Policy Research Initiative | Projet de recherche sur les politiques

SUSTAINABLE DEVELOPMENT
BRIEFING NOTE

Market-Based Instruments for Water Demand Management I: The Use of Pricing and Taxes

Highlights

- Pricing and taxes are proposed to internalize environmental externalities, reduce water use, allow for cost recovery and, more generally, raise state revenues.
- The lack of systematic *ex-post* evaluation and appropriate data, impedes assessment of pricing strategies.
- Implementation costs can make pricing/taxes non-cost-effective.
- The appropriate role of pricing and tax strategies for water demand management depends on local conditions and institutional contexts.
- User participation in strategy design can improve the odds of success.

Background

While regulation has often led to improvements, it is expected that market-based instruments (MBIs) can bring similar or better results at lower cost by harnessing market forces, rewarding continuous improvement, and stimulating technological development. With the exception of pricing for municipal water supply, there is limited experience with MBIs for water demand management in Canada, in spite of their prominence in the *1987 Federal Water Policy*. Indeed, the OECD recently criticized Canada for not making enough use of these instruments for environmental purposes in general. The current wave of water policy changes at the provincial level indicates a renewed commitment to the use of MBIs.

Water demand management is promoted to maximize the use of existing infrastructure where the capital requirements of maintaining or adding new water storage, treatment, and distribution systems are increasingly prohibitive. It can also alleviate the consequences of diminishing water availability in regions where demand may otherwise exceed the ecosystem's tolerance limits, such as southern Ontario and southern Alberta.

A number of policy tools can be used in isolation or as packages to support water demand management. Examples include regulations (e.g., lawn watering by-laws), education (e.g., water use audits in homes or enterprises), or the adoption of more efficient technologies (e.g., low-flow toilets).

Increasing the price of water – including through taxes – is often promoted for environmental purposes to internalize the costs of externalities.[1] This could provide an incentive for enterprises, farmers or individuals to invest in more efficient water use processes – doing the same or better with less – and to revise their water use habits.

This Note reviews the role of pricing and taxes for water demand management. A companion briefing note, *Market-Based Instruments for Water Demand Management II: Water Markets*, examines the use of water trading mechanisms.

1 The notion of externalities refers to positive or more often negative impacts of an action, such as reducing water availability in a watershed, not factored into a firm or individual's costs.

Canada

Appropriate Pricing Depends on the Objective

The issue is not so much raising the price of water, but how it is done to attain desired objectives. There are two main goals pursued through pricing strategies: cost recovery and efficient water allocation. It is difficult, in practice, to attain the two main goals simultaneously. Both goals can, in theory, be adapted to internalize environmental costs and provide different signals to water users with respect to water availability.

Full cost recovery or full cost pricing requires that utility prices should, in theory, reflect all the costs of operating, maintaining, and replacing water infrastructure plus the opportunity costs[2] and environmental costs associated with water use. Cost recovery can be implemented, as in Ontario, without taking environmental costs into account. Cost recovery implies that infrastructure and water use are no longer subsidized. While costs can be recovered with a volumetric charge, they can also be recovered through a fixed charge, in which case metering is not required.

The costs of providing water can be separated into fixed (e.g., infrastructure) and variable costs (e.g., some operation, maintenance, and environmental costs). Economic theory posits that water users will make better decisions if the price they face accounts for all the variable costs of providing the volume of water they use.[3] This requires metering. By requiring only that variable costs be fully covered, this theory allows fixed costs to be subsidized while still achieving efficient water allocation.

Industrial users present a different case, since they are mostly self-supplied (90 percent of industries in Canada), that is, they draw water directly from wells, rivers, or lakes. Self-supplied firms cover the full costs of water withdrawals but typically have not internalized environmental costs. Public authorities do grant permits to allow firms to use water, but licensing fees in most provinces are generally not closely tied to the quantity of water abstracted and are not high enough to create an incentive for firms to use water more efficiently. Thus, it is often proposed to tax self-supplied firms, including municipal utilities – through what is often referred to as abstraction charges – in accordance with the quantity of water they use.

Prices and Taxes in Practice

Implementation Costs

A difficulty with the establishment of taxes and prices is related to the existence of transaction and institution costs. These costs can be high, and can include:

- gathering the information needed for firms/individuals to adjust successfully or for governments/utilities to set the appropriate tax or price level/structure (e.g., the latter require measuring all costs of water provision with precision or a comprehensive knowledge of firms' cost structures);
- measuring and costing environmental externalities;
- the cost of installing and reading meters; and
- the institutional/administrative costs of doing things differently.

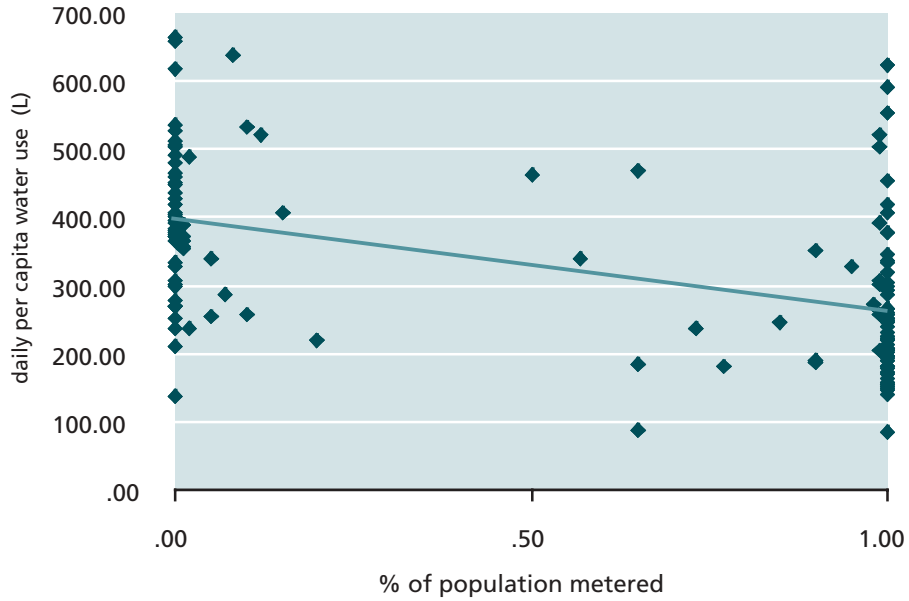
Any pricing strategy should account for these costs to evaluate if they exceed the anticipated benefits.

2 Opportunity costs refer to the benefits lost in not using water for other, more valuable purposes.

3 This is equivalent to marginal cost pricing.

Water Use Decreases Slightly with Metering

Metering explains less than 25% of variation in per capita use



A regression of daily per capita water use (litres per day) on percentage of clients metered (for municipalities serving populations of 30,000 or more) shows a slight decrease in water use with an increase in metering. However, the effect is not strong: the adjusted R^2 is only 0.23, suggesting that metering explains less than one quarter of the among-municipalities variation in daily per capita water use.

Data source: Environment Canada, Municipal Water Use and Pricing Database, 1999.

Experience with the Use of Taxes and Prices

Most studies show that the effect of prices on water use is relatively limited, and water use varies more with the price structure (constant versus volumetric pricing) than with the actual price level. However, some apparent contradictions need to be explained.

In the United Kingdom, utility prices have increased to ensure cost recovery, but per capita water use has still increased in the residential sector. One explanation offered is that metering is not universal, raising the question of the relative effects of price and metering on water use. But contrary examples can be found in Canada, where full metering is not always associated with less water use than partial or no metering.

Moreover, results of surveys in Denmark indicate that consumer education explained 60 percent of changes in water use patterns and pricing 40 percent. More generally, while price increases and reduced water use have been observed in a number of European countries, the effect of pricing has not been found to be very significant and, more importantly, little is known about the determinants of water use. Insufficient knowledge of these determinants is also an issue in Canada.

In the agricultural sector, most irrigation systems are not metered and some studies show that introducing metering might not be cost effective. In addition, water demand in agriculture can be the result of policies not related to the price of water (such as crop subsidies), so price changes alone may not affect water use patterns significantly.

The South East Kelowna Irrigation District, in British Columbia, shows how metering, pricing, and education can be applied to reduce water use. Metering was introduced to measure water used, educate farmers on their actual water needs and on efficient water use, and set allocations accordingly. A 10 percent reduction in water use was achieved without introducing volumetric pricing. A later change to the price structure, a metered rate penalty for exceeding water allotments, resulted in a further 22 percent reduction.

While industry is more sensitive to price changes than the municipal and agricultural sectors, in European examples water abstraction charges have been set mainly to raise state revenues. Further, many industrial and agricultural water users have been shielded from these charges or from price increases, making their impact difficult to assess.

Documenting Social and Environmental Effects

If prices and taxes have been introduced for environmental reasons, it is not clear that they have reached this objective, and even less clear if this was achieved at least cost. A related problem is that environmental goals are not well defined. Increased water use efficiency is sought in the hope it will leave more water for environmental services, but it may not always achieve this, and there might be undesirable secondary effects such as increased pollutant concentration. Further, the need for increased water for environmental services is not always clear. Better knowledge and understanding of watersheds is needed to make such assessments.

Furthermore, there is limited analysis of the socio-economic effects of pricing changes, in particular in the agricultural sector and on industry competitiveness.

Conclusion

Pricing and taxes can clearly be expected to affect water use. However, the absence of systematic *ex-post* evaluations makes it difficult to evaluate the results of implementing pricing or taxes. This task is made more difficult given the number of objectives that appear to be pursued jointly: recovering infrastructure costs, raising state revenue, behaviour change, water use efficiency, and others. From a policy research perspective, there are needs for:

- quality data on water use;
- better understanding of water use determinants;
- better understanding of transaction and implementation costs;
- documenting cost effectiveness and effects of different policy tools; and
- better understanding the conditions that make water demand management and pricing strategies successful, including the role and form of stakeholder participation.

Further Reading

Ait Ouyahia, M., B. Cantin, and I. Campbell, I. 2005. *Economic Instruments for Water Demand Management in an Integrated Water Resources Management Framework.* Policy Research Initiative Report: Ottawa.

Canadian Water Resources Journal. Forthcoming, Spring 2005. Special Issue on Economic Instruments for Water Demand Management.

Green, C. 2003. *Handbook of Water Economics. Principles and Practice*, John Wiley and Sons Ltd.

OECD (Organization for Co-operation and Economic Development). 1999. *The Price of Water.*