Determinants of public support for water supply reforms in a small developing economy

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Abstract: In most small developing countries, the public sector is struggling to provide an optimum level of public goods to the citizens. A particularly important good is water. Safe drinking water has been recognised as a basic need for a long time. Inadequate supply of safe water can have major health implications and Fiji has faced serious problem with respect to the supply of water to its general population. In this paper, we examine the case of two urban cities and one town where disruptions to the supply of drinking water are a frequent occurrence. The severity of the problem is measured together with the strategies employed by the affected households to cope with the problem. We found that households are willing to pay more to secure better services. Utilising an established econometrics approach, the determinants of the willingness to pay are also identified.

Keywords: water supply; WTP; willingness to pay; Tobit model; contingent valuation.

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1 Introduction

In most small developing countries, the public sector is struggling to provide an optimum level of public goods to the citizens. With the steady growth in urban populations, this issue has become a graver one. Particularly important in this regard are the issues pertaining to housing, waste disposal and public utility provision such as water and electricity. Public ownership of utilities is emphasised by the Keynesian model of social welfare according to which state provision of merit goods is in the general economic and social interest (Ernst, 1994; Graham, 1997). Lack of appropriate and timely services

affects efficiency and productivity of service delivery and thus affects the overall competitive edge of the business sectors. There are other associated social problems to these which increase the vulnerability of the general populace. These problems arising out of poor quality and low efficiency of service delivery include poor health of households' occupants, lack of quality living space amongst these household occupants and thus increase in school drop outs and the associated issues of crime and violence.

The problem of the public sector in developing countries is compounded by low-economic growth, widening budget deficit and mounting debt, worsening social problems and greater role in provision of goods and services to the general population. A panacea to these problems has been reform of the economies, one towards a more market-oriented economic system. The basic objectives of the reforms have been to increase the participation of the people in governments' decision making and to reduce the burden placed by the state on the private sector (Liew et al., 2003). The key pillars of these reforms included macroeconomic policy prudence, outward orientation, liberalisation of trade and domestic markets (Williamson, 1990) and other required structural changes. The reforms that are expected to put an economy on a market-oriented growth path are based on the neoclassical theory. This theory assumes that markets are working well and that the economy is functioning in line with its comparative advantage (Solow, 1956; Swan, 1956). Therefore, the theory essentially assumes that all the appropriate institutions for markets to be contestable are in place, that there are no price distortions, and there is no resource misallocation.

The issue of poor state of public service delivery and thus a call for a reform of it is not new and uncommon in Fiji. One of the problems that has caught the attention of the entire nation is the inability of government to provide continuous supply of safe drinking water to a large cross-section of Fiji's population. Safe drinking water has been recognised as a basic need for a long time (ILO, 1966). However, it has been often taken for granted (Falkenmark, 1990). Inadequate supply of it can have major health implications. Some developed and developing countries also envisage water to be a major constraint for continued and sustainable agricultural development (Chakravorty and Zilberman, 2000). In a recent 2001 International Food Policy Research Institute conference, water was identified as the most critical constraint to food self-sufficiency and security (International Food Research Institute, 2002). Furthermore, hydrological projections of the world's fresh water resources have pointed to an emerging global threat, the dwindling supply of fresh water relative to the growing demand for water world wide (Falkenmark et al., 1998; Revenga et al., 2000; Vörösmarty et al., 2000).

Frequent disruptions can be either a management and delivery problem or a water scarcity problem. Tackling both the issues can have major implications on economic growth. Additional resources to address the problem will require government to exploit less accessible sources of fresh water appropriately and purchasing a greater share of aggregate economic output. In small developing countries which often tend to face fiscal crisis, this diversion of resources can have a major blow to economic growth. The government has proposed to reform the public water supply system and one of the aspects would be to promulgate cost-recovery user charges. In a country where poverty levels and unemployment rates are high, such measures could mean more suffering to the general populace than what they are currently facing with the intermittent supply of water. It is thus imperative to examine in detail how households respond to such situation. Identification of these strategies will help policy makers in a number of ways.

In certain situations, it may help in ensuring that inappropriate strategies do not give rise to a greater problem. Furthermore, it is also important to examine if households are willing to pay high charges and if so what are the levels they can afford and what factors determine their willingness to pay (WTP).

Therefore, in this paper, we examine the case of two urban cities and three towns where disruptions in the supply of safe drinking water are a frequent occurrence. The severity of the problem is measured together with the strategies employed by affected households to cope with the problem. We also ascertain their WTP more to secure better services. Given that Fiji has two distinct ethnic groups; policy making can be more effective if research can identify any difference to resource use and behaviour of these two ethnic groups. Utilising an established econometrics approach, the determinants of the WTP is also identified.

2 Background: water supply issues in Fiji

Water cuts, shortages and disruptions have always been a problem in Fiji. The persistence of this problem has been due to a number of factors. Firstly, there is a supply problem. While total water supply has not increased significantly, water demand has. Total water consumed in 1980 was 31,710 m^3 which rose to 503,100 cubic meters in 2004. This increased demand for water is due to two factors. The first is the rise in per capita consumption. Per capita water consumption in 1980 was 50 L/person. In 2004, this figure rose to 600 L/person. The second reason is the rise in overall population. The population in 1980 was 634,200 which increased to 838,500 in 2004.

The increasing demand for water is further compounded by two factors: the disintegration of piping systems resulting in water leakage and the rise in overall economic activity thus raising water demand from the industrial and service sectors. Water leakage from the system is often visible. In a study conducted on water and sanitation situation in Suva, Mohanty (2001) found that 49% of the water was lost from the system through leakage. Leakage is primarily due to the delivery system reaching its maximum lifespan. Due to financial constraints, governments have engaged in maintenance work rather than changing the system. On the other hand, the rise in economic activity has further increased the demand for water. In a case noted in Ba, it was seen that water pressure to a settlement was severely affected by a new connection to a confectionery company nearby (*The Fiji Times*, 2007, p.3). It is, therefore, evident that investment on supply side has not kept up with the rising demand thus causing regular water cuts.

Water is a necessity for life and consequently there are a number of repercussions when there is a sudden cut or disruption. These cuts or disruptions lead to closure of schools and health centres to disruption of state functions. There is a risk of serious health problems that can arise due to use of poor quality water. In a response to journalists, one of the consumers said:

> "…Even though some of us have dug wells, the water that we get from the wells is sometimes polluted and posses a health risk. We are all poor farmers living in the area and to travel to Nadi to lodge a complaint for no water is just too expansive." (*The Fiji Times*, 2005, p.8).

Another news article reported the following:

> "More than 50 families of squatter settlement in Ba have to rely on a creek for water after continuous water disruption for the past three years." (Naivaluwaqa, 2005, p.5)

The health risk issue is often not brought to the limelight because its effects are not visible immediately.

3 Theoretical model of household water demand

We begin by assuming that the households behave as a typical rational consumer in pursuit of utility maximisation subject to constraints. In light of this, we model the demand for water within the utility maximisation framework as described below:

$$E(W, X) \quad \text{s.t.}\, U = U(W, X) \tag{1}$$

Facing the expenditure (E) for both water services (W) and a composite good (X), the typical consumer will attempt to minimise the expenditure function given below:

$$E = E\left(P_W, P_X, U\right) \tag{2}$$

where U is the utility and P is the price.

Given that unlike a market good, water price is given, consumers does not observe P_W, but have to choose if they want to accept W. Therefore, in the above expenditure function, P_W is replaced with W thus leading to the following expenditure function:

$$E^* = E\left(W, P_X, U\right) \tag{3}$$

In this case, the WTP for uninterrupted safe drinking water will be the difference between the two expenditure functions (W_1 and W_0 with $W_1 > W_0$). The compensating surplus (CS) welfare estimate can be derived as follows:

$$\text{CS}\left(W_0, W_1\right) = E\left(W_0, P_X, U_0\right) - E\left(W_1, P_X, U_0\right) \tag{4}$$

The above-stated estimate of CS is a measure of the WTP for public water services brought to their home. Given that this is the amount that households are willing to give up to remain on the same utility as they were before the water cuts, the CS above will be negative. Furthermore, given that there are a number of factors that affect the WTP of a household, we can extend the CS as follows:

$$\text{CS}\left(W_0, W_1\right) = E\left(W_0, P_X, U_0, Z\right) - E\left(W_1, P_X, U_0, Z\right) \tag{5}$$

The factors that affect the WTP of a household are now represented by the Z variable.

4 Methodology

Two basic theoretical approaches are available for making reliable estimates of households' WTP. The first, 'indirect', approach uses data on observed water use behaviour (such as carting cost from additional sources when water supply is disrupted) to assess the response of consumers to different characteristics of improved water system. Some of the modelling approaches that could be used here include the travel cost and

hedonic property value models. The second direct approach is simply to ask an individual how much he or she would be willing to pay for improved water services. This approach is termed as the 'contingent valuation method' (CVM) because the interviewer poses questions within the context of a hypothetical market. In this study, we utilise this second approach.

The CVM has been widely used in developing countries. It has been used effectively to estimate assess demand for natural resources. Some of the studies utilising this methodology include Whittington et al. (1990, 1991), Altaf et al. (1993), McPhail (1993), Briscoe (1993), Crane (1994), Griffin et al. (1995), Murty et al. (1998), Whittington et al. (2002), Davis (2004), Ntengwe (2004) and Ahmad et al. (2005). These studies successfully utilised CVM to assess WTP for improved supply conditions and the efficacy of government policies on water supply. These studies affirm that despite the poverty prevailing in the low-income countries, many households are able and willing to pay for water and sanitation services if the public water utilities are run along commercial lines. The studies also reveal that demand side information about household preferences and priorities can provide a valuable input into the planning process.

The WTP will be ascertained from interview of heads of households using structured questionnaire. This questionnaire will also ascertain the socio-economic dimensions of the respondents. Apart from descriptive statistics, econometric analysis will be carried out to explain the determinants of WTP. For econometric analysis, the Tobit model is adopted to analyse and explain the manner in which various factors affect WTP. In general, this type of model is known as 'adoption behavioural model'. A general adoption behavioural model can be stated as follows:

$$\mathrm{WTP}_i^* = \beta' X_i + u_i \sim N\left(0, \sigma^2\right)$$

where

$$\mathrm{WTP}_i^* = \begin{cases} \mathrm{WTP}_i^*, \text{ if } b' X_i + u_i > 0 \text{ (the observed values)} \\ 0, \text{ otherwise} \qquad\qquad \text{(the unobserved values)} \end{cases} \tag{6}$$

where WTP_i denotes the dependent variable. The variable WTP takes a non-zero value (WTP > 0) such as WTP or takes a value zero (WTP = 0) when the respondent are unwilling to commit for any rise in tariff rates. Since the dependent variable is truncated at zero, WTP = 0 for those not willing to pay, while those willing to pay display a certain level of commitment, the Tobit model is used (for more details on limited dependent variable model and Tobit model, see Long (1997) and Maddala (1983). Empirically, the Tobit WTP function can be specified as follows:

$$\begin{aligned} \mathrm{WTP}_i^* = {} & \beta_0 + \beta_1 \mathrm{ETH}_i + \beta_2 \mathrm{HS}_i + \beta_3 \mathrm{Age}_i + \beta_4 \mathrm{Edu}_i + \beta_5 Y_i \\ & + \beta_6 \mathrm{WCH}_i + \beta_7 \mathrm{CWBM}_i + \beta_7 \mathrm{Gen}_i + \varepsilon_i \end{aligned} \tag{7}$$

where

WTP_i^* measures the amount willing to pay above the current water bifcll per year (in F$)

ETH_i measures the ethnicity of the respondent (1 = Indo-Fijian, 0 = Ethnic Fijian)

HS_i measures the size of household (in no of members)

Age_i measures the age of the respondent (in years)

Edu_i measures the education level of respondent (in years of formal schooling)

Y_i measures the gross income of the household (in F$)

Gen_i measures the gender of the respondent (0 = male, 1 = female)

$CWBM_i$ is the households' current annual water bill (F$)

WCH_i is the water cut in hours per month (hr)

ε_i is the error term.

Data for this study was collected from water disruption areas of Fiji's two main cities, Suva and Lautoka and one town, Nasinu. These three areas are the most affected one and home to 70% of Fiji's urban population.

The survey was administered over a three-month period in March–May 2006. A total of 415 households were interviewed using structured questionnaires. Of this, 375 questionnaires were retained for analysis. The rest of the questionnaires were either incomplete or data on key variables were missing due to refusal of the respondent to cooperate. The survey was carried out with the support of University undergraduate students.

A summary profile of the respondents is provided in Table 1. The mean age of the respondent was 43 years with an average education level of 9 years of formal schooling. The sample comprised 32.5% ethnic Fijians and 67.5% Indo-Fijians. As Fiji's population consists of 52% Fijians and 42% Indo-Fijians, the sample distribution is rather unfortunate as most of the Fijians on the sample list refused to cooperate. The ethnic variable is visible in all parts of Fiji life. With a succession of ethnic Fijian dominated governments, the government machinery is also dominated by ethnic Fijians. Hence, there have been numerous complaints that water carting during periods of water disruption have also been plagued with discriminatory distribution with ethic Fijians getting first priority. Therefore, ethnic Fijians have always sided with the government and have not been very vocal about piped water disruptions as carted water by government carriers has been promptly supplying water to their doorsteps. The respondents were mostly males. The gender bias again reflects the dominant role of males as heads of households in small developing societies.

Table 1 Socio-economic profile of respondents

Variable	*Index*
Age (years)	43
Gender	
Male (%)	89
Female (%)	11
Education level (years)	9
Ethnicity	
Fijian (%)	32.5
Indo-Fijian (%)	67.5
Income ($)	

Table 1 Socio-economic profile of respondents (continued)

Variable	*Index*
Mean	11,851
Minimum	1,300
Maximum	73,528
Household size (No)	5
Sample Size	375

Source: Data obtained from the primary survey of the informal sector activities.

5 Results and discussions

5.1 Water supply disruptions and coping strategies

The survey results reveal varying degrees of severity in water supply disruptions to the sample area. About 65.9% of the households are affected less than 10% of the time, 11.7% are affected between 11% and 20% of the time and 8.8% are affected 21% and 30% of the time. To cope up with the water cuts, the residents resort to various means of water collection (Table 2). Most of them, 77.6%, store water in drums and tanks while 10% of them use water provided by trucks carting water to the area. A small proportion, 2.4%, uses water from creeks and rivers thus exposing themselves to serious health risks. There are also a small proportion of households, who spend personal funds to hire vehicles to cart water when water is not provided on time or the water trucks run out of water.

5.2 Health risk posed by alternative water source

The alternative source of water, be it from the river, stored in drums or carted from elsewhere have in fact showed evidence of contamination (Table 3). Results from the survey show that 77.6% of the respondents have noted soil, dust and sand particles in it which could be a possible source of health risk.

Given such a scenario of lack of water and contamination of the little i.e. available, the question that was posed to the residents was whether they were willing to pay more if water supply is brought back to normal and water quality satisfies health requirements. A good 48.8% of the households responded ‘no’ for any extra payment over the existing rate (Table 4). However, the remaining volunteered to pay different amounts. While 10% are willing to pay between \$1 and \$10, another 33% are willing to pay between \$11 and \$30. On the upper side, there are a small proportion of households, 2.7%, who are wiling to pay as much as an additional \$41–50 per year to ensure that safe drinking water is supplied uninterrupted.

Table 2 Coping up strategies for water supply affected households

Coping up strategies	*No*	*%*
1 Use stored water in drums/tanks	291	77.6
2 Use water from river/creek	9	2.4
3 Use water from well/bore hole	26	6.9
4 Use water delivered by water trucks	38	10.1
5 Cart water using hired vehicles	11	2.9
Total	375	100

Table 3 Visual evidence of water quality

Visual evidence	*No of household*	*% of household*
1 Brown colour water with soil, dust and sand	291	77.6
2 Insects, worms and mosquitoes in water	20	5.3
3 Bad odour	26	6.9
4 Crop residue	38	10.1
Total	375	100

Table 4 WTP an additional amount per year for uninterrupted safe drinking water supply

$	*No.*	*%*
0	183	48.8
1–10	36	9.6
11–20	82	21.9
21–30	41	10.9
31–40	8	2.1
41–50	4	1.1
51–60	10	2.7
61–70	2	0.5
71–80	0	0
81–90	0	0
91–100	3	0.8
>100	6	100

5.3 Determinants of WTP

The ability of an individual household to pay a certain amount over and above the current water bill can be affected by a number of factors as defined by the empirical model. These include factors such as age, education, gender ethnicity, education, household size, income, annual water bill and the severity of water cuts. In the sample, the mean age of respondents is 43 years with a mean education level of 9 years of formal education. The mean income level was F$11,851 while the mean household size was 5 persons.

Results from this study reveal that of these factors, the four key factors that determine individuals' households' likelihood to pay for water reforms in Fiji are age of the head of the household, ethnicity, income level and water cut severity (see Table 5). The age variable indicates that older people tend not to be willing to pay. A possible reason for this would be their ability to organise alternative water source given that they generally tend to spend more time after work at home. The second variable is ethnicity. The dummy variable can be interpreted as Indo-Fijians being not willing to pay relative to the Fijians. A possible explanation for this, gathered from in-depth interviews is discrimination in water distribution by government water carriers. There have been numerous complaints that government water trucks tend to service more the ethnic Fijian households than the Indo-Fijian households. Given that the current government is one dominated mainly by ethnic Fijians, the Indo-Fijians are venting their anger by refusing to pay any extra. The third variable is income. With a positive sign, it implies that higher income people are more willing to pay than lower income people. This makes perfect sense given the prevalence of low levels of income and high cost of living. The fourth variable that affects a person's WTP is the severity of water cuts. Interestingly, this variable has a negative coefficient which indicates that people who are more severely affected are less willing to pay any extra for improvement in supply. The explanation for such result found from in-depth interview is that these households, while being severely affected by water cuts, have not seen a major reduction in their water bills during the water cut period. Therefore, by refusing to pay any extra, they are in a way revealing their frustrations on the government.

Table 5 Tobit model estimates of the determinants of WTP

Variable	*Coefficient*	*t-ratio*
Age	–0.01403	–2.48
Gender	0.30765	1.64
Ethnicity	–0.33374	–2.01
Education	0.01148	0.86
Household Size	0.04648	1.44
Gross income	0.00002	2.42
Water bill/year ($)	–0.00023	–0.02
Water cuts (hr)	0.44541	–2.98
Constant	0.44500	1.35

6 Summary and conclusion

The supply of safe drinking water is a priority for any government. However, in some developing countries, this is a major problem. A large proportion of Fiji's urban population has been experiencing disruptions in water supply for the last decade and this problem has reached unprecedented levels over the last two years.

This study examined the coping up strategies of the affected households and their WTP more to ensure they received a continuous and safer supply of water. Given that

recent government announcements have indicated the potential use of price policy to address the problem; this paper examined the determinants of the WTP.

The results from the study indicate that water supply affected households have resorted to a number of strategies to access water. However, some of these strategies, such as obtaining water from rivers and creeks, can pose serious health risks. Households have also carted water using hired vehicles which has significantly affected their ability to spend on quality food and for savings and investment.

While the government has indicated its intentions of reforming the water supply section of its public service sector, its proposal to increase prices may have serious implication on low-income households. The WTP result indicates that a large proportion of people are not willing to pay any additional amount over the existing rate. A key factor is income. Higher income households are generally willing to pay extra to ensure uninterrupted supply is received. Indo-Fijian households are, in general, not keen to pay any extra given the discriminatory treatment they have received from water carriers. Moreover, older people tend to organise themselves better during water cuts and, therefore, are not wiling to pay extra.

The government should tread carefully in using price policy to generate additional income to finance its proposed water reform agenda as it will affect the low-income households severely. Any proposal to raise the price must see step-pricing introduce and water bills to be payable monthly rather than quarterly as is the case. With monthly bills, households can take advantage of step pricing by rationalising water use thus keeping consumption within the first step. Those liberal in water consumption will have to folk out the additional unit price thus helping government finance its reform programme.

References

Ahmad, J.K., Goldar, B.N. and Mishra, S. (2005) 'Value of arsenic-free drinking water to rural households in Bangladesh', *Journal of Environmental Management*, Vol. 74, No. 1, pp.173–185.

Altaf, M.A., Whittington, D., Jamal, H. and Smith, K. (1993) 'Rethinking rural water supply policy in Punjab, Pakistan', *Water Resources Bulletin*, Vol. 29, No. 1, pp.1943–1954.

Briscoe, J. (1993) 'When the cup is half full: improving water sanitation services in the developing world', *Environment*, Vol. 35, No. 4, pp.7–37.

Chakravorty, U. and Zilberman, D. (2000) 'Introduction to the special issue on: management of water resources for agriculture', *Agricultural Economics*, Vol. 24, No. 1, pp.3–7.

Crane, R. (1994) 'Water markets, market reforms and the urban poor: results from Jakarta, Indonesia', *World Development*, Vol. 22, No. 2, pp.71–83.

Davis, J. (2004) 'Assessing community preferences for development projects: are willingness-to-pay studies robust to mode effects?' *World Development*, Vol. 32, No. 4, pp.655–672.

Ernst, J. (1994) *Whose Utility? The Social Impact of Public Utility Privatisation and Regulation in Britain*. Milton Keynes: Open University Press.

Falkenmark, M. (1990) 'Global water issue confronting humanity', *Journal of Peace Research*, Vol. 27, No. 2, pp.177–190.

Falkenmark, M., Klohn, W., Lundqvist, J., Postel, S., Rockstrom, J., Seckler, D., Shural, J. and Wallace, J. (1998) 'Water scarcity as a key factor behind global food insecurity: round table discussion', *Ambio*, Vol. 27, No. 2, pp.148–154.

Graham, S. (1997) 'Liberalised utilities, new technologies and urban social polarization: the UK experience', *European Urban and Regional Studies*, Vol. 4, No. 2, pp.135–150.

Griffin, C., Briscoe, C., Singh, J.B., Ramasubban, R. and Bhatia, B. (1995) 'Contingent valuation and actual behaviour: prediction connection to new water systems in the state of Kerala, India', *World Bank Economic Review*, Vol. 9, No. 1, pp.373–395.

ILO (1966) *Employment, Growth and Basic Needs: A One-World Problem*. New York, London: Praeger.

International Food Research Institute (2002) 'Sustainable food security for all by 2020', *Proceedings of an International Conference*, 4–6 September 2001, Bonn, Germany, p.145.

Liew, L.H., Bruszt, L. and He, L. (2003) 'Causes, national costs and timing of reforms', Revised version of the paper presented at the *Workshop on "Understanding Reform", Global Development Network Meeting*, Cairo, Egypt, 16–17 January.

Long, J.S. (1997) *Regression Models for Categorical and Limited Dependent Variables*. California, USA: Sage Publications, p.297.

Maddala, G.S. (1983) *Limited Dependent and Qualitative Variables in Econometrics*. United Kingdom: University of Cambridge Press, p.397.

McPhail, A.A. (1993) 'The 'five percent rule' for improved water service: Can households afford more?' *World Development*, Vol. 21, No. 6, pp.963–973.

Mohanty, M. (2001) *Water and Sanitation Issues in Suva*. Suva, Fiji, Mimeo: University of the South Pacific, p.10.

Murty, M.N. and James, A.J. and Misra, S. (1998) *Economics of Industrial Pollution Abatement: Theory and Empirical Evidence from the Indian Experience*. Oxford University Press.

Naivaluwaqa, T. (2005) 'Squatters use creek for water', *The Fiji Times*, 3rd July, p.5.

Ntengwe, F.W. (2004) 'The impact of consumer awareness of water sector issues on willingness to pay and cost recovery in Zambia', *Physics and Chemistry of the Earth*, Vol. 29, Nos. 15–18, pp.1301–1308.

Revenga, C., Brunner, J., Henninger, N., Kassem, K. and Richard, R.P. (2000) *Pilot Analysis of Global Ecosystems: Freshwater Systems*. Washington, DC: World Resources Institute.

Solow, R.M. (1956) 'A contribution to the theory of economic growth', *Quarterly Journal of Economics*, Vol. 70, No. 1, pp.65–94.

Swan, T.W. (1956). 'Economic growth and capital accumulation', *Economic Record*, Vol. 32, No. 2, pp.334–361.

The Fiji Times (2005) 'Water cuts pose risk', *The Fiji Times*, 12th March, p.8.

The Fiji Times (2007) 'Residents face water woes', *The Fiji Times*, 6th January, p.3.

Vörösmarty, C.J., Green, P., Salisbury, J. and Lammers, R.B. (2000) 'Global water resources: vulnerability from climate change and population growth, *Science*, Vol. 289, No. 2, pp.284–288.

Whittington, D., Briscoe, J., Mu, X. and Barron, W. (1990) 'Estimating the willingness-to-pay for water services in developing countries: a case study of the use of contingent valuation surveys in Southern Haiti', *Economic Development and Cultural Change*, Vol. 8, No. 2, pp.293–311.

Whittington, D., Lauria, D.T. and Mu, X. (1991) 'A study of water vending and willingness to pay for water in Onitsha, Nigeria', *World Development*, Vol. 19, No. 3, pp.179–198.

Whittington, D., Pattanayak, S.K., Yang, J. and Kumar, K.C.B. (2002) 'Household demand for improved piped water services: evidence from Kathmandu, Nepal', *Water Policy*, Vol. 4, No. 1, pp.531–556.

Williamson, J. (1990) 'What Washington means by policy reform', in J. Williamson (Ed.), *Latin American Adjustment: How Much Has Happened?* Washington, DC: Institute for International Economics.