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DEMAND MANAGEMENT FOR MELBOURNE'S WATER

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INTRODUCTION

Water restrictions have operated in Melbourne since October 2002. The immediate reason for their introduction was that the water in storage was depleted by drought. However, the Victorian government has expressed concern that the combined effects of population increase and possible adverse effects of climate change on water supplies, along with the traditional problem of variable runoff into water storages, could mean Melbourne will be approaching its supply limits within fifteen years (Victorian Government 2004, p.94). The government has recently reviewed options for Melbourne's water economy, in the context of an overall assessment of Victoria's water future. The review included the preparation of green and white papers on water (Victorian Government 2003, 2004). Key outcomes of the government's examination of the Melbourne water economy included:

- a new dam would be a last resort
- a target per capita reduction of 15 per cent in consumption of drinking-quality water by 2010, compared with the 1990s average, to be achieved by smarter use of water
- a target for recycling 20 per cent of Melbourne's waste water by 2010
- retention of a regulatory regime for managing water in Melbourne, with the innovation of a rising block water tariff for Melbourne households
- imposition of an "environmental levy" on Melbourne's government-owned water retailers to fund environmental and other water-system improvements
- silence on whether the policy of not allowing trade in water from irrigators to the Melbourne system, and vice versa, might be reviewed.

The aim in this paper is the limited one of examining the regulatory demand management regime in the Melbourne water economy. With one significant qualification, the supply-side, supplementing Melbourne's water resources, is not considered. The qualification is to recognise that some approaches to containing demand are more conducive to efficient sourcing of new water supplies than others. The focus in the paper is on providing a critique of the main measures used to reduce water

consumption. Most attention is given to the new rising block tariff, and to the package of restrictions on water use.

In assessing the demand management measures used in Melbourne, main reliance is placed on two closely related criteria. The first is the extent to which reduction of water use is achieved by price or by non-prescriptive quotas that give water users the freedom to decide where and how to reduce their water use. The second criterion is the consistency of the demand management regime with maximising the social value of water---that is, economic efficiency. The two criteria overlap substantially, and under certain conditions, especially correspondence between marginal private and marginal social valuations of water, coincide precisely. A third criterion, equity, while given less attention, is not ignored.

Some reform possibilities that would enhance freedom, the social value obtained from water and equity are considered. Those reforms also lie within the regulatory paradigm that characterises the demand management regime in Melbourne and other Australian cities. The favoured options involve a move away from prescriptive regulation of water use to relying on regulated water prices. Consideration of more thorough-going reforms introducing contestability to the functions of the urban water system---water sourcing, storage, wholesale and retail water services---is beyond the scope of the paper.

It is of interest that urban water authorities, including Melbourne's, have been assessed as having "substantially implemented their 1994 COAG water reform agreement obligations" (Senior Officials' Group on Water 2004, p.22). Those reforms included the commercialisation and corporatisation of government water bodies, and pricing reforms including consumption-based pricing and full cost recovery (Productivity Commission 2004, p.26). Notwithstanding that a key objective of the COAG/NCP reform process was to facilitate the allocation of water to its highest value uses, the COAG-agreed reforms stopped short of what was required for economic efficiency, and the Senior Officials' Group (2004, p. 22) said: "there is significant scope to improve water use efficiency in urban Australia, to adopt best practice in key areas, and to improve the interface between urban and rural water supply". The last words encompass the potential for trade in water between irrigators and urban water economies, and vice versa, to increase the value of the water resource and to enhance the security of urban water systems.

Because the approach taken to regulation of Melbourne's water implies that the social marginal value of water is often very different from private

marginal values, consideration is given first to the question "whose values count?"

WHOSE VALUES COUNT?

Central to assessing the economic efficiency of a demand management regime for water is the judgement made on whether individuals' values should be the basis of comparing the marginal value of water for different users and uses, or whether individual valuations should be overridden by values determined by water authorities or state governments.

For the array of goods and services for which supply and demand are coordinated by markets, the values assigned to the items by individual consumers are taken to be the economically and socially relevant values. For water, there are important public goods to be considered in managing the resource, including health and environmental public goods. However, water used by households, firms and other organisations in urban settings exhibits the two key characteristics of private goods---competition in consumption and excludability. Given the strong private good characteristics of water, it is not surprising to find that many economists analysing water have viewed reliance on the private valuations of water by individual water consumers as appropriate for the economically efficient allocation of the resource (e.g. Harberg 1997; Agthe and Billings 2003; Freebairn 2003). Harberg (1997), writing in the context of a need to reduce water consumption in a dry period, said:

"…..the tastes and preferences of individual customers may vary widely…For example, a particular residential customer might prefer never to wash a car in order to provide water for a cherished garden. Other customers might cheerfully let all landscape die in order to retain longer-than-average showers. These taste differences are generally of no concern to the water provider." (p. 45).

Acceptance that individual valuations of water are appropriate for allocating water has the policy consequence that the adjustment of demand to available supply in times of drought would be made by non-prescriptive measures, such as price increases or water quotas at the household level.[1] This is not the approach that has been followed in Melbourne and in other Australian cities. Rather than follow the non-prescriptive approach of allowing individuals to choose where to make any required reductions in water use, urban water policymakers have

[1] Banks (2004) notes that excessively prescriptive regulation emphasises subsidiary requirements over the underlying requirement of the regulation.

opted to ban some water uses, to restrict other uses, and to leave yet other uses of water unrestricted.

In Melbourne, prohibitions apply to watering lawns, washing paths and patios, washing cars with standard hoses, and, subject to a significant qualification, filling swimming pools. The Green Paper on water released in August 2003 said: "Behaviour such as hosing driveways and footpaths must become actions of the past" (p.43). A ban on the use of water for a particular purpose can be taken to mean that, in the prevailing circumstances, the net marginal social value of that use of water is determined by the government to be zero or negative. Other uses of water are subject to restrictions. Gardens can be watered with sprinkler systems only between certain hours in the evening and early morning.

The government does not appear to have relied on differences in externalities between water uses in justifying the pattern of water restrictions. The banning of washing of paths and patios has not been publicly based on externalities from runoff into the storm water system. Inside use of water, which is unrestricted, likely involves greater negative externalities after use than does the watering of lawns and gardens.

Notwithstanding that some Melburnians place a high value on using water for "non-essential" and even "wasteful" purposes, Water Minister John Thwaites was "pleased to announce" in April 2003 that stage 1 restrictions would be made permanent. That appears to suggest that the negative social consequences of those water uses are viewed as independent of the amount of water available.

Given the government's emphasis on reducing water use in Melbourne, and its unwillingness to rely mainly on increasing prices to do this, some form of non-price rationing is necessary. If rationing takes the form of bans and other restrictions on particular uses of water, rather than non-prescriptive rationing of overall water use, it has to be possible to enforce the restrictions. Without unthinkable eavesdropping by government inside private homes, the rationing needs to be confined to outside uses of water.[2] It is likely that this constraint in policing water restrictions goes some way towards explaining the form of the restrictions, and the government's judgements about the social value of water in different uses implicit in the regulations. Indeed, Premier Steve Bracks authorised a full-page advertisement that appeared in Melbourne newspapers on 28

[2] On the method of policing the water regulations, Melbourne Water (2005) says: "Where necessary, patrols will be conducted. However, the retail water company will continue to rely on the public to report any suspected breaches of restrictions".

June 2004 saying Melburnians need to take fewer baths and that their average shower time, already reduced by one minute to 6 minutes, needs to be reduced to 4 minutes.[3] Currently (January 2005), an illuminated sign near the Tullamarine freeway advises that a 3 minute shower saves 200 glasses of water. These exhortations remain in the realm of suasion, untranslated into regulations that impose state values on private acts of consumption.

In Melbourne, there is no is no clear policy of varying the price of water inversely with the level of water in storage. Taken on its own, this suggests that the state sees the social value of water as independent of the scarcity of water. However, with the regulatory restrictions on water use being made tougher as the volume of water in storage drops, a schitzophrenic syndrome is revealed: the social value of water for rationed uses is reduced (to zero or less in the case of water for prohibited uses) while it is unchanged in unrestricted uses.[4] From 1 October 2004, however, Melbourne householders have had a rising block tariff. What this pricing approach means for the private and social value of water is examined in the next section.

A number of writers on water policy have drawn attention to the contrasting approaches to determining the value of water in the irrigation sector and in the urban sector. For example, Crase and Dollery (2005, pp. 18-19) write: "Put simply, instead of the market determining what represents a higher value activity (as in irrigation), the government has chosen to specify what behaviours are of greater value to the community in urban settings".

DEMAND MANAGEMENT MEASURES

In this section consideration is given to the main demand management measures used for water in Melbourne. These measures are:

- the rising block tariff
- regulations that restrict the use of water
- subsidies for water-saving fittings, appliances, and practices
- mandating water-efficient appliances and water efficiency standards

[3] The source of the government's information on shower times was not revealed.
[4] The fall in social value of water in prohibited uses can alternatively be expressed as an increase in the social opportunity cost of water in that use.

- education and moral suasion

Rising block tariff

The price paid by Melburnians for water bears little relationship to the supply-demand balance for water. Yarra Valley Water, Melbourne's largest water retailer, says its market research shows that a significant number of its customers think the price of water is too low to encourage water conservation (Yarra Valley Water 2004, p.91). In its white paper on water the Government said "a smarter pricing system in Melbourne", a rising block price scheme, would be introduced for water in October 2004 (Victorian Government 2004, p.125). Under this scheme, the marginal water price fell from $0.79 per kilolitre to $0.75 per kilolitre (down 3.8 per cent) for households using up to 40 kilolitres of water a quarter. For households using 40 to 80 kilolitres of water, the marginal price rose from $0.79 to $0.88 per kilolitre (up 11.4 per cent), and for "wasteful" households using more than 80 kilolitres, the marginal price rose from $0.79 to $1.30 per kilolitre (up 64.6 per cent).

The price increases on 1 October 2004 were said to average 5 per cent, and to add around $6 a quarter to the average water bill. (Victorian Government 2004, p. 129, Yarra Valley Water 2004). The price increases in Melbourne, together with smaller, delayed increases for rural water authorities, will fund an environmental contribution of $225 million over four years for addressing degradation of rivers, encouraging water recycling, improving water infrastructure, and implementing new water saving measures (Victorian Government 2004, p.129, Yarra Valley Water 2004). That is, the revenue generated by the price changes associated with the rising block price scheme will be earmarked for uses judged to yield environmental (and political?) benefits.

The white paper dubiously suggested that rising block tariffs "are widely regarded as the fairest and most effective way to price water for conservation. Not only do they encourage water conservation, but they also recognise the need to provide water for essential domestic use at an affordable price" (p.127).

Consider the efficiency and equity consequences of rising block tariffs.

Economic efficiency

According to the white paper, the rising block tariff (also called increasing block tariff, IBT) would "reward efficient users and penalise

excessive use" (p.125). "Efficient users" here means not those for whom the marginal value of water is high (economic efficiency), but low volume of water use. Similarly, "excessive use" means not that the marginal value of water to users is low, but that more water is used than the government considers appropriate.[5]

A three-level pricing scheme ensures that the marginal value of water cannot be equal across all households, a condition for efficient water use, unless the state denies the validity of private valuations in the case of water and imposes its own. Moreover, the particular nature of the necessary adjustments required to the three different marginal private valuations of water for consumers in each of the three blocks to bring them to a common marginal social valuation would fail any "reasonable assumptions" test. To illustrate, the excess of marginal social valuation of water over marginal private valuation for a wealthy retired judge living alone and using little water (consumption within the block-one volume) would have to be larger than the excess for an "average" household consuming within block-two, and greater also than for a struggling family of four within block-two.

Efficiency considerations point to one price for all water. The case for reducing the marginal price to low-volume users when it is increased to others is open to particular criticism given the government's view that Victorians understand that the prices they pay for water have not reflected "the true value of the resources they use" (Victorian Government 2004, p. 126).

Regulating for a three-level price scheme in Melbourne creates incentives for trade in water between neighbours on different water price blocks. This reality was not addressed in the green or white papers. On the usual assumption that water prices reflect marginal private, and social, valuations, inter-household trade would be efficiency-enhancing. However, that would not be so if the price structure introduced with the rising block tariff did in fact result in a common marginal social valuation for water across all users. The small potential gains to most households from water trade will likely mean the amount of water trade between households is small. But it can be expected that some mutually-beneficial water trade will occur, notwithstanding that that will be efficiency-reducing if the social marginal valuations of water to different users

[5] The white paper also sees IBT as "reward[ing] water conservation and encourag[ing] efficient use of alternative, more sustainable, sources of supply" (p.126). In a careful assessment of balancing water supply and demand, these two objectives would be separate from the objectives noted above---rewarding low volume users and penalising those using "too much".

implicit in the rising block tariff are accepted. How will this consequence of Melbourne's smart water policy be viewed by the government and by Melburnians?

Although this paper is concerned with demand management, it needs to be recognised that price plays the dual role of rationing demand and eliciting new water supplies. Decisions on the sourcing of supplementary water supplies through changing catchment management, reducing system losses, recycling waste water, harvesting runoff from rooves, desalination, building new dams, inter-catchment water trade and other means can only be evaluated satisfactorily from an overall economic perspective if the price that rations demand also signals the value of extra water supplies. The introduction of the block tariff, with three different marginal water prices for different groups of consumers, complicates further the task of assessing options for adding to water supplies for Melbourne. The task was already difficult because of the mix of price rationing and restrictions on use.

The efficiency costs of rising block pricing would be much reduced if the number of blocks was kept to two, and the volume of water supplied at the block-one price was sufficiently low that nearly all households were buying block-two water. Then, nearly all households could be supposed to have a marginal private valuation of water equal to the block-two price, and the scope for win-win trade in water between households would be reduced.

With almost all households paying the block-two price at the margin, it would be easier to see pricing policy as consistent with the government's view that Victorians know they get their water too cheaply.

A two-block tariff is now examined more closely.

A two-block tariff

While economic efficiency points to use of a uniform price for all water sales, a two-block price scheme may be worth considering if objectives concerning equity, or containing the size of water bills, are seen as important. A two-block pricing mechanism could allow all households to access a "base" amount of water, perhaps determined in relation to judgements about "essential" water needs, at a low price, while avoiding most of the losses in economic efficiency of a three-block price scheme.

If base-water corresponded to the estimated “normal” requirements for bathroom, toilet, laundry and kitchen use, its price elasticity of demand would be very low. “Extra” water would include a substantial volume used on gardens and lawns, and the marginal minutes under the shower: these would be expected to face more price-elastic demand.

Suppose price is the sole means used to ration water.If price increases for water applied entirely or mainly to the excess-water, a given reduction in water use could be obtained with a smaller average price increase and a smaller consumer welfare loss, as measured by consumer surplus. This is illustrated in Figure 1. There householders’ demand for water is disaggregated into base water, Db, and extra water, De, with De more price elastic than Db. To reduce aggregate consumption from Q to Q’ with uniform pricing for all water, price must increase from P to P’. Consumer surplus for water users is reduced by area PP’CD per period. If the reduction in water use is obtained by increasing price for block two water only, the price for that water increases from P to P’’, and consumer surplus falls by PP’’EF, which is less than with uniform pricing. (Note that (Q-Q’)=(Qe-Qe’’)).

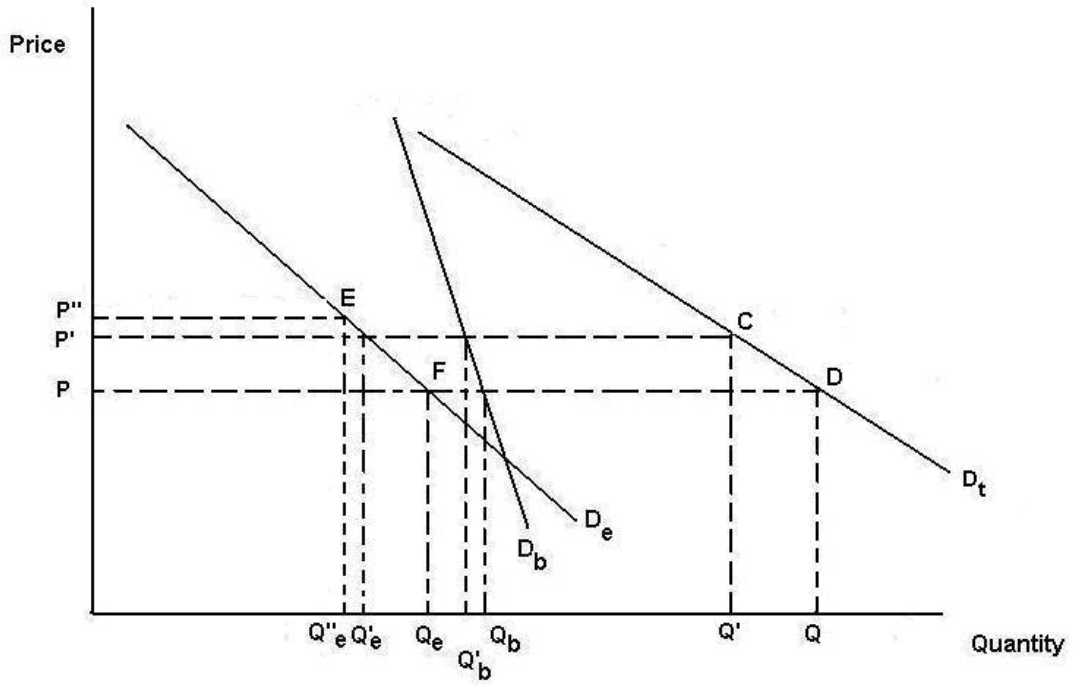

Figure 1. Reducing water consumption using price, with and without price discrimination.

Seasonal pricing and cross subsidies

In both the green and white papers the idea of seasonal pricing of water was canvassed. In the white paper it was said that seasonal tariffs “are not

favoured as they do not encourage year-round conservation" (p.127). If there was good reason to introduce seasonal price differences, the fact that they encouraged water conservation only for part of the year would not be a sound economic argument to reject them. In fact, there seems to be no sound economic reason to vary prices on the basis of time of year.

Notwithstanding the non-supportive attitude to seasonal water tariffs in the white paper, it was said there that the use of quarterly consumption levels for billing purposes "introduces a seasonal element into the pricing framework" (p.127). With the watering of gardens and, if the ban under the level-two water restrictions is removed, lawns, many households are expected to use more than 80 kilolitres in the summer quarter, and pay the block-three tariff for usage over 80 kilolitres. In effect, for many households, the block tariff scheme represents price discrimination against the use of water for lawns and gardens.

The rising block tariff introduced cross-subsidisation of lower-volume water users by higher-volume households. That is inconsistent with economic efficiency. It was in part because of this that all state governments had earlier agreed through COAG and the NCP to reduce or eliminate cross-subsidisation in water (Productivity Commission 2004, p.26).

Institutionalising price differences between water users has precisely the opposite effect of a policy to which the Victorian government is sensibly committed in the irrigation context---removing barriers to trade in water. Freeing trade works to diminish differences in water prices between users and facilitates the use of water where it is most valuable. Block pricing creates price differences between users, reducing the overall value obtained from water on conventional definitions; nor can it be rationalised readily in terms of maximising the social value of water.

Equity

Spending on water and sewerage rates and charges was less than one per cent of spending on goods and services for the average Victorian household in 1998-99. (See Table 1). The data provided publicly by ABS does not disaggregate state data by level of household income. At the national level, however, households in the lowest income quintile spent 1.1 per cent of their weekly income on water in 1998-99. This was a little over half their spending on tobacco and on alcohol, and much lower relative to spending on the other items shown. It seems likely that the

picture for low-income Victorian households would be similar to the national story.

Table 1 Household spending on water and selected other items, Victoria and Australia, 1998-99

	Victoria (mean)		*Australia (mean)*		*Australia (5th quintile household gross income, mean)*	
	per week	total weekly spending	per week	total weekly spending	per week	total weekly spending
	$	%	$	%	$	%
Water [a]	6.81	0.9	5.91	0.8	3.89	1.1
Domestic fuel and power	21.59	3.0	17.87	2.6	12.85	3.7
Transport	130.50	18.2	117.82	16.9	48.15	14.0
Food and non-alcoholic beverages	134.22	18.7	126.99	18.2	67.15	19.6
Alcoholic beverages	20.32	2.8	20.43	2.9	7.26	2.1
Tobacco products	10.53	1.5	10.74	1.5	6.59	1.9

[a] Water and sewerage rates and charges

Source: ABS-HES: Detailed Expenditure Items, 6535.0 1998-99.

Because an urban household's water bill typically comprises service charges and user charges---the latter being the smaller component for most households---the percentage increase in a household's water bill in response to a given percentage increase in the (uniform) price of water would be smaller than the price increase for water, even with zero price elasticity of demand for water. With the realistic assumption that there is some elasticity in water demand, the percentage increase in the typical household's water bill with a given increase in the price of water would be smaller again.

How large would the price increase for drinking-quality water need to be to reduce per capita consumption by 15 per cent against average 1990s water use, the government's target for 2010? Assuming that price was the sole measure used to reduce water use, and a price elasticity of demand for water in the range -0.2 to -0.5, the price increase required to reduce consumption by 15 per cent would lie between approximately 30 per cent and approximately 75 per cent.[6] Accepting that there was a downward trend in per capita water use in the 1990s, due partly to the introduction of volume-based water charges by the Kennett government early in the

[6] OECD (1999) summarises studies on urban water, with most price elasticities of demand falling in the range -0.2 to -0.5. Barrett (1996, 2005) finds that the price elasticity of demand for residential water in Australia is typically around - 0.5.

decade, a significant amount of the target reduction was achieved before the Bracks government announced the target. Further reductions have been achieved as a result of the Bracks government's package of restrictions, education and suasion. Some of these water savings would stick if the regulatory regime, or just the restrictions, were removed. Hence, reliance on price to achieve the consumption target would require an increase in a uniform water price considerably lower than the 30-75 per cent mentioned above, and the required price increase would be lower again if some of the restrictions on water use were retained.

The unimportance of water in household spending and the reality that service charges are a substantial part of the water bill for most households points to questioning of the equity case for departing from an efficient, simple one-price-for-all-water. It might be suggested that there is a stronger case for governments to contrive to introduce block pricing for food or transport, much larger items in households' budgets, than there is for water.

Putting aside the issue of whether a uniform water price would have a substantial adverse effect on low-income households, there remains a significant question about the IBT from the view of equity between households. Why should a household of two using 200 litres a person per day pay a marginal water price of $0.75 per thousand litres, while a household of five using 200 litres each a day pays a marginal price of $1.30?[7] O'Brien (2005, p.10) calls it "grossly unfair". Notwithstanding that households of five or more may be eligible for special assistance to help them reduce their water use,[8] the question arises whether water pricing policy is seen as a way of discouraging larger families and households?[9]

Boland (1992) draws attention to an alternative to a two-tier water pricing scheme introduced in Los Angeles. Under that scheme, all consumers pay a uniform price for each unit of water used, but qualifying low-income households are targeted for lump-sum credits towards their water bills. In

[7] This question can also be asked in relation to the two-block tariff outlined earlier.

[8] The white paper, in which the envisaged cut-off family size for this assistance was six, said: "….families with six or more members who are finding it difficult to pay their new bills could apply to their water authority to receive a water savings package. This measure is made in recognition that large families may be using water wisely but due to the size of their water consumption they are being priced at the top block tariff" (Victorian Government 2004, p.128).

[9] Rising prices for household inputs do make children more expensive, and provide economic incentives to reduce the size of families. It is reasonable to suppose that the size of this effect in the case of conceivable price increases for water would be negligible in the Australian context. It is more likely that the block pricing regime will influence the size of households in ways other than through increasing the number of children. That, also, is presumably not a policy objective.

principle, a scheme of that type could direct assistance more accurately to low-income water users than could a two-block scheme or the three-block scheme introduced in Melbourne. However, because it requires identification of eligible households, the Los Angeles scheme would be harder administratively and politically to implement.

Summary

The rising block tariff introduced in Melbourne in October 2004 was subjected to little assessment in the green or white papers. The claim was made that the rising block tariff is widely seen as the "fairest and most effective way to price water for conservation" (Victorian Government 2004, p.127). While some of those words mean different things to different people, the rising block scheme can be characterised as follows: it ensures (unless assumptions about adjusting private marginal values to social marginal values are accepted that would be laughed out of court by a lay jury) that water will be used inefficiently in an economic sense; it creates win-win incentives for trade in water between households; and it discriminates between households on the basis of number of household members in a way that many will see as inequitable. That assessment is consistent with the conclusion reached in a review of IBTs by Boland and Whittington (2000, p.234): " IBTs introduce inefficiency, inequity, complexity, lack of transparency," and other difficulties(p.234). Is the rising block tariff smart water policy?

Regulation of water use

Since the introduction of level 1 water restrictions in October 2002, Melbourne households have been subject to regulatory restrictions on the use of water. The main level 1 restrictions are bans on washing paths and patios, bans on the use of regular hoses to wash cars, restrictions on the hours that garden sprinklers can operate, and a requirement to obtain written approval to fill swimming pools and spas. Subsequently level 2 restrictions were introduced. The main additional restriction under level 2 restrictions was a prohibition on watering lawns.

From the view of their social costs, and accepting the conventional view that private valuations correspond to social valuations, regulations are less efficient the more they deny the preferences of individuals. It can be expected that most people using water for a particular purpose would

experience a larger welfare loss from the prohibition of that activity than from the restriction of the hours in which it can be undertaken.[10]

For many people, the restrictions on hours of watering their gardens would have no effect on their behaviour, and perhaps be seen by them as costless, even though their lawful options are reduced. For others, the restrictions would involve costs for reasons of inconvenience and other factors, with the size depending on the particular circumstances of individual households.

It should be noted that the greater technical efficiency of watering in the early morning and in the evening, due to lower evaporative losses, does not, if individual values have primacy, provide an economic justification for regulating to confine watering to those times.

In addition to Melbourne's water restrictions, there are other regulations that are intended to save water. These include mandated dual-flush toilets and water-efficient shower heads. From July 2005 new houses in Melbourne must include either a water tank or a solar energy unit.

The requirement that toilets be dual-flush is an instance of regulation that compels people to add to their options without restricting their behaviour. Unless the government's presence in the bathroom becomes more intrusive, no-one who wishes to continue to use the full flush every time needs to stop doing so! However, the development of a mandated "smart toilet", which applies the full flush only upon detection of a non-liquid evacuation, could end the choice that consumers at present have in this domain!

The regulatory regime is clearly inconsistent with obtaining the greatest value from the water resource if individual marginal valuations of water in different uses are accepted as the best guide to social marginal valuations. Many Melbourne householders would likely welcome the opportunity to use a bit less water for unrestricted inside uses, or restricted outside uses, and use it instead to water their lawns. The restrictions on water use result in different marginal valuations for water in different uses within households---as the rising block price scheme leads to differences in marginal private valuations of water between households.

[10] However, prohibition of a low-value use of water may cause smaller costs than less drastic restrictions on a higher-value use.

Can the regulatory package be seen as equating marginal social valuations of water across uses within households? Realistically, no. The prohibition on watering lawns implies that the marginal social value of water in this use is zero. The absence of restrictions on inside use of water could be viewed as indicating that the marginal private and marginal social valuations for that water coincide. Are the restrictions on hours of watering gardens to be interpreted to mean that marginal private and marginal social valuations of water in that use coincide between 5 a.m. and 8 a.m. and 8 p.m. and 11 p.m., while marginal social valuation outside those hours is zero?[11]

Swimming pools

The regulation of water for filling swimming pools and spas of more than 2000 litres takes a different form to regulation of other water uses. Filling such a pool or spa requires written approval from the water retailer. To obtain approval, it is necessary to commit to a plan to achieve savings in water use in other areas of the household equivalent to the water needed for the pool/spa. Enforcement is by random audits by the water retailers. This "offsets" arrangement represents internal trade---trade within the household. Householders can "buy" an exemption from the prohibition by making water economies elsewhere if they value the pool experience highly enough.

The offsets arrangement for swimming pools and spas, considered on its own, is conducive to freedom and to a more efficient system of water rationing. Introducing an offsets mechanism is in some respects a step towards an overall water quota from a starting point of regulating particular water uses.

However, the offsets system for swimming pools gives rise to two questions:

- Why should there be an offsets option for swimming pools but not other prohibited uses of water, such as watering lawns? Are the preferences of those who place a high value on full swimming pools judged less socially unacceptable than the values of those who place a high value on a green lawn in summer?[12]

[11] For watering systems that turn themselves on and off, watering is permitted between 11.00 p.m. and 6.00 a.m.

[12] The reason for allowing offsets for swimming pools but not lawns may, of course, have something to do with the fact that there are far less swimming pools than lawns, so that the administration and enforcement costs would be higher for the latter. Furthermore, perhaps the fact that lawns are common

- Why should internal trade be viewed as an acceptable way to obtain the right to fill a swimming pool but not external trade? That is, why shouldn't a household be able to pay other households to make the required offset savings in water use if that is cheaper than making the savings themselves?

These questions highlight the logical consequences of an initial step towards allowing householders to use the market to find a lower-cost solution while still achieving the water savings of a prescriptive regulation. Why should further steps towards providing options to householders not be taken? And, ultimately, why not rely fully on price to obtain the required reductions in water use, giving consumers maximum potential to make savings in the way that involves the smallest marginal sacrifices to them?

Household water quotas

Water use could be reduced without imposing state values on water in different uses by introducing household water quotas. To give an efficient allocation of water according to private valuations tradeable property rights in water would need to be established and allocated to households, and a market established in which those rights could be traded. This appears to be illegal in Victoria at present, posing a large obstacle to the option of establishing a water market in Melbourne via tradeable household water quotas.

Subsidies on water-saving items

Economists see subsidies having a potential role when positive external effects from an activity would otherwise result in a level of the activity that was socially sub-optimal. This justification cannot reasonably be applied to the Victorian government's use of subsidies to encourage people to instal water-saving items. A partial list is of these subsidies is: $150 for installing a rainwater tank, with an extra $150 if it is connected to the toilet; $50 for retrofitting of dual-flush toilets; $10 for AAA shower roses; $20 for garden mulch if a total of $100 is spent; and, for two months from 1 October 2003, $150 for AAAA washing machines and $100 for AAA dishwashers.

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results in a perceived sense of most households sharing in a sacrifice for the overall good. Unless the offsets option is provided for lawns, it is hard to establish what private value householders place on a green lawn.

Economic principles suggest that a desired reduction in water use is achieved most efficiently using price---either on its own, or through a tradeable water quota scheme. The pervasive, uniform incentives for water saving and augmentation provided by those policies are unlikely to be approximated in cost-effectiveness by any ad hoc set of subsidies. Using information contained in the white paper on the volume of water saved as a result of rebates offered on ten categories of water-saving outlays by households, Crase and Dollery (2005) calculated implied values to the government ranging from $770 per megalitre from AAA shower roses to $33,395 per megalitre for AAA dishwashers; water-efficient shower roses was the only item below $2,700 per megalitre. Relatedly, Yarra Valley Water (2004, p. 24) reported a study by RMIT engineers finding that water tanks did not pay for themselves in 30 years.[13]

It is likely that a substantial part of the outlays on rebates will reduce the net cost of the subsidised item to the purchaser without changing their behaviour. Economic efficiency considerations aside, is the distributional impact of those subsidies consistent with the government's equity objectives? Would a table classifying subsidy recipients for the washing machines and dishwashers by post-code be of interest?

If the rationale for the subsidies is to deal with a problem of under-use of water-efficient appliances and inputs stemming from lack of knowledge, the problem could be addressed more directly by disseminating information on water savings available by using the items. That approach would potentially change the behaviour only of those who are ill-informed, while subsidies give everyone an incentive to buy more of the subsidised items.

Mandating water-efficient appliances/water-efficiency standards

Other things equal, water-users prefer to use less water if the marginal price is positive. But other things may not be equal when a "water-efficient" shower-head or washing machine is installed. The experience provided by the "water-efficient" item may be judged inferior by the water-user---e.g. the shower doesn't feel so good, the front-loading washing machine is considered less user-friendly. Even if the water-saving item is viewed by the householder to be as good or better than the water-inefficient one, its cost may be such as to make it an inferior purchase.

[13] The payback period will have been reduced somewhat for households on block-one and block-two prices since October 2004, but increased for households paying block-one prices.

The “consumer sovereignty” principle that underlies the organisation of most economic activity in Australia implies that people are made worse-off if they are forced to do something that they have the option of doing but choose not to do. Accepting that saving water is a subsidiary objective to advancing citizens’ welfare is sufficient reason to give low marks to options that compel people to save water in particular ways when they could achieve the same water savings in ways that give higher welfare.

Is there a documented assessment of the costs and benefits of the requirement from July 2005 that new homes must have a water tank or a solar hot water system? If there is not, the presumption must be that this regulatory requirement is cost-ineffective in saving water.[14]

Education and moral suasion

It is likely that public education has a socially beneficial role (benefits greater than costs) in changing urban water use. This is partly because of the changing technological options for saving water, and the public good nature of information on ways to reduce water use. Possession of information on the water requirements of European and native gardens may help many people make better decisions, in their own judgement, on what plants to grow.

The role of moral suasion cannot be assessed within the economics framework. As indicated in the earlier section on values, moral suasion has been a conspicuous part of the Victorian government’s strategy to reduce urban water use. It is unclear what effect this part of the strategy has had. Is it reasonable to expect that moral suasion would be less successful in reducing water consumption in the presence of a widely-held view that water is too cheap to take conservation seriously? Would suasion be even less effective if the community understood that there is the option of win-win trade in water between the large-volume irrigation sector and the small-volume urban water system?

SEARCHING FOR A RATIONALISATION OF THE REGULATORY REGIME

[14] The cost-effectiveness of savings in non-renewable energy is also open to challenge, and home ownership will be made more difficult for some.

Sieper (1983), drawing on literature in the private interest field, offered a convincing rationalisation of many forms of the then extant rural regulation. Is there a comparable rationalisation for the urban water regime?

Part of the explanation for the economically inefficient---wasteful---demand management regime for Melbourne's water lies in the populist approach to urban water management taken by the Victorian government. Notwithstanding the fall in Melbourne's water in storage over much of the period since the introduction of water restrictions in October 2002, price played a negligible role in restricting use of the "undervalued" water resource until October 2004. Even then, while households on blocks one and two experienced price increases at the margin of 11.4 per cent and 64.6 per cent, respectively, the price for block-one water fell 3.8 per cent.[15]

In announcing the rising block tariff in the white paper, the government said: "This reform is made in recognition of the overwhelming support for tariff structures that reward conservation…" (p.127).[16] That support was established largely through consultation with customers by the three government-owned water retailers.

It is not surprising that, when asked, water users would strongly support higher prices for households that use more water than they do. Consumers of food, petrol and many other items might say the same thing if they were asked. The idea that price should rise with consumption is perhaps especially likely when the state has enacted constitutional change to ensure the resource is in public ownership, and when there is a history of politically-influenced regulation of the resource. Both of these apply for water in Melbourne.

In choosing to ration a scarce resource to all members of society using measures preferred by a majority, a government may compel a substantial minority to accept a policy regime very different from the one they would prefer for achieving the required reduction in demand. Rothbard (1982, p.164) writes: "….even if the majority of the public specifically endorsed

[15] Boulding (1964), amongst others, has supported private ownership of water because of the political pressures to keep water prices too low, subsidizing economically inefficient uses, with public ownership.

[16] A uniform price for all water would also reward conservation. Melbourne's rising block tariff rewards conservation by block-three users more and by block-one users less than a uniform price set between the block-one and block-three prices. A uniform price would not violate the efficiency requirement of equating the marginal social value of water between users as a rising block scheme does unless unreasonable assumptions about marginal social valuations are accepted.

each and every particular act of the government, this would simply be majority tyranny rather than a voluntary act undergone by every person in the country". If a minority objects strongly to a restriction on their behaviour, a government, populist or not, may see political advantage in easing the restriction. This may be relevant in explaining provision of the offset option which allows households to buy their way around the prohibition on filling swimming pools and spas.

CONCLUSION

The Victorian government has responded to short-run depletion of Melbourne's water reserves because of drought and to concern about the longer-term supply/demand balance for the city's water by introducing a multi-component demand management regime. The regime includes bans on some water uses, restrictions on some others and, from October 2004, a three-level rising block tariff scheme. It also includes subsidies on a range of water-saving fittings, appliances and garden inputs and mandated use of water-saving items. The regime is both regulatory and, in many respects, prescriptive. It restricts people's freedom, and only by accepting unreasonable assumptions about adjustments to marginal private valuations of water to arrive at marginal social valuations for different water uses and users, can the regime be seen as consistent with the objective of using water where it is most valuable to society. With usual approaches to equity, the rising block tariff rates poorly on that criterion also. Is it smart policy? Restrictions somewhat less limiting than the level 1 restrictions will become made permanent on 1 March 2005.

Given the small share of water in households' expenditure, even for low income households, the question arises whether the costs of the current regime are excessive. These costs include: reduced value obtained from urban water on conventional, liberal approaches that give primacy to individuals' marginal valuations of water use; costs of enforcing the water restrictions (including erosion of social capital through reliance on Melburnians to report their neighbours observed violating the restrictions); costs of administering a complex regulatory price system; costs of education and moral suasion directed to reducing water consumption; costs of "selling" the regulatory regime; and costs of reduced progress on the COAG/NCP goal of reducing cross-subsidisation of water. Aside from the reality that water is in public ownership and under political control, it is hard to see why any required rationing of water should not be achieved entirely by the first-best method of increasing a (uniform) water price. The clear marker of the value of water provided by reliance on a single price to reduce demand would help

greatly in the supply-side objective of sourcing new water supplies in the most cost-effective way. In this context, one-price-for-all-water would have the particular virtue of encouraging the government and others to examine seriously the option of allowing trade in water between irrigators and the Melbourne (and other urban) water economies.

A compromise between relying on a simple, efficient, single price for water to ration demand and the present multi-part regulatory and prescriptive regime would be use of a two-block tariff, set up so that almost all households faced the block-two price at the margin. That would leave to individual households judgements about which uses of water were of lowest marginal value and hence most dispensable. It would allow the political objective of providing a base amount of water at a "low" price to be achieved, and reduce cross-subsidisation compared with the three-block tariff, while providing incentives for efficient use of water on conventional definitions. Enforcement would require only the billing of customers in accordance with readings of their water meters.

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