% of current mean output). In terms of product-specific economies of scale (increasing the scale of a specific output in isolation), there is substantially stronger evidence that the operating costs of urban water utilities would benefit from increasing scale with regard to chemical compliance, water quality and service complaints, and the number of connected properties. In contrast, capital costs would benefit from scale increases with regard to the management of water losses and water main breaks. For economies of scope, it is clear that there are substantial cost benefits from the joint production of treated quality water delivered across a network with minimal water losses and main breaks. The main cost advantage at all levels of output is decreasing water losses, and this would benefit both operating and capital costs.

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1. Introduction

A number of factors have combined to reignite global interest in water policy as it relates to urban water utilities in the 21st century. Starting from their essential nature as natural monopolies, operating as utility or network industries with similar treatment and delivery systems, countries around the world have progressively evolved very different approaches to providing urban water services, especially in the mix of privately and publicly owned entities and the extent of regulatory intervention to govern pricing and standards. However, recent circumstances, however, have added impetus to these longstanding developments. These include declining rainfall associated with climate change; pressing needs for maintaining and expanding expensive water supply infrastructure; jurisdictional, sectoral and environmental conflicts over existing surface and groundwater supplies; the expansion of supply options to include recycling, desalination, stormwater and managed aquifer recharge; the adoption of water recycling

programs, and rapid population growth and urbanisation. In response, governments worldwide, including in Australia, have refocused on improving the efficient management and delivery of urban water services.

Apart from sharing these developments through the recent catalyst of the National Water Initiative, perhaps one of the most defining features of Australian urban water utilities is the considerable variance in their scale (size) and scope (diversity of outputs). This is an outcome of two separate processes. First is the evolution of the urban water utility sector in this country into sometimes very large (regional and intraregional), publicly owned, corporatized water utilities operating under regulated prices. Second is the continuance of existing arrangements for small water and sewerage utilities owned by local councils operating without formal independent price regulation but with some assurances that water services are independent of other council functions. Consider first the different scales of operation. At the wholesale water level, the Australian Capital Territory (ACT), the Northern Territory and South Australia each have a single urban bulk water supplier; NSW has two; Tasmania and Victoria both have three; Queensland several; and about twenty operate in Western Australia. Of these, some are responsible only for urban water, which may or may not be the same entity engaged in the downstream retail business, while

^{*} Corresponding author.

E-mail addresses: a.worthington@griffith.edu.au (A.C. Worthington), h.higgs@griffith.edu.au (H. Higgs).

others are responsible for both rural and urban bulk water businesses.

A similar picture emerges at the retail level. Here, urban water services are sometimes very highly concentrated (as in the ACT, Northern Territory and South Australia), whereas Victoria has three metropolitan and 13 regional urban retail businesses; NSW and Queensland each have over time three or fewer businesses centred on their largest population centres (Sydney and Southeast Queensland) and more than 100 local government or other suppliers. Even among the 73 largest urban water suppliers considered for this analysis, there is astonishing variability in size, with businesses serving anywhere between ten thousand and 1.7 million households (the several hundred smaller utilities in Australia serve anything from a few hundred to a few thousand households). As for scope, there is very little alignment between urban water supply and urban water drainage services, with most stormwater and drainage services remaining the responsibility of local governments or only the very largest urban water utilities. Putting this aside, there is again a wide range of behaviour with many utilities providing both water and sewerage services, and a few water or sewerage services only.

Clearly, the substantial variation in the scale and scope of Australia's urban water utilities suggests the potential for economies of scale and scope to impact upon efficient outcomes and thereby provide inferences concerning, among others things, industry practice and the impact of regulation and future industry structure (Fraquelli et al., 2004; Fraquelli and Moiso, 2005). Unfortunately, very few studies of the efficiency of Australia's urban water utilities are known (Woodbury and Dollery, 2004; Coelli and Walding, 2006; Byrnes et al., 2010; Worthington, 2011a, 2011b). This is a particularly glaring omission in that urban water regulators elsewhere, especially the UK, have made substantive use of efficiency-based techniques in guiding policy (Ofwat, 2010a, 2010b, 2010c). Moreover, none of these concern estimation of economies relative to scale using the widest sample possible from throughout Australia (Worthington, 2011b; Abbott and Cohen, 2009a, 2009b) provide a useful general discussion of urban water utility issues, including in Australia). Accordingly, the purpose of this paper is to estimate economies of scale and scope for Australian urban water utilities.

The paper is divided into four main sections. Section 2 briefly discusses the nature of costs in urban water utilities and the theoretical and conceptual sources of any economies of scale and scope. Section 3 deals with the specification of costs and outputs. Section 4 focuses on the cost function specification used to estimate economies of scale and scope herein and Section 5 presents the results. The paper ends with some concluding remarks in the final section.

2. The nature of economies of scale and scope in urban water

In general, we can divide the costs (expenditure) required to operate an urban water utility into two main areas: operating costs and capital costs. We broadly define operating expenditure as the day-to-day expenditure incurred by the water utility in managing its business, while capital expenditure relates to those amounts typically invested in long-lived assets and depreciated over time. Using the NWC's (2010a) indicators and definitions handbook, operating costs (operation, maintenance and administration) typically include the following: water resource access charges or resource rent taxes (paid by the utility); purchases of raw, treated or recycled water; salaries and wages; overheads on salaries and wages; materials, chemicals, and energy; contracts; and accommodation. They also include items expensed from work in progress (capitalized expense items), pensioner remission

expenses, and competitive neutrality adjustments; they may also include but are not limited to, land tax, debits tax, stamp duties and council rates. In contrast, and again using the NWC's own definitions, capital expenditure includes all expenditure for new works, renewals or replacements, other expenditures that would otherwise be referred to as capital, and assets devoted to water recycling.

Importantly, as in most other business, external parties will almost universally handle some of the services associated with these expenditures, whereas others lie along a spectrum of in-house and external third-party providers. For example, NWC (2010a) highlights the role of 'alliance' contracts (used to deliver operations and maintenance work, customer service, or capital expenditure activities) as an increasingly prevalent feature of water utility operations in Australia. While individual alliance contracts differ, they typically involve an agreement between the water utility and an alliance partner(s) with regard to the reimbursement by the utility of the alliance partners' direct and indirect expenses, usually including an agreed upon profit margin; a transparent forecast of expenditures on capital or operating programs is also commonly agreed upon in advance. Alliance arrangements also include reporting from the alliance partners to the utility once programs are underway, along with the sharing of any cost savings or overruns between the utility and its alliance partners (NWC, 2010a).

The actual behavioural stance water utilities take to these expenditures, both operating and capital, is potentially difficult to conceptualise. Australia's urban water utilities are mainly commercialized public-sector entities operating in highly regulated quasi-markets. Nonetheless, there is often an expectation of profitability by the (government) owners, in terms of dividends paid. As argued by the NWC (2010a), the level of dividends payable will reflect government dividend and pricing policies, the profitability of the utility, and its future cash requirements. Nevertheless, government generally sets dividend policy and it is often outside the direct control of the individual utility, even though the utility retains the capacity to set prices, etc. (though limited as a regulated monopoly). In addition, we typically only observe a stable dividend policy in the very largest water utilities, often with very high payout ratios, while in practice few of the smaller water utilities pay dividends at all. Clearly, we cannot blindly apply a profit-maximising objective across the sector. However, one acceptable long-run cost objective for water utilities is to be in a position to produce the desired output (or outputs), either stipulated by regulation and/or required by customers, at the lowest possible cost (or cost minimisation). This minimal performance criterion should apply to any economic enterprise desiring the efficient use of resources.

As discussed in Worthington (2014), the principal outputs for most urban water utilities would appear to be the quantity and quality of water produced and distributed and the number of customers served in the distribution network. Efficient production would then entail, among other things, adjusting the scale of production to the most appropriate size for the outputs produced. Sometimes dividing the production process into smaller more specialized production units can result in operating economies, as evidenced by the division of most urban water utilities into separate departments responsible for water and sewerage services. Other times, this will be the division into entirely different entities operating with or without physical interconnection (in practical terms, the potential for exploiting scale economies will always be larger with the former). On other occasions, enlarging the scale of production can achieve lower unit costs. This can proceed over time through a continuum ranging from the internal provision of services to full contracting out. These arrangements can help water

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