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**URBAN WATER RESTRICTIONS: ACCOUNTING FOR BEHAVIOURAL
DIFFERENCES**

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Abstract

Notwithstanding the neoclassical predilection for markets as a means of allocating scarce resources, it remains the case that state-devised attenuation of behaviour is the norm for many resource allocation decisions. This is particularly apparent in the case of water in urban areas in Australia, where mandated water restrictions limit the forms of water use that are permissible. Whilst there has been much debate about the efficacy of this approach, an important underlying question relates to the motivations for individuals to comply. More specifically, if a restriction regime is broadly in line with underlying motivations then, *prima facie*, it will generate less severe welfare losses than one which is largely at odds with individual drivers of behaviour.

This paper addresses the broad question of how people are motivated to accept restrictions on their behaviour. The paper outlines an approach that builds on social science, philosophy and rational choice models by considering moral and social dimensions associated with compliance behaviour. The aim is to present a framework that should prove useful for contemplating the challenge of designing effective enforcement strategies. The paper also addresses potential tools that can be employed to further our understanding of the drivers of compliance behaviour in the context of urban water restrictions. This will contribute to better stipulating compliance policy and institutional design.

1.0 Introduction

Constraints over the use of water have been a common response to the severe drought in southern Australia throughout the first decade of this century. Water restrictions have been applied in almost every major urban centre in Australia, regardless of their merits, and often in the absence of any debate about the compliance regimes that accompany them. Water restrictions are claimed to be a means of changing water-use behaviour, a vehicle for encouraging greater awareness of water use or even a mechanism for promoting greater environmental consciousness generally (see, for example, Water Corporation 2010; Goulburn Valley Water 2010). Such propositions are seldom tested or challenged. The apparent enthusiasm for mandatory urban water restrictions in some spheres raises important questions about how water consumers view the attenuation of their rights to use water. In this context, it also raises broader concerns about the mechanisms for gaining compliance with regimes that *prima facie* impinge on individual liberties.

The literature points to a need to understand and integrate two areas if we are to better understand compliance in a given setting. Firstly, understanding compliance behaviour requires knowledge of social norms, moral and ethical values, as well as perceptions of fairness and appropriateness surrounding the regulation itself (see, for example, Frey 1997; Sutinen and Kuperan 1999; Tyler 1990). Secondly, understanding the decision-making process of consumers and the impact of incentives and penalties is an important component of optimal compliance (see, for instance, Levitt and Dubner 2005; Sagdahl 1992).

A way forward would involve exploring these components empirically. However, some understanding of the psychology of choice behaviour is required to facilitate this approach. This paper seeks to contribute to our understanding of the most effective and efficient instruments for achieving compliance with regulations. Compliance behaviour is contemplated in the context of mandatory urban water restrictions.

This paper is comprised of seven main parts. A brief review of New Institutional Economics (NIE) is provided in part two to create the context for reviewing enforcement and compliance behaviour. In part three, the literature from the disciplines of psychology, sociology and economics is employed to investigate the theoretical underpinnings of compliance. Part four presents a framework that represents an extension of the enforcement and compliance literature inasmuch as it brings together important but disparate influences. The survey design and sample used to tentatively deploy this framework are briefly described in part five. Part six discusses the results of an ordered logit model used to probe the drivers of compliance with water restrictions before offering some brief concluding remarks in part seven.

2.0 NIE

The focus on comparing real-world alternatives where the choice is not exclusively between ‘the market’ and ‘the government’ is one of the central characteristics within the emerging literature examining institutional organisation and change (Pagan 2009). While acknowledging the challenge in accurately defining the new institutional paradigm, several common themes are apparent (see, for example, Alston, Eggertsson and North

1996, p.1), including an interest in the constraints on human rationality and a penchant for integrating lessons from other disciplines.

2.1 Institutions in NIE

One of the core concepts of NIE is the notion of institutions itself. In common parlance the term ‘institution’ implies some organisation, body or group with authority or standing. In the NIE sense ‘institutions’ takes on a number of meanings (Saleth and Dinar 2004, p. 23). North (1990; 1995) treats organisations as agents of institutional change rather than institutions *per se*. Alternatively, institutions are regarded as “the rules of the game in society or, more formally are the humanly devised constraints that shape human interaction” (North 1990, p.3) and it is this definition that is adopted in this case.

Question arises around the constituent parts of ‘good’ institutions. Pagan (2009) identifies a range of heuristics and characteristics that help distinguish superior institutions. In a comprehensive review of the institutional literature pertaining to water resources he identified five generic design features that define good institutions: Clear objectives; adaptiveness; interconnection with other formal and informal institutions; appropriateness of scale, and; compliance capacity. Notwithstanding the inherent contradiction embodied in some of these features, the latter three characteristics have particular bearing on the present research.

Interconnection between formal and informal institutions

Superior institutions can be distinguished by the extent to which the informal ‘rules of the game’, say in the form of social norms and mores, are consistent with the formal rules established to govern behaviour (Challen 2000; North 1990). The congruity between formal and informal rules has been accredited with explaining the superior performance of markets in the United States, where the underlying institutions that enforce individualism reinforce the market mechanism itself (North 1990). Similarly, Keefer and Shirley (2000) found that the differences in the growth in foreign investment in China and Ghana could be explained by the relative complementarity of formal and informal institutions. This is not to say that the informal institutions can substitute for formal institutions in all cases (Dovers 2001). Rather, the proposition is that greater alignment of formal institutions with the underlying rules of social networks and the like will give rise to lower costs, and thus superior institutions generally (Dovers 2001).

This observation has particular relevance in the current context. Very little is known about the preferences and motivations of urban water users. In essence, restriction regimes targeting specific outdoor water uses have arisen from historical engineering notions about water security and the practicality of monitoring behaviour. Arguably, attempts have subsequently been made to convince urban water users that these constitute the preferred and socially desirable behaviour (i.e. the informal institutions). The extent to which this is actually the case is an empirical matter.

An alternative interpretation of these theoretical insights in the context of the current problem is that political players have adjudged that using market rules to allocate urban water is too far removed from existing informal institutions and would thus give rise to severe political costs, ultimately felt at the ballot box. This also has implications for the cost of any policy adjustment in this sphere.

Appropriateness of scale

Dovers (2001) recognises that the spatial and administrative scales upon which institutions are based are highly important to their success. The administrative scale of an institution describes those who are responsible for its implementation (see, for instance, Pagan 2009). This could involve a social group, a government group or the community in general. Pagan (2009) defines spatial scale as the physical area over which the institution operates. A spatial scale could be determined on the basis of a river catchment, state, local government boundary, or the people living in a particular city. As institutions form constraints that shape individuals' interactions, accounting for social context is important when determining an appropriate scale over which to form institutions (Pagan 2009).

Studies have suggested that accounting for social boundaries is critical in sustaining particular groups over time (see, for example, Curtis et al. 2002). It could be argued that the development of groups over which an institution operates based on a scale that reflects shared informal institutional foundations influences its potential success. Thus, attempts to align formal institutions with the underlying rules of social networks should be considered in the context of the scale of the institution. In the case of regulations, it

appears that the scale of an institution will also influence the types of incentives that will be effective in achieving compliance. For instance, an institution that is comprised of multiple conflicting social networks is not likely to be in a position to rely solely on social norms as an incentive for compliance with regulations unless the intent is to have one group inform on another. Alternatively, regulations may have to be enforced via economic incentives such as fines or sanctions.

Compliance capacity

Enforcement and the ability to bring compliance to rules has been identified as one of the core features of good institutions generally (North 2000) and for institutions dealing with water allocation and sharing in particular (Ostrom 1993). Pagan (2009, p. 33) argues that compliance and enforcement are important because there are costs involved in the making of a contract. These costs mean that contracts are invariably incomplete. This leaves scope and incentive for individuals to expend resources to capture the benefits left unspecified in the contract.

There are two basic genres of compliance mechanisms – self-enforced and third-party enforced. These mechanisms are basically internal and external compliance measures respectively. Individuals, groups or the state can provide third-party enforcement. At the heart of each of these enforcement techniques is the capacity to punish by either reducing the stream of benefits from a long term relationship or by imposing harm (Barzel 2000). In the context of third-party enforcement, Pagan (2009, p. 33) contends that the state enjoys a comparative advantage, inasmuch as it has the capacity to immediately impose

large costs or penalties. By way of contrast, self-enforcement “works well when there is a positive value for all parties associated with maintaining the contract” (p. 33). Ultimately, there are significant differences in the costs that attend different compliance regimes.

Regardless of these important differences, very little is understood about the cost of securing compliance with urban water restrictions. This stands in stark contrast to the hefty public investment in crafting water legislation (formal institutions) and efforts to persuade the public about the preferred-socially responsibly water-using behaviour via advertising (informal rules). More specifically, there is limited empirical evidence attesting to the most effective or preferred compliance regimes that would best suit water users (see Cooper 2010). Consideration of this is important for at least two reasons. First, it seems likely that formal institutions (including those pertaining strictly to compliance) that better match the underlying motivations of individual behaviour will achieve more success and cost less. Second, the extent to which self-enforcement can occur has ramifications for the public purse. Put simply, if consumers self-enforce water restrictions then state-owned water utilities stand to make savings on the cost of securing compliance. It is against this theoretical background that this work is being undertaken.

3.0 Theoretical underpinnings of compliance

Enforcement is a key aspect of regulatory policy design (Cohen 1998) and institutional design generally (Pagan 2009). Gaining more and improved enforcement services is not an inexpensive task. For instance, enforcement is often identified as the most expensive

aspect of natural resource management programs (Sutinen and Kuperan 1999). Given this, there are two questions of relevance. Firstly, what are the approaches that would increase the cost-effectiveness of traditional enforcement? Secondly, what are the other non-traditional approaches to securing compliance which could avoid extreme dependence on costly enforcement?

Securing individual compliance with regulations is the ultimate objective of enforcement procedures (Cohen 1998). Notably, there has been a tendency for regulatory scholars to shift their focus from analysing the enforcement procedures of regulatory bodies to the motivations underpinning individual compliance with regulations (see, for example, Cohen 1998; d'Astous, Colbert and Montpetit 2005). Notwithstanding the research interest in this field, much remains to be done. It appears that the fundamental question associated with the development of regulatory policy is 'Why do individuals comply with the law?' The existing research on compliance motivations fails to provide a consensus answer. Inconsistency in these findings may be attributed to a range of factors, including differences in regulatory regimes, the different methodologies employed for analysis, and/or the variability in the nature of the entities being regulated (Wenzel 2005). Five separate strands of literature have emerged in this context and each is briefly analysed below.

3.1 Calculative motivations

The most prominent theory regarding regulatory compliance stems from calculated motivations for compliance. In Becker's (1968) seminal work he proposes that the

regulated will comply with a particular regulation when they perceive the benefits of compliance, including avoidance of fines and penalties, surpass the associated costs (see also Ehrlich 1972; Stigler 1970). Although the approach to this calculation may vary, depending on how an individual evaluates benefits and costs of compliance, the process of selecting between complying and not complying is based on the expected utility in terms of net return (Becker 1968). In the case of water restrictions, the costs of compliance may be in the form of losing a lawn or garden, or not being able to refill a swimming pool.

A succession of studies on the economics of crime stem from Becker's model (1968) (see, for example, Anderson and Lee 1986; Heineke 1978; Milliman 1986; Pyle 1983; Sutinen and Andersen 1985). These studies employ the basic deterrence framework in which the threat of sanctions is the single policy lever offered to increase compliance with regulations.

This 'self-interest' standpoint has been criticised as being too limited (Wenzel 2005). More specifically, recognition of the relatively small degree of audit and lenient penalties within society indicates that deterrence alone cannot explain the generally large extent of compliance across the population (see, for instance, Alm, McClelland and Schulze 1992). It has been suggested that social motivations, such as social norms and ethical concerns, perceptions of legitimacy and fairness, as opposed to mere selfishness, substantially influence individuals' behaviour in this sphere (James, Hasseldine, Hite and Toumi 2001;

Tyler 1990). Thus, individuals may not be motivated only by extrinsic incentives (see, for instance, Carroll 1987).

3.2 Intrinsic Motivation and Morality: Incorporating Intrinsic Motivation into the Basic Deterrent Model

A sense of moral obligation is a common reason why many in society comply, even though illegal gains are greater than the anticipated penalties (Sutinen and Kuperan 1999). Put differently, the need to ‘do the right thing’ is perceived as being an important motivation clarifying much of the evidence regarding compliance behaviour (Sutinen and Kuperan 1999).

Regrettably, the paradigm generally employed in economics to describe and anticipate behaviour (particularly the theory adopted for policy analysis) provides limited allowance for personal moral values. This raises questions as to whether regulatory policy developed by economists is adequately grounded.

Moral development and personal values

It has been conjectured that there is a positive relationship between the moral development of an individual and their propensity to comply with regulations (Sutinen and Kuperan 1999). Kohlberg (1969, 1984) proposes that there are three apparent levels of moral development: pre-conventional, conventional, and post-conventional.

Pre-conventionals generally base their rationale on fear of punishment and/or the costs that they will incur as a result of non-compliance (Sutinen and Kuperan 1999). Conventionalists are inclined to reason on the basis of social conformity and stability (Sutinen and Kuperan 1999). Post-conventionalists rationalise on the basis of moral principles that are independent of social order (Sutinen and Kuperan 1999). Kohlberg (1969, 1984) argues that rule violations are likely to diminish at higher levels of moral development and this has been supported by empirical research in a variety of contexts (see, for example, Kuperan and Sutinen 1994).

3.3 Extrinsic motivation: social motivation

In a related but separate stand of literature the concept of social motivation has also been identified as an impetus for compliance; that is, “the desire of the regulated to earn the approval and respect of significant people with whom they interact” (Grasmick and Bursik 1990 in Winter and May 2001, p.3).¹ Possible foundations for these social pressures include external advocacy groups, family, friends, the media and other regulated entities.

Social influence is an important part of daily social exchange, generally adopting the subtle means of ostracism or the withholding of favours. Similar to the role of enforcement authorities, peer groups are able to punish and reward their members (Sutinen and Kuperan 1999).

¹ This is consistent with the conventionalist perspective as specified by Kohlberg (1969).

In sum, both social influence and moral obligation can potentially create high degrees of compliance, even when a weak ‘calculative’ deterrent effect exists. Thus, formal inspection styles are not always necessary to achieve compliance. It also seems that compliance may not necessarily increase as a result of increased inspection, in fact, it may decrease. Further understanding of this behaviour in the context of water restrictions can only be found by investigating the drivers of individual behaviour, which in turn has implications for overall compliance, *ceteris paribus*.

3.4 Extrinsic versus intrinsic motivations

Frey (1997) considers potential crowding effects between extrinsic incentives (e.g. monetary compensations, social pressures) and intrinsic motivations (e.g. morals, values). More specifically, a situation where extrinsic incentives undermine some or all intrinsic motivations for a particular action has been termed the crowding-out effect. Alternatively, when intrinsic motivations are reinforced by extrinsic incentives it is termed crowding-in (Frey 1997).

Frey (1997) identifies some valuable applications of the crowding-out hypothesis. For example, intrinsic motivations can be undermined when governments are granted high levels of supervisory authority and the individual is given only limited liberty to behave according to their own intrinsic motivations. Therefore, concepts such as civic virtues, trust and voluntary behaviour could be undermined by regulations. Intrinsic incentives could also be undermined by the adoption of punishment (the stick) for non-compliance, compared to the use of rewards (the carrot) for compliance. Notably, environmental

morals may also be negatively influenced if monetary incentives are employed (Frey 1997). For example, compensating a community for substantially conserving their water may simply prompt all other communities to request compensation in all other conservation cases thereafter.² It is also conceivable that strategic behaviour can emerge where conservation efforts are deliberately delayed in order to attract public subsidy.

3.5 Additional Factors Affecting Compliance Motivations

In addition to these three fundamental motivations for compliance (i.e. deterrence, moral and social motivations), some researchers also factor in the ability and the capacity of the regulated to comply (see, for instance, Winter and May 2001). These are addressed separately below.

Ability to comply

Willingness to comply is inadequate in its own right if individuals do not have the knowledge of what is required of them and/or are unable to make the requisite steps (Winter and May 2001). It has been suggested that those with a higher awareness of rules will have a greater sense of civic duty to comply, as they are expected to be more cognisant of the reasons for the rules.

² As an aside, it is worth noting the difficulties experienced in the irrigation sector, due to the uncoordinated sequencing of 'rewards' between jurisdictions. More specifically, the decision by the Federal government to fund the Northern Foodbowl Modernisation Project in Victoria after NSW irrigators had independently funded their own 'upgrades' was roundly criticized by NSW irrigators. Consequently, CoAG undertook to fund a range of other projects in jurisdictions outside Victoria (CoAG 2008).

Capacity to comply

Ability and willingness to comply, whether initiated by calculated, normative or social motivations, is subject to a resource constraint. That is, complying with some regulations may require the existence of financial resources that can be committed to compliance behaviour (Winter and May 2001). Compliance may also cost time or be inconvenient, depending on the nature of the rule. For example, water restrictions do not have equal effects on the rich and poor, i.e. the rich can purchase a computer system to turn sprinklers on during the night, but the poor will have to forego sleep if garden watering is only permitted late in the day.

The concept of compliance is multifaceted and the literature surrounding this concept is extensive. From the literature it appears that individuals comply with regulations either because they fear detection of violations and subsequent penalties, feel a duty to comply, or feel social pressure to comply (see, for instance, Sutinen and Kuperan 1999; Winter and May 2001). These motivations can generally be classified into extrinsic and intrinsic motivations. The existing literature suggests that extrinsic motivations are a function of enforcement practices (see, for instance, Becker 1968; Burby and Paterson 1993; Gray and Scholz 1993) and social and environmental influences (see, for example, Kagan and Skolnick 1993; Wenzel 2004). Intrinsic motivations are a function of an individual's attitude toward regulations, perceptions of legitimacy towards regulations and authorities (see, for example, Sutinen and Kuperan 1999; Tyler 1990), moral predispositions (see, for instance, Kohlberg 1969, 1984), sense of civic duty (see, for example, Akerlof 1983) and perceived personal consequence of non-compliance (see, for instance, Grasmick and

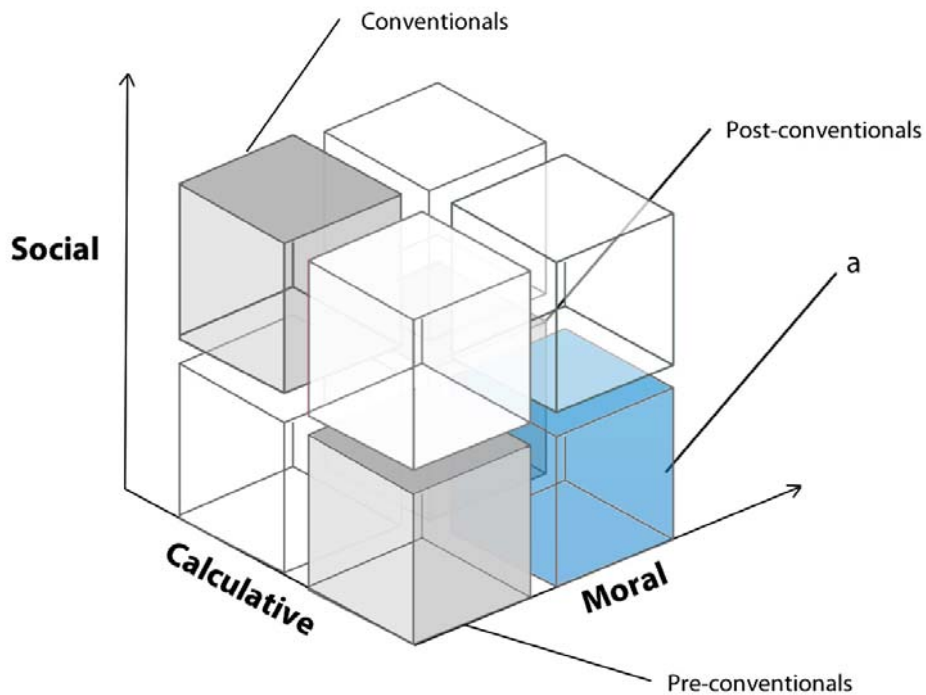
Bursik 1990). There is a relationship between these different motivations, which ultimately has an impact on compliance behaviour. Empirical research also shows that capacity to comply will have an impact on an individual's ability to act on both extrinsic and intrinsic motivations and ultimately effect compliance behaviour (Winter and May 2001).

4.0 Compliance framework

A framework that captures the pertinent concepts of compliance motivations can be used to reduce the complexity of the preceding literature. Moreover, a framework that encapsulates Burby and Paterson's (1993) typology of compliance motivations and Kohlberg's (1969, 1984) threefold typology would be of value.

A diagrammatic representation of this framework appears as Figure 1.

Figure 1 Compliance cube



This 'compliance cube' is used to capture the three key motivational dimensions of compliance - calculative, social and moral. This framework facilitates the segmentation of individuals according to the motivations that drive them to comply. For instance, individuals that are solely driven by economic (utilitarian) motivations fall into the pre-conventionals segment; social motivations are classified as the conventionals segment; and moral motivations fall into the post-conventionals segment. Individuals who are driven by more than one dimension fall between these extremes. For instance, segment 'a' would include those individuals that are driven by both moral and economic motivations.

The challenge for policy makers is to be able to meaningfully segment markets that are subject to regulations and then use the segments to increase social welfare – say by better targeting compliance activities. Drawing from the moral development literature discussed earlier in this paper, the framework can be employed to identify which segments of the citizenry are least likely to comply and which are most likely to comply.

In the case of segmenting the urban water market, a useful basis would be an increased understanding of the different intrinsic and extrinsic factors that influence householders' compliance with water restrictions. The remainder of this paper is used to describe the results of an ordered logit regression used to gain some preliminary insight into the factors that significantly influence householders' compliance behaviour. More specifically, the key objectives of this analysis are to gain some insight into whether moral variables, social norms and calculative (utilitarian) type factors have a significant influence on compliance behaviour and whether they can be meaningfully distilled from empirical information. This will provide a constructive grounding for investigating drivers of compliance behaviour further in order to better stipulate compliance policy and institutional design.

5.0 Survey design and sampling

To investigate householders' preferences and behaviour surrounding urban water restrictions, data were collected from households across southern Australia in April of 2008. The questionnaire consisted of four parts. The first part contained questions

regarding respondents' attitudes toward complying with water restrictions. The choice experiment was presented in the second section (see Cooper 2010) and questions regarding the respondents' socio-economic status were presented in part three. The final section was used to probe respondents about their willingness to pay to avoid water restrictions (see Cooper et al. 2010). To provide some preliminary investigation into the drivers of compliance behaviour, the focus of the remainder of this paper will be on the findings of a regression analysis that employs attitudinal and socio-economic data from the questionnaire.

Six cities were selected to draw the sample for conducting the main survey, which was distributed on-line to a random sample of households. Refer to Fleming and Cook (2007) for a review of the advantages and disadvantages of on-line surveys. These cities provided scope for analysis on several dimensions, including comparisons between Victorian and NSW cities; urban cities with differing levels of water scarcity; and regional and metropolitan cities. The final data set of this study consisted of 512 respondents (Wodonga: 54; Albury: 94; Melbourne: 106; Sydney: 102; Goulburn: 51; Bendigo: 105) which represented a response rate of 59 percent. The characteristics of the sample are presented in Table 1.

Table 1 Socio-demographics of the survey respondents

Metropolitan (Sydney, Melbourne)	40%
Rural or Regional Centres (Albury, Wodonga, Goulburn, Bendigo)	60%
New South Wales	48%
Victoria	52%
Average age	42 yrs
Average household income before tax	\$978 per week
Own their home	30%
Male	40%
Completed a tertiary degree	34%
Have a lawn and/or garden that requires watering	85%
Have an outdoor pool or spa	15%

The sample comprised cities from NSW and Victoria in order to test the input of differing legislative and policy background to water use. There is also a lack of consistency between these two states regarding the penalties and fining processes that apply for non-compliance. Ultimately, this has implications regarding the frequency with which punishment is metered out in the different states. For instance, in 2008 it was within the power of a water inspector in Sydney to impose an ‘on-the-spot fine’ if a householder was found violating water restrictions. In Melbourne this was not the case, with water inspectors having to negotiate a complex series of warnings and restraints before being able to impose a fine. Between June 2006 and July 2007 the number of fines issued to householders for violating water restrictions was 1353 in Sydney, compared to zero in Melbourne (per comm. Ethal 2007; Maudsley 2007). Given the knowledge of the different fining processes in both of these cities, it would be spurious to suggest that householders in one city are more compliant than in the other. Rather, the disparity in the

number of fines issued in each city is likely to be caused, at least in part, by the administrative differences between jurisdictions.

The number of water inspectors per household would also impinge on the number of fines that were issued to householders since rates of detection will invariably hinge on the ratio of inspectors to households. In this context the number of water inspectors that were employed in each of the study locations at the time of data collection are presented in Table 2.

Table 2 Water inspectors

City	State	Rural or Metropolitan Centre	Population	Number of Water Inspectors	Number of Water Inspectors per household
Melbourne	Victoria	Metropolitan	3.9 million [†]	7	1: 557 142
Wodonga	Victoria	Rural	34 504 [*]	2	1: 17 252
Bendigo	Victoria	Rural	96 741 [*]	4	1: 24 185
Goulburn	NSW	Rural	27 277 [*]	1	1: 27 277
Albury	NSW	Rural	48 629 [*]	6	1: 8 104
Sydney	NSW	Metropolitan	4.4 million [†]	50	1: 88 000

[†]Source: ABS (2009)

^{*}Source: ABS (2008a-d)

6.0 Ordered logit model

To initiate some empirical groundwork on the drivers of compliance with urban water restrictions, an ordered logit model was applied (see Greene 2003). An ordered logit specification is used because of the nature of the dependent variable used. Basically, this builds on the logit regression model for dichotomous dependent variables, allowing for

more than two (ordered) response categories. The model cannot be consistently estimated using ordinary least squares, rather it is usually estimated using maximum likelihood.

In the ordered logit model, there is an observed ordinal variable, Y , which is a function of another variable, Y^* , that is not measured. Thus, Y^* is a continuous, unmeasured latent variable whose values determine what the observed variable Y equals. Moreover, the continuous latent variable Y^* has various threshold points.

For instance, let the underlying process to be considered be:

$$Y^* = x' \beta + \varepsilon,$$

where Y^* is the unobserved dependent variable; x is the vector of independent variables, and β is the vector of regression coefficients which are to be estimated. While Y^* cannot be observed, the categories of response can be observed using the rule:

$$Y_i = 0 \text{ if } Y^*_i \leq \mu_1$$

$$Y_i = 1 \text{ if } \mu_1 < Y^* \leq \mu_2,$$

$$Y_i = 2 \text{ if } \mu_2 < Y^* \leq \mu_3, \dots$$

$$Y_i = N \text{ if } \mu_N < Y^*.$$

Here, the ordered logit model will use the observations on Y , which are a form of censored data on Y^* , to fit the parameter vector β .

A random disturbance term is included in the model. This accounts for the fact that relevant variables may be left out of the equation, or variables may not be perfectly measured.

In the context of the current study, the dependent variable is a proxy for how often respondents believe that they comply with urban water restrictions.³ The question was phrased as: “How often would you say that you comply with water restrictions?” with five ordered response categories that represented the frequency of respondents’ compliance. These categories ranged from “less than 20% of the time” to “90% or more of the time”.⁴

The independent variables included in the model were comprised of variables to proxy intrinsic (moral), social norms, and calculative (utilitarian) factors, which it is hoped will allow a preliminary investigation of the drivers of compliance with water restrictions.

6.1 Findings

An ordered logit model was initially estimated for all respondents. Table 3 reports results for 3 models: Model 1 pools data from the two states, while models 2 and 3 treat them independently. Significant internal and exogenous items have been reported.⁵

³ There are clearly some limitations of this proxy including mis-reporting; cognitive misjudgements and the like.

⁴ Notably, this study is limited by the subjective nature of the data.

⁵ Refer to Appendix A for a description of the additional independent variables.

Table 3 Ordered logit models

	Model 1: combined		Model 2: NSW		Model 3: Victorians	
	Coefficient	Z statistic	Coefficient	Z statistic	Coefficient	Z statistic
COMPLIANCE						
MORAL	0.3344	2.33**	0.6671	3.23***	-	-
SOCIAL NORMS	0.4851	2.91***	-	-	0.8117	3.44***
E-BELIEFS	0.8202	5.88***	1.008	5.29***	0.7727	4.04***
LAWN	0.7595	2.66***	1.0684	2.51**	0.7228	1.89*
POOL	-1.117	-3.99***	-1.528	-3.84***	-0.6701	-1.64*
INFORMED	0.4599	5.54***	0.5544	4.84***	0.4260	3.49***
METROPOLITAN	-0.4792	-2.14**	-	-	-	-
NSW	0.4563	2.00**	-	-	-	-
Cut points						
μ_1	-4.90		-4.55		-5.68	
μ_2	-3.41		-3.38		-3.77	
μ_3	-1.59		-1.42		-2.16	
μ_4	0.12		0.31		-0.40	
Model statistics						
Log likelihood	-340.008		-162.489		-172.403	
Pseudo R2	0.21		0.24		0.20	
Number of obs.	510		248		262	

*** indicates significance at the 1 percent level. ** indicates significance at the 5 percent level. * at 10% level.

The likelihood ratio chi-square of 180.87 for Model 1 with a p-value of 0.000 specifies that the overall model is statistically significant, as compared to models with no predictors. Model 1 indicates that a number of internal, social and calculative factors have a significant influence on householders' frequency of compliance with water restrictions. In terms of internal variables, Model 1 implies that a positive moral predisposition toward complying with the law in general and positive beliefs towards the environment indicates a higher frequency of compliance with water restrictions. This suggests that some individuals comply because they feel it is 'the right thing' to do morally and perhaps environmentally. This reconfirms Cooper et al.'s (2010) findings that suggest that it is possible that some individuals are philosophically opposed to removing water restrictions entirely, even if there is no cost to them.

Model 1 also indicates that social norms have a positive and significant impact on frequency of compliance. Thus, there is seemingly a portion of the sample that complies with water restrictions as they want to do 'the right thing' by others.

There are also variables in Model 1 that can be considered as proxies for calculative drivers of compliance: ownership of a lawn that requires watering and ownership of a pool. Model 1 implies that having a lawn has a positive and significant influence on frequency of compliance with water restrictions, whilst having a pool has a negative and significant relationship with compliance. Given the monetary cost associated with the establishment of a pool, one would expect pool owners to be more reluctant to comply with water restrictions, which often ban the refilling of swimming pools. Pools can

provide benefits on a number of dimensions including health benefits and social enjoyment. In addition, the relatively non-conspicuous nature of a household swimming pool may also lower the social cost of non-compliance with water restrictions.⁶ Alternatively, the often conspicuous nature of a lawn means that non-compliance with water restrictions generally incurs high social costs. Notwithstanding that losing a lawn through compliance with restrictions incurs a monetary cost, a green lawn is not usually socially acceptable in cities faced with restrictions. In fact, some residents of cities in regional north-east Victoria have experienced threats and vandalism to their property when maintaining a green lawn during periods of drought (Wells 2007).

Model 1 also reveals that the more respondents feel informed about water restrictions the more likely they are to comply with water restrictions. This is consistent with the literature discussed in section 3.5, which identifies that individuals cannot intentionally comply if they do not have the knowledge of what is required of them (Winter and May 2001). However, the corollary is that excessive and gratuitous advertising/education campaigns may ultimately undermine the social support for compliance.

The findings from Model 1 also show that respondents living in a regional city indicated a higher frequency of compliance with water restrictions compared to those in a metropolitan city. The apparent enthusiasm from regional residents towards complying with water restrictions is consistent with Cooper's (2010) study, which found that respondents from regional cities were willing to pay for a hotline to report others for non-

⁶ It is feasible to fill a swimming pool with a hose and attract limited attention versus using sprinklers on a lawn.

compliance with restrictions. This may be due to the more overt affects of drought in regional cities or some other underlying social force in the communities. Alternatively, this finding may be a reflection of how the history of restriction regimes and the policies regarding water use across various locations may have shaped water users' preferences (see sections 2.1).

Finally, Model 1 indicates that respondents living in NSW points to a higher frequency of compliance with water restrictions than those living in Victoria. This could be a function of the differing enforcement procedures and fining processes in place across these states. As highlighted in section 5.0, households in NSW are subject to more water patrol inspectors than those in Victoria. Moreover, on-the-spot fines were issued in Sydney, whereas Melbourne had a more onerous fining process at the time of data collection. Thus, those not complying in NSW were subject to a higher probability of attracting a fine compared to those flouting restrictions in Victoria. Moreover, these findings stand in strong contrast to the compliance behaviour portrayed by the fines issued in Sydney (NSW) compared to Melbourne (Victoria) (see section 5.0). Evidently, the number of fines issued is not an accurate indicator of personally reported compliance with water restrictions.

Given the different enforcement procedures, fining process and historical response to water shortages across NSW and Victoria, the sample was split across the states variable to investigate if the significant influences of compliance behaviour differed. Separate

ordered logit models were estimated for both NSW respondents (Model 2) and Victorian respondents (Model 3).

The likelihood ratio chi-square of 102.44 for Model 2 with a p-value of 0.000 specifies that the overall model is statistically significant. This model suggests that respondents living in NSW indicate a higher frequency of compliance when they express that they feel they have a duty to comply with the law, have a lawn, do not have a pool, have high environmental beliefs and feel informed about water restrictions. Notably, social norms do not have a significant influence on frequency of compliance with water restrictions for NSW respondents.

Model 3 is also statistically significant overall. In this case, the likelihood ratio chi-square is 82.37 and the p-value is 0.000. Model 3 implies that respondents living in Victoria indicate a higher frequency of compliance when they want to do the right thing by others (i.e. positive social norms), have a lawn, do not have a pool, have high environmental beliefs and feel informed about water restrictions. However, in this case, Victorians feeling that they have a duty to comply with the law is not significant. Thus, on the basis of these data it could appear that the moral predisposition of Victorian respondents is not transferring to compliance behaviour.

To reiterate, Model 2 and 3 suggest that social norms have a positive and significant influence on Victorians frequency of compliance with water restrictions, but not NSW respondents. Alternatively, moral predisposition has a positive and significant influence

on NSW respondents' frequency of compliance with water restrictions, but not the Victorian residents in the sample. Interestingly, there is no significant difference between the other significant variables reported in the models across the two states i.e. LAWN, POOL, INFORMED, E-BELIEFS.

Given that this is simply a preliminary empirical analysis of the drivers of compliance behaviour we must address these findings with caution. However, a number of matters are worthy of tentative speculation. Firstly, as discussed, respondents from NSW indicated a higher frequency of compliance with water restrictions than the Victorians and moral predisposition was found to be a significant driver of frequency of compliance in NSW, but not Victoria. The literature and the compliance cube presented in section 3.2 and 4.0 suggest that individuals that comply due to moral drivers are likely to comply more often (Kuperan and Sutinen 1994). Put simply, some empirical support for the theoretical model appears in these data. Thus, the significant influence that moral predisposition has on the compliance behaviour of NSW respondents may explain their higher frequency of compliance with water restrictions.

Secondly, the positive and significant influence of social norms on frequency of compliance with water restrictions in Victoria, but not NSW could be contributed to a number of factors. Ostensibly, this could partly be due to the heavy and consistent investment by the state government of Victoria in education and awareness campaigns over recent years to encourage water conservation inside and outside of the home. For instance, in 2003 the Premier launched a \$6.2 million conservation campaign, which

involved development of television, radio, print and billboard advertisements (Victorian Government 2003). More recently, a number of programs have been implemented under the *Our Water, Our Future* plan (2007) such as the ‘Waterwatch Program’, ‘Water-Learn it! Live it!’, making water bills more informative and the public reporting of water authority’s progress in meeting water-saving targets. This may have not only played a part in shaping the social norms of Victorians, but in how they respond to predominant social norms surrounding water-use behaviour. The insignificant role played by social norms in influencing frequency of compliance in NSW could be due to crowding effects (see section 3.4). More specifically, the high level of inspectors and enforcement in NSW could be undermining the role of social norms in influencing compliance behaviour

Thirdly, we can also tentatively speculate about the positive and significant influence of moral predisposition on frequency of compliance for NSW residents, but not for Victorians. Notably, the distribution of moral predisposition is similar for NSW and Victorian respondents, however, moral stance regarding duty of compliance with the law is not influencing Victorians compliance behaviour. As discussed in section 3.2, intrinsic motivations have been recognised as one of the key dimensions associated with compliance behaviour. In the case of water restrictions, some individuals comply because they feel it is ‘the right thing’ to do or they have a positive attitude toward the enforcement regime itself. Therefore, it may be that Victorians who feel that they have a duty to comply with the law, in general, do not feel that they have to comply with water restrictions, as they may have a negative attitude toward either water restrictions or the enforcement regime itself. This may be attributed to the lack of water patrol officers in

Victoria or the onerous fining process adopted. The ability of water patrol officers to actually fine residents who are non-compliant may be perceived more favourably by householders. This is consistent with Cooper's (2010) study across cities in NSW and Victoria found that residents were willing to pay to have more water inspectors in their city.

In sum, the evidence of heterogeneity in the drivers of compliance behaviour across the two jurisdictions highlights that drivers of behaviour differs significantly across institutions. Notwithstanding that the significance of these drivers are often shaped by the laws themselves, enforcement procedures and education imposed on residents by the state, this information forms a useful basis for identifying enforcement mechanisms that are more closely aligned with individual motivations. Acknowledging the heterogeneity in the urban water-user market can potentially lead to the development of more cost effective and superior approaches to achieve compliance. Moreover, the 'compliance cube' framework highlights that a one-size-fits all approach to achieving compliance with regulations is unlikely to be effective and fraught with political risk. Alternatively, it would appear that more appropriate enforcement regimes would be developed if policy makers considered the informal rules and significant drivers of compliance across different cities, regions or states.

7.0 Concluding remarks

Policy formulation often occurs in an environment which presupposes perfect compliance achieved at no cost. As acknowledged earlier, when problems arise with a policy,

enforcement is commonly deemed to be responsible for the policy failure, with the outcome being the demand for improved enforcement (Sutinen and Kuperan 1999). There seems little doubt that the current policy setting could be improved and acting on the preference heterogeneity across the population would be a useful starting point. For instance, acknowledging the existence of different motivations and preferences amongst segments might lower the transition costs associated with a different policy setting.

To an extent, these findings capture the heterogeneity associated with drivers of compliance behaviour. Again, policy makers looking for a one-size-fits all response might find some discomfort in these results. The key dimensions of compliance behaviour were illustrated in the ‘compliance cube’ framework presented in Figure 1. The information gained on individuals’ preferences might be applied to the ‘compliance cube’ presented in section four (see Figure 1). This could be used to usefully segment the population and to lower the costs of securing compliance. For instance, if social norms are a prominent dimension of compliance then formal deterrence enforcement mechanisms are unlikely to be cost effective, at least for that segment. This would enable the application of compliance mechanisms that are more closely aligned with motivations, and thus more likely to be effective.

Future research is unlikely to be confined to a singular disciplinary approach, since this necessarily understates the complexity of individuals’ decisions about compliance regimes and the response of individuals to avoiding constraints on their behaviour.

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APPENDIX A

ATTRIBUTES/ VARIABLES	DESCRIPTOR	LEVELS/CODING
COMPLY	How often respondents believe they comply with water restrictions	< 20% of the time=1 20-40% of the time=2 41-70% of the time=3 71%-89% of the time=4 90% plus=5
LAWN	Do respondents have a lawn/garden that requires watering	Yes=1 No= 0
POOL	Do respondents have a pool	Yes=1 No= 0
INFORMED	How informed respondents feel about water restrictions	1 (Very uninformed)=1 2=2 3=3 4=4 5 (Very informed) =5
METROPOLITAN	Do respondents live in a metropolitan or regional centre	Metropolitan=1 Regional=0
NSW	The state the respondent lives in	NSW=1 Victoria=0

ATTITUDE VARIABLE	DESCRIPTOR	EXAMPLE QUESTION	CODING
ATTITUDE	Attitude toward water restrictions: where an increase in this variable implies a more favourable attitude toward complying with water restrictions.	“I think it is a good idea to comply with water restrictions”	Factor score: 11 questions (5 stage Likert scale) were reduced to 2 variables- ATTITUDE and SOCIAL NORMS.
SOCIAL NORMS	Respondents attitude toward social norms: where increased social norms implies a greater concern for behaving ‘appropriately’ according to society’s norms.	“Most members of my family think I should comply with water restrictions” x “Generally speaking, I want to do what most members of my family think I should do”	
E-VALUES	Environmental values: where increased environmental values implies stronger values for the environment.	“It makes me sad to see natural environments destroyed”	Factor score: 8 questions (5 stage Likert scale) were reduced to 2 variables- E-VALUES and MORAL PREDISPOSITION.
MORAL PREDISPOSITION	Moral predisposition in general: where increased moral predisposition implies stronger values for complying with the law in general.	“Generally, I feel that I have a duty to comply with the law”	
INTENTION	Intention to comply with water restrictions: where increased intention implies greater intention to comply with water restrictions.	“I intend to follow water restrictions in the future”	Factor Score: 4 questions (5 stage Likert scale) were reduced to a single INTENTION variable.

Note: Items reduced by employing a factor analysis