USER PAYS WATER PRICING SENSITIVITY AND ADOPTION INCENTIVES

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ABSTRACT

This study empirically examines the reasons for the slow adoption, even after the provision of incentives, of the most significant water resource and water services provisioning management initiative for urban water entities, user pays pricing policy. This is an exploratory study given that no empirical studies, particularly from an accounting perspective have been undertaken of this issue. Given anecdotal claims about water resource and water pricing political sensitivity, in this study, a combined Agency and Transaction Cost theoretical framework is used to develop the study empirical model that is tested using data from the Queensland urban water industry. In the development of the model the supply side focus of pricing policy and incentives is identified. This supply side focus has failed to recognize demand side political sensitivity driven by the economic transfer of wealth away from an urban water entity and its stakeholders due to the user pays pricing model. The study findings support anecdotal claims of political sensitivity and identify a number issues requiring consideration in remedying the supply/demand imbalance implications for adoption incentives and slow adoption of the user pays pricing model by urban water entities. The study findings are of interest to regulators, policy makers, managers, users and other stakeholders.

Key Words: Urban water services, Pricing policies, Agency Theory, Transaction Cost Theory

INTRODUCTION

Reform of the urban water industry has been underway for at least two decades. In the past decade a fundamental focus of the reform in Australia and worldwide has been the user pays pricing of urban water services (COAG, 1994; WHO, 1990, 1994a, NCC, 1997; IWRA, 2002). Despite the positive water resource management and sustainable water services delivery benefits that such a pricing policy has to offer and adoption incentives, unless mandated by governments and regulators, urban water entities have been slow to adopt user pays (DoTaRS, 2001; NCC, 2001; IWAR, 2002). Anecdotally, a confounding issue is the political sensitivity associated with water as a resource and its pricing. Focussing on the Queensland urban water industry, this study empirically examines the determinants of the pricing policy choices confronting Urban Water Entities. A combined Agency Theory (Political Cost) and Transaction Cost Theory framework is used to build understanding about potential impediments to user pays adoption and assess both political sensitivity and adoption incentive deficiencies/short falls. The study findings empirically support anecdotal claims of political sensitivity. Further, it highlights the implications of a potential economic wealth transfer from urban water entities and their stakeholders due to a supply side focus to the development of urban water pricing policy and incentives. This contributory factor impedes the adoption of user pays pricing. Given that this is the first study of this type to empirically examine user pays adoption issues, the study findings are of interest to regulators, policy makers, managers, owners, user and other stakeholders.

The structure of this paper takes the following form. In the following section some background to the evolution of urban water services pricing and an overview of some types of adoption incentives used are provided. Critical to this study is understanding the urban water industry stakeholder relationships and the pricing model choices that the urban water industry

entities are required to make. Next these stakeholder relationships are examined and the study theoretical framework outlined. The study hypotheses and the study empirical model are then outlined. The paper is concluded with a discussion of the results from empirically testing the study model and the detailing of some tentative findings.

SOME BACKGROUND TO URBAN WATER SERVICES PRICING POLICY DEVELOPMENT AND ADOPTION INCENTIVES

Historically and contemporarily it has been argued that the pricing of water services is politically sensitive (Miller, 1999; Wright, 1999; Dargan and Wilson 1999; Giles, 2002, Ryan, 2002; How, 2002; PWD, 1984; DNR, 1988a; Walsh, 1995; Petersen, 1996; and Gleick, 1998). Within this environment both in Australia and internationally there have been two decades of consistent action by Governments and Regulators to reform the urban water industry. These times have been marked by the first decade focussing on the true cost of supply issues and the second on commercialisation and user pays. This study examines implications of user pays pricing initiatives under those reforms to build understanding as to why urban water entities have been slow to adopt user pays in the Queensland urban water industry. Some background to urban water services pricing policy development and adoption incentives are now provided.

In Australia, up until a few of decades ago, the charging for water services was covered under the Local Government general rate charge. The basis for charging the general rate was the unimproved or the improved value of the land (depending on respective council rating policy) owned by the ratepayer. On the inception of the charging for water services access, the land valuation basis for rate determination was also used. Apart from a consistency between rating structures (general and water rates), the land valuation basis was perceived, by some, to provide a form of equity, in that persons able to afford dearer land had a better capacity to pay. Over time, as the demand for and the cost of supply of water services grew, particularly over the last couple of decades in Australia, councils began to introduce a charge for excess water usage. This was primarily a demand management initiative. These issues are reflected in the following access charging model for water services:

$$R_{ac} = FBC + xVC_{exc} \qquad\qquad (1)$$

Where: R_{ac} = Access charge revenue

     FBC = Fixed Base Charge calculated as a politically determined percentage of unimproved/improved land value and, in some cases, a predefined service consumption allowance (life-line limit).

     x = The units of service consumed over and above the predefined service consumption allowance.

     VC_{exc} = A politically determined charge per unit of excess water services consumption.

The inclusion of an excess water charge in the rating for water services represented a change in attitude toward water services charging. This change was driven by two factors, increasing pressure on water resources and the 'hidden' cost of supply of these services (NCC, 1997). The cost of supply issue is particularly reflected in the water pricing literature. The water industry financial and accounting focused research, over the past two decades, has primarily taken a management/supply focus in terms of examining the costing and pricing of services

(Officer, 1981; Bruggink 1982; Jonsson, 1982; Bethke, 1983; PWD, 1984; Audit Commission of the United Kingdom, 1984; DNR, 1986; Mercer & Morgan, 1986; Hepworth, 1987; Ingram and DeJong, 1987; Ng, 1987 and 1988; Samra, 1987; Day, 1988; Department of Natural Resources, 1988a and 1988b; Dixon & Norman 1989; Hunt & Staunton; 1990; ADB 1993; WHO, 1990, 1994a and 1994b; Ogden, 1995; NCC, 1997; DNR, 1999; Thanassoulis 2000; Sawkins, 2001, and DCILPG, 2002a, 2002b, and 2002c; Gleick, 2002).

Intuitively, a fundamental driver of water services pricing sensitivity would be demand side issues. Demand side issues, particularly as these issues relate to the political sensitivity/cost of water services pricing, have not been researched either normatively or positively. Whilst some later studies (Hunt & Staunton, 1990; ADB, 1993; WHO, 1994a; Ogden, 1995 and Thanassoulis, 2000) incorporated financial accounting and water distribution supply side considerations they also did this without examination of demand side, user considerations. Other studies such as those by Shaoul (1997) and Lee *et al* (2001) focused on utility infrastructure asset reporting issues. Whilst Ogden (1997) and Hunt (1999 and 2000) examined stakeholder (customer/consumer) issues in relation to the pricing and management of water service outcomes, they did not directly address all demand side issues that could give rise to pricing policy implementation friction for owners/users. Arguably, supply side issues are still the driving force underlying the construct of the Queensland user pays model which takes the following form:

$$R_{up} = FC + xVC + r \qquad\qquad (2)$$

Where: R_{up} = User pays revenue

FC = Fixed direct and indirect overhead costs for the supply of water services that are insensitive to the levels of supply (DCILGPS, 2000a: 13)

x = Number of units of service consumed

VC = Direct and indirect variable costs per unit of service supplied.

r = real rate of return (RROR) on infrastructure investment

Given that the user pays model promotes a long-run marginal cost approach the variable cost (*VC*) per unit of service component:

$$VC = oam + os + a_{rra} \qquad\qquad (3)$$

Where: oam = per service unit contribution toward operations and maintenance costs less depreciation, interest and other financing/non-cash charger (DCILGPS, 2000a: 13)

os = per service unit contribution to operations support

a_{rra} = per service unit contribution to planned future asset renewal, replacement and/or augmentation

The access charge model is a politically determined model with little relationship to water services supply and pricing issues whereas the user pays model is designed to directly consider water service supply issues in determining the price of water services. However, whilst the user pays model, through RROR and service input considerations, attempts to place an upper pricing limit to minimise the charging of monopoly rents (NCC, 1997; DCILGPS, 2000a), market demand considerations do not extend to issues such as capacity to pay (Posner, 1974; and Hunt 1999 & 2000). Further, underlying the user pays model is a requirement for the entity to implement full cost pricing (FCP). This requires infrastructure assets to be valued on a deprival value (DV) basis and used in the determination of entity RROR. However, a fundamental issue not taken up is the removal of state and federal

government capital grant contracts as the user pays pricing model requires future capital expenditure to be included in the pricing of services. This represents a regulatory driven change in the contractual relationship between water entities and Federal and State Governments. The removal of capital grants represents a wealth transfer away from the water entity. Also, in the initial adoption stages of user pays, there does exist the potential to significantly increase the price of services of those entities having aging infrastructure. Some insight into the supply and quantum focus of pricing and planning for water services is provided by Tucker (1985). He observed Queensland Local Government as being the agents of allocation economic efficiency and effectiveness. User pays shifts the water business controlled by Queensland Local Government to agents concerned with productive economic efficiency and effectiveness. However, in the user pays pricing model the issues of demand and price, important productive efficiency and effectiveness considerations, do not appear to be embraced in its implementation. The lack of demand and price considerations is also reflected in the types of adoption incentives offered.

These incentives have been designed to facilitate adoption of user pays water services pricing in Australia. Initial funding support is provided for the revaluation of infrastructure assets in order to achieve full cost pricing (FCP). Funds are also available to assist with information systems infrastructure and software for more sophisticated reporting about, billing of services provided, the supply and installation of meters, and associated training. Further, funding was available for adopting entities on meeting predefined adoption targets. These incentives are supply side focused. The implications/consequences of the implementation of user pays on two significant stakeholder groups, the owners and the users, have not been considered in this implementation/adoption process. Given that most Australia water entities are managed by the public sector at the Local Government level, owners and users are predominantly one and the same group of stakeholders. For any balancing of supply and demand considerations in the adoption of user pays the relationship between the owner/user stakeholder group and the urban water entity must be considered.

A STAKEHOLDER RELATIONSHIP DRIVEN THEORETICAL FRAMEWORK

As previously stated, the operating context for this study is the Queensland urban water industry. Figure 1 provides an overview of the primary relationships.

Figure 1   A Structural Map of the Decision Relationship
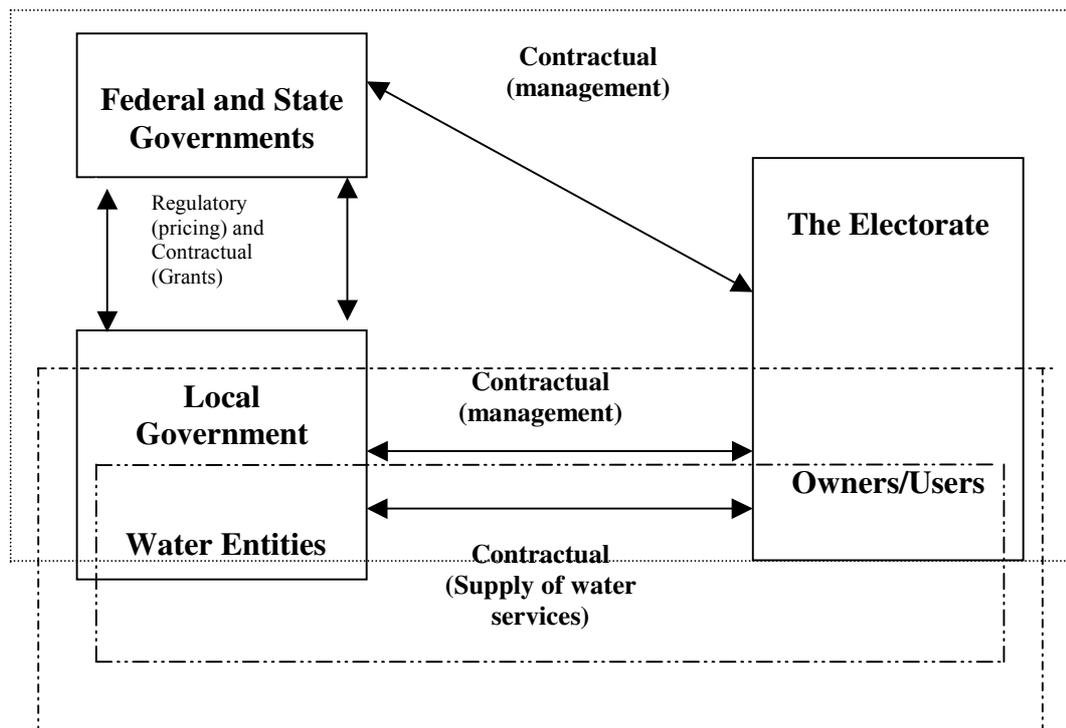
The bi-directional arrows in Figure 1 represent the two-way nature of the principal and agent contractual relationship between the parties. The contracts are either terminating (the management and grant contracts) or open ended (the regulatory and supply of services contracts). The management contracts are between the various levels of government and the electorate as the owners, in total (Federal) or part (State and Local Government). A degree of complexity is added to these relationships concerning the contracts for the supply of goods and services as they are also the electorate, but in the electorate's capacity as users of those goods and services. The Local Government/water entity and owner/user contractual relationship is a complex one that includes both supply and demand issues. The complexity lies in the simultaneous existence of two separate but related contracts. At one level there exists a management contract between the managers (including the elected councillors – board) of the water entity and the electorate (as owners). At another level there is a contract between the water entity and the electorate (as users) for the supply of water services.

Whilst the simultaneous coexistence of both of these contracts adds one level of complexity to this relationship, that complexity has the potential to be increased through the electorate having multiple motivations in dealing with the adoption of user pays. As owners, user pays provides a framework for improved management and performance monitoring of water resources and water services provisioning. As users, the adoption of user pays has the potential to increase the price of water services (NCC, 1997). Further, as both owners and user, the user pays pricing model has the potential to transfer economic wealth away from the entity and the community it serves – the electorate (the owners and users). These competing considerations have the potential to evoke differing motivations when an entity is confronted with the choice to adopt or not adopt user pays. This complex relationship has the potential to contribute to the anecdotal claims about water services pricing political sensitivity referred to in the previous section.

Agency Theory provides a basis for explaining and predicting politically sensitive contractual relationship behaviour. Agency Theory has withstood the tests of time (Field *et al*, 2002). Agency Theory in this paper is targeted at developing a theoretical framework to provide a positive basis for understanding the determinants of the pricing policy choice confronting Queensland Urban Water entities, particularly the demand implications associated with that choice in a politically sensitive environment. In an Agency relationship Watts and Zimmerman (1979: 284) make the following observation about the measurement of political cost/sensitivity:

> If we call the sum of costs of political action the "transactions costs" of political decisions, the crucial question is "what is the magnitude of these transactions costs?"

A framework for examining transaction costs is provided by Transaction Cost Theory (Williamson, 1979). The theoretical framework in this study has been extended to include both agency and transaction cost theoretical considerations. In terms of political costs, Watts and Zimmerman (1979) identified size as being positively related to an entity incurring political costs. However, later reviews of positive accounting theory (Panchapakesan and McKinnon, 1993; Whittred, Zimmer and Taylor, 2000; and Deegan, 2002) argue that size by itself might not be sufficient.

These observations support Panchapakesan and McKinnon (1993) regarding size as a single factor political cost consideration and the need for consideration of multiple factors such as: (1) Market share; (2) Industry; (3) Capital intensity; (4) Number of employees; (5) Number of shareholders; (6) Social responsibility disclosure; (7) Level of press coverage. Further, whilst a range of size measures are highlighted (1, 3, 4, and 5), in terms of political costs a number of other measures additional to size are argued to be necessary to gain an improved measure of political costs. Four of the first five Panchapakesan and McKinnon (1993) proxies for size are different measure of entity size whereas Industry (2 above) has different connotations, and the latter two proxies relate to disclosure and publicly reported political sensitivity. Whittred, Zimmer and Taylor (2000: 45) also specifically identify factors additional to size (e.g., nature of the industry, potential voters, geographical location, marginal vs safe electorate, impending elections) that need to be considered in measuring/explaining political costs. Agency demand driven costs would also include the issue of 'capacity to pay' identified by Posner (1974) in terms of political self-interest and by Hunt (1999 and 2000) in terms of the adoption of user pays in a developing country setting.

In terms of transaction costs Williamson (1979) emphasises the need to consider supply, demand, quantity and price when determining transaction costs. Williamson provides a framework for categorization of transaction costs. This framework identifies three types of transactions (non-specific; mixed; and, idiosyncratic) that are categorised in terms of frequency (occasional and recurrent). The user pays pricing policy falls into the idiosyncratic class of transaction in which the infrastructure investment is occasional but results in recurrent transactions (the supply of services). Williamson (1979) identifies these classes of transactions as being the most costly. This is consistent with the anecdotal evidence about the political sensitivity of water pricing. Issues with the potential to drive costs in the adoption of user pays would include size of investment (also a significant agency consideration), asset age, current levels of capital investment/expenditure, and the demand growth pattern.

The scope of this paper is limited to identifying and building explanation about factors that would determine that an urban water entity would not adopt user pays. Whilst there are at least two sides to every story, understanding issues that would determine entity adoption of

user pays form part of a larger study that limitations on length of discussion do not permit in this paper. Study hypotheses are developed and the empirical model provided in the next section.

THE STUDY HYPOTHESES AND EMPIRICAL MODEL

In the preceding sections a number of factors were identified that might, individually or collectively influence the agent's decision as to whether or not an urban water entity might adopt user pays. These include Size, Geographical Location, Asset Age, Operations and Maintenance Costs, Rate Base Growth, Capacity to Pay/Willingness to Pay, Strategic Advantage, Industry, Number of Voters, Electoral Marginality, Capital Intensity, Social responsibility Disclosure, and Level of Press Coverage. The listing of these factors should not be read as an order of weighting particularly given that there is no prior literature relating to the study context.


Given that all urban water entities are natural monopolies operating in a strategically important industry under already significant and uniform reporting requirements, a number of these factors will be constant across the study data set. To this end, factors such as Strategic Advantage, Industry, and Social Responsibility Disclosure are taken as being constant in this study as they equally apply to all these entities. Level of press coverage is also considered to be a constant as press coverage tends to be about general water issues rather than urban water entity specific. However, whilst these factors will be considered constant for all study entities, they do highlight an underlying potential for sensitivity.

Due to the exploratory nature of this study the variables of Size, Asset age (Operations and Maintenance and Capital Expenditure Ratio), Capacity to Pay, and Service Growth trend only are assessed. The following hypotheses, in the alternate form, have developed for testing:

H_{a1}:   *The relative demand per service connection (POPCON) is predicted to be negatively related to an entity choosing to adopt user pays.*

Hs_{a2}:   *Operations and maintenance costs per connection (OMAPCON) is predicted to be negatively related to the user pays choice.*

Hd_{a2}:   *The capital expenditure ratio (CAPEXR) is predicted to be positively related to the user pays choice outcome.*

H_{a3}:   *Capacity to Pay (ARREAREV) is predicted to be negatively related to user pays choice.*

H_{a4}:   *Service growth trend (ANGRO) is predicted to be positively related to user pays choice.*

Where appropriate both supply and demand considerations have been included in the variable construct (e.g. the proxy for H_{a1} incorporates population density as a function of the number service connection for the entity using the variable proxy acronym POPCON. This also designed to mitigate between entity comparative issues). The rationale behind the construct of H_{a1} has been applied consistently to the development of the other hypotheses. Also, the proxies have been selected from accounting type data. This is particularly reflected in the capacity to pay proxy ARREAREV which uses payment arrears as a ratio of total revenue instead of, say, average household income. The above hypotheses and the variables about which their predictions are made concerning the explanation/prediction of an urban water entities pricing policy choice are now presented in Figure 2 in the form of the study model.

Figure 2   **An Empirical Model For Explaining Urban Water Entity User Pays Choice**
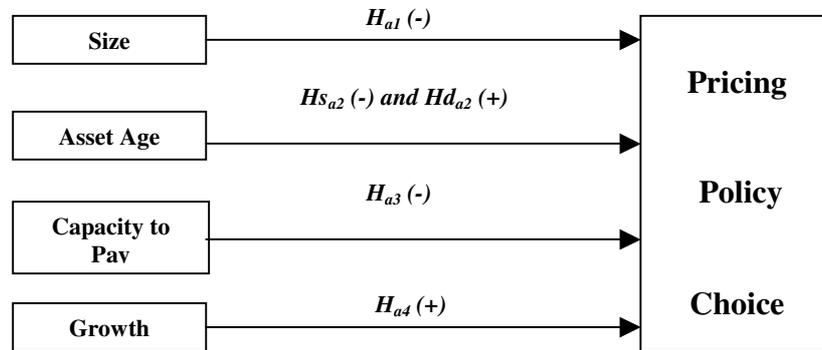
The arrows in the model should be interpreted as indicating association and not cause and effect. The study model is expressed in the following more formal terms:

$$Y_{ppc} = A + \beta_1 POPCON + \beta_2 ARREAREV + \beta_3 ANGRO + \beta_4 OMAPCON + \beta_5 CAPEXR + + \mathcal{E} \qquad (4)$$

Where:

Y_{ppc} is the dependent variable (DV), Pricing Policy Choice and takes a dichotomous form (0) for non-adoption of user pays and (1) for the adoption of user pays;

A is a constant;

β is the respective explanatory/predictor coefficient for each of the proxies identified prior to formalisation of the study model; and

$\mathcal{E}$ is the error term.

Given the model form, a dichotomous dependant variable, and the sample size presented by the study scope being limited to Queensland Urban Water entities, logistical regression has been identified as suitable model testing technique (Tabachnick and Fidell, 2001; Howell, 1997; and, Hair *et al,*1998). In the next section the output from testing the study model is analysed and some tentative findings discussed.

TESTING THE EMPIRICAL MODEL AND SOME TENTATIVE FINDINGS

In order to put some dimension on the entities being studied and the variables being tested, the following descriptive statistics are provided in Table 1.

Table 1   **Summary of Descriptive Statistics of Variables used in the Restricted Model Logistic Regression**

	N	Minimum	Maximum	Mean	Std. Deviation
Size:					
NCONNECT	94	113	41216	4110	5716.29
POPDEN	107	.0036	1306.20	23.94	132.86
Capacity to Pay:					
ARREAREV	107	.00	.384	0.0611	.0608
Infrastructure Age:					
OMAPCON	107	.00	1049.51	281.75	212.4
CAPEXR	98	.00	6.17	1.4474	.9953

From the descriptive statistics in Table 1, it can be seen that in all cases the sample distribution is bimodal and skewed to the left. This also indicates that there is significant variation between the entities being studied in terms of size, user capacity to pay, and the age of entity infrastructure. Further, the categorical variable relating to growth trend is fairly evenly split for cases between positive (46) and negative (45) with only two cases experiencing static growth. The empirical model is now tested using the SPSS binary logistic regression package. All data used in this study has been collected from secondary data sources (DLGP, 2002; and ABS, 2003). The test output is detailed in Table 2 below.

Table 1:   Pricing Policy Choice Determinants for the Queensland Urban Water Industry – Restricted Model

$$Y_{ppc} = A + \beta_1 POPCON + \beta_2 OMAPCON + \beta_3 CAPEXR + \beta_4 ARREAREV + \beta_5 ANGRO + \varepsilon$$

Variable	Dir (+/-)	Model (i)		Model (ii)		Model (iii)		Model (iv)	
		Coef.f	Wald[a]	Coeff.	Wald	Coeff.	Wald	Coeff.	Wald
Intercept		.712	1.006	-.246	.177	.877	2.255	.611	.801
		(.316)		(.674)		(.133)		(.371)	
POPCON	-	-152.816	1.485			-143.081	1.536	-154.836	1.490
		(.223)				(.215)		(.222)	
OMAPCON	-	-.003	3.069	-.001	1.354	-.002	2.462	-.003	3.084
		(.080)		(.245)		(.117)		(.079)	
CAPEXR	+	.257	.964	.295	1.590			.236	.853
		(.326)		(.207)				(.356)	
ARREAREV	-	-2.111	.247	.827	.052	-1.433	.118		
		(.62)		(.819)		(.731)			
ANGRO	+		4.614		2.679		5.228		4.804
ANGRO (1)	-	-1.042*	4.413	-.465	2.675	-1.036*	4.525	-1.055*	4.540
		(.036)		(.102)		(.033)		(.033)	
ANGRO (2)		.290	.045	-.313	.079	.694	.297	.363	.072
		(.831)		(.779)		(.586)		(.788)	

	Model (i)	Model (ii)	Model (iii)	Model (iv)
Nagelkerke R^2	21.9%	10.7%	18.6%	21.6%
Log likelihood	106.881	120.853	110.308	107.135
Model Chi-squared (sig)	16.297 (.012)	8.023 (.155)	13.808 (.017)	16.042 (.007)
No Change % Classified Correct	84.5%	88.7%	78.0%	81%
Adopt user pays % Classified Correct	51.4%	30.6%	42.9%	48.6%
Overall % Classified Correctly	72.0%	67.3%	64.9%	68.8%

Variable definitions: The dependent variable Y_{ppc} is coded 1 when user pays is adopted and 0 when the existing pricing policy is retained; *POPCON* is the ratio of population density to the number of service connections for each case; *OMAPCON* is the operations and maintenance costs per service connection for each case; *CAPEXR* is the ratio of capital expenditure to net assets for each case; *ARREAREV* is the ratio of payment arrears to total service provision revenue for each case; and *ANGRO* is a measure of the direction of growth for each case using a categorical variable where *ANGRO(1)* represents negative growth, *ANGRO(2)* represents no growth, and because the logistic regression tests the change.

Dir. (+/-) refers to the hypothesised direction of the relationship between the independent and dependent variable, *p*-values are in brackets.

The Wald statistic has a chi-squared distribution and tests the null that a coefficient is zero.

The column headed Model (i) provides a summary of the full model test output. The columns headed Model (ii), Model (iii), and Model (iv) have been included for the purposes of testing the parsimony of Model (i). Given that Model (i) results in a prediction probability of greater than chance for both the prediction of those entities that choose not to adopt user pays (84.5%) and those entities choosing to adopt user pays (51.4%), it is argued that Model (i) achieves parsimony in terms of this study. Effects of multicollinearity are considered limited given that in the bivariate Spearman correlation matrix for the independent variables, whilst indicating some overlap, none of the pair-wise correlations exceeded 0.400. Further, the hypotheses sign predictions for all independent variables tested were supported. Given the political cost framework used to develop this model, it is argued that this outcome empirically confirms the anecdotal evidence concerning water services pricing political sensitivity. The ensuing analysis of model output will now focus on Model (i) results only.

Overall model statistical significance is supported by Model significance of $p = .012$ ($\alpha = .05$). On inspection of the independent variables, with the exception of negative annual growth ($p = .036$), none of the model independent variables are statistically significant. However, the more formal Hosmer and Lemeshow model prediction probability analysis does highlight that the model has an 84.5% probability of predicting entities that will choose not to adopt user pays. To this end it is argued that cumulatively the independent variables do provide a significant basis for explaining why urban water entities will not choose to adopt user pays. That is, entity size combined with the potential cost of the transfer of economic wealth away from entities as reflected in considerations about age of systems assets, current levels of capital expenditure, user capacity to pay and demand growth patterns do enter into the user pays choice decision.

Additionally, this also highlights stakeholder sensitivity to the threat of any economic wealth transfer away from the entity and its principal stakeholder groups. However, given that the model also has some predictive capacity about those entities choosing to adopt user pays (51.4% and overall 72.0%), case by case consideration of the removal of economic support by way of capital grants would need to be considered in addition to existing incentives. Given that capital grant support can impact directly on user pays model considerations about future capital works and operations and maintenance costs, consideration needs to be given to the phasing out of such support. This could explain low user pays adoption rates where blanket adoption of user pays pricing is mandated by governments and/or regulators.

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