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Willingness to Pay to Avoid the Cost of Intermittent Water Supply

A case study of Bandung, Indonesia

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CONTENTS

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Abstract

This study summarizes the results of a contingent valuation survey of 200 households in Bandung, Indonesia for 24-hour water supply. The existing piped water supply in the city is intermittent and unreliable giving rise to additional cost to piped water users as well as inducing excessive use of ground water leading to the depletion of water table and land subsidence. The empirical data indicates that the project would generate social benefits. The mean willingness to pay to obtain a continuous service is Rp 22,156,- per month or equal to 29.7% surcharge over the water charge. The statistical analysis confirms that, family size, children and education determine how much households will be willing to pay; whereas only education accounts for the decision to pay or not to pay anything. By employing two treatment groups, the paper shows that the sample households opt that uninterrupted service is provided by the government rather than by a private operator.

Key words: contingent valuation, intermittent supply, private sector, willingness to pay.

1 INTRODUCTION

More than half of Indonesian urban population has no access to improved drinking water[1], and the majority of urban residents struggle to cope with both low and intermittent water supply conditions. While there has been a significant development in the water sector, this improvement cannot compete with the fast growing population and urbanization. According to the study of Asian Development Bank in 1998, economic losses due to poor sanitation and inadequate clean water supply in Indonesia reached 2.4 percent of GDP, or 13 US dollars per household (Kompas, 2008).

Intermittent water supply is acceptable in many Indonesian cities because people are unaware of the coping cost and the health risks tied to such supply and in many cases they do not know that 24-hour service to the home is the 'norm' in most countries (McIntosh, 2003). The cost incurred by intermittent service includes the cost to transport, store, pump and abstract ground water as well as the health cost associated with waterborne diseases such as diarrhea, cholera and dysentery. A research project in Katmandu, Nepal reveals that coping cost can be twice as much as the current water bills paid to the water utility which corresponds to 1% of incomes, excluding the potential health cost (Pattanayak, Yang, Whittington, & Bal Kumar, 2005). These hidden costs, although not directly visible as cash costs, have a value to consumers (Choe, Varley, & Bijlani, 1996). They can be decreased by replacing an intermittent supply with a 24-hour service which delivers water to users continuously, on demand at high pressure.

In a much broader perspective, providing the society with an uninterrupted water supply will benefit the environment. In Indonesia, where a large proportion of household water demand is full filled by the use of ground water and environmental awareness is generally low, offering a continuous supply of water can therefore have two potential goals; to meet the water needs for the community and at the same time to reduce the dependency on groundwater resource. It should be noted that the program can only be effective as long as a regulation governing ground water abstraction is also in place and the price of continuous water is affordable.

[1] The World Health Organization defines an improved drinking water-source as one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with fecal matter. These include piped water, standpipe, tube well/borehole, protected dug well, protected spring and rainwater. Unprotected dug well, unprotected spring, small cart with tank/drum, tanker truck, surface water (river, dam, lake, pond, stream, channel, irrigation channel and bottled water are defined as unimproved drinking water source).

Nonetheless, the investment required to deliver continuous services is out of reach of public sector's financial capacity. Government entities lack the financial supports to heavily subsidize solution to this problem. Consequently, the public sector must formulate innovative financial arrangements, not only to meet future demand, but to maintain and improve the current level of service for such a fast-increasing urban population. If beneficiaries of such improvements are to pay more than in the past they must be consulted and draw into the planning process in a meaningful way (Bateman, Willis, & Arrow, 2002). Whether the public sector decides to utilize debt markets or private-sector participation as viable financial alternatives, its ability to recover the costs of these alternatives, as well as sustain water supply, will ultimately be gauged by consumer's willingness to pay for water service (Choe, et al., 1996). Therefore, obtaining willingness to pay (WTP) for water service improvement in question can help policy makers assessing acceptable water charges to users upon which water policy can be developed with the confidence of achieving cost recovery (Littlefair, 1998).

This research project departs from an increasing awareness that little is known about household's willingness to pay for uninterrupted water supply in Indonesia. To the author's knowledge, only one study exists that value the access to safe and improved domestic water sources in Indonesia by applying hedonic pricing approach (see Yusuf & Koundouri, 2005), and yet no contingent valuation study for similar issue has been performed. Hence, this paper seeks to redress the balance of studies and to present evidence of willingness to pay to avoid the cost associated with intermittent water supply from Bandung Municipality in Indonesia. The paper then analyzes how these preferences are affected by socio-economic aspects; service characteristics; knowledge about the heath risk of intermittent supply and trust. Further, to understand how household attitudes diverge across different service providers two treatment groups are introduced; first in which the respondent are told that the water service was provided by municipal water utility (PDAM), or second in which the respondent are told that the water service is provided by a private company.

This thesis contributes to the scarce knowledge of household willingness to pay for the water service improvement. Such information serves as critical input to policy makers who often lack of empirical data when deciding how much to invest. The paper is also unique as to bring the first evidence of household preferences towards private sector involvement in piped water

provision in Indonesia. The result can be used as a preliminary guideline to consider the potential of introducing private sector participation in Bandung's water sector.

A contingent valuation study (CV) was conducted in Bandung during March 2011 to ask individual households how much they would be willing to pay for uninterrupted water supply in addition to current fees. The survey was undertaken by in-person interviews with 200 households having individual piped water connection who reside in the regions where PDAM distribute water between 1 hour/2 days up to 10 hours/day.

Four hypotheses were advanced to guide the study design:

(H1) Willingness to pay of household with shorter supply duration will be greater than that of households with longer supply duration;

(H2) Female would be willing to pay more than male and highly educated people are willing to pay more for the service improvement;

(H3) Willingness to pay will be lower when household awareness of the risk tied to intermittent water supply is lower;

(H4) Respondents assigned to private sector treatment group will be willing to pay a slightly higher amount than those in the PDAM (government) treatment group.

The last hypothesis is motivated by the fact that water utilities in developing countries are strongly criticized for being inefficient (ADB, 2007), corrupt and rent-seeking (Davis, 2004; Whittington, Pattanayak, Yang, & Bal Kumar, 2002). As reported by several contingent valuation studies in Asia that in many locations respondents distrust the government which they blame for the poor condition of public facilities, and this is reflected in their low WTP for commodities such as water supply improvement (FAO, 2000). Based on that, it is expected that household would pay slightly higher amount for continuous water provided by private sector than that provided by PDAM, provided that their present municipal piped water is delivered in non-continuous basis.

There are limitations that need to be acknowledged regarding the present research. The thesis is accomplished with a limited time and budget, so that the sample size is relatively small and of

non-random selection. This implies that the findings presented herein should be viewed as illustrative rather than generalizable. However, they can provide valuable information for a real contingent valuation study in the future.

The paper is organized as follows. In the next second section the theoretical framework and findings from previous research are presented. In the third and fourth sections, the paper describes the existing Bandung's water supply condition and the study design. The fifth section of the paper presents the findings of the research. Finally, in the sixth and seventh sections the paper offers some concluding remarks and policy implications and direction for future research.

2 THEORETICAL FRAMEWORK AND PREVIOUS RESEARCH

There has been a wide debate over which stated preference or valuation method that most accurately estimates people's preferences when it is not possible to rely on people's revealed preferences. For example, in the case of water development projects in developing nations, estimating revealed preferences usually not works because there are no historical data that exist. In this circumstance, economists need to rely on stated preference approaches such as contingent valuation surveys which directly elicit WTP response from respondents (Mitchell & Carson, 1989). Or as emphasized by Hanemann (1994), surveys offered a way to trace the demand curve for a public good that could not otherwise be gleaned from market data.

In this particular case study, contingent valuation questionnaires were designed to reveal the WTP for a specific alteration in piped water availability. This alteration implies a number of resulting changes in levels of use- and non-use values. The WTP can be used as a welfare measure representing the Hicksian compensating variation because it leaves a respondent at the same utility level after the proposed water improvement and resulting in WTP response (Köhlin, 2001).

As an *ex ante* benefit measurement, maximum WTP relates to but not equivalent to the future economic demand for new or improved water services. From the perspective of estimating future demand, it does not inform how much water will be consumed. Instead it measures the consumer benefits to be applied in the cost-benefit analysis. Or in the context of policy setting, do the benefits of providing 24-hour water service exceed the costs of the infrastructure and operational investments (Pattanayak, Van den Berg, Yang, & Van Houtven, 2006)?

The model is derived from an indirect utility function (*V)* which describes the maximum amount of utility a household can derive from their income (*y)*, given the prices of the goods(*p)* and increased availability of water ($q^1 > q^0$) and the bid function *(WTP).* It is also assumed that the household's utility will depend on other demographic and economic factors *(s)* (Bateman, Carson, et al., 2002).

$$V(y, p, s, q^0) = V(y\text{-}WTP, p, s, q^1) \quad (1)$$

The consequence of the above mentioned equation is that *WTP* should be a function of (i) the initial and final level of water availability (q^0 and q^1), which in this case is the status of water service before and after intervention; (ii) income; (iii) prices faced by the households including those of substitute goods or activities; and (iv) other household's characteristics.

This paper aims to understand how socio-economic traits (S), service characteristics (H) and other variables Z, in this case knowledge and trust, affect WTP. The econometric model of the bid function of household *i* is then given by the equation below.

$$WTP_i = \beta_0 + \beta_1 (S_i) + \beta_2 (H_i) + \beta_3 (Z_i) + u_i \quad (2)$$

Where: WTP_i is household *i* willingness to pay for 24-hour water supply; S_i is socio-economic characteristics; H_i is the service characteristics; Z_i is other control variables; β_0, β_1, β_2, β_3 are coefficients and u_i is an error term.

As previously mentioned, socio-economic factors determine how much households are willing to pay. Richer people has been shown to be willing to pay more (Goodstein , 2008) and women, who in developing countries are often responsible for obtaining water, usually report greater WTP (FAO, 2000). The later hypothesis is refuted in several studies, perhaps because women in developing countries have little control over the household finances and may restrain to express their own opinions for cultural reasons (Singh, et al., 1993). The effect of family size to WTP is ambiguous. Some studies report that WTP vary significantly with family size, while some others conclude that family size is not an important factor (FAO, 2000).

Willingness to pay is also a function of current water supply condition. For example, Fujita et al (2005) report that in Peru, the lower the current water usage volume or the shorter the water availability time, the higher the WTP is.

The existing literature also highlights the knowledge which is associated with different WTP for improving water supply. Choe et al (1996) report that respondents who are more aware that intermittent water supply system is more vulnerable to waterborne disease, are willing to pay more. In relation to the trust variable, it is expected that if respondents do not believe that their water provider are capable of delivering a continuous supply, then they will be willing to pay less (Walsh & McKean, 2002). The finding by Altaf et al (1993) shows that WTP for improved reliability is lower among those households that are already connected with the piped water system as a result of the household's experience and increased skepticism with the existing system (Altaf, Whittington, Jamal, & Smith, 1993).

In the context of private sector involvement, Whittington et al. (2002) examine households' demand for the improved piped water services in Kathmandu, Nepal where the government is considering the possibility of involving the private enterprise. Their study suggests that there is a substantial public support among both poor and non-poor households. Seventy percent of the population is willing to pay fivefold increase in current water bills for the service provided by private operator (Whittington, Pattanayak, Yang, & KC, 2002). Similar findings are also reported by Choe et al for water supply upgrading in India, that respondents are willing to pay more for private sector provision of full continuous service and double increase of number of hours supply than the same services provided by the government.

3 AN OVERVIEW OF BANDUNG AND THE EXISTING WATER SUPPLY

Bandung is located in the western part of Java about 120 kilometers from the capital, Jakarta. The city is situated between 107°36" East Longitude and 6°55" South Latitude, with altitude of 791 m above sea level. With an average temperature of 23.6°C and average raindrops of 156.4 mm, Bandung has humid and cool mountain climate (PDAM, 2006). The city is part of Bandung Basin that is one of Java's largest watersheds. Extending 16,729.50 km², the city area encompasses 30 districts *(kecamatan)* with total population of 2,329,928 people and population growth rate of 1.88%. Its average population density is 14,125 people/km², and Bojongloa Kaler is a *kecamatan* with the highest density of 38,288 people/km² (National Sensus, 2010).

Clean water in this region is provided by the municipally-owned water utility, PDAM Kota Bandung. An official estimate of the service coverage is 65% by 2010 (BPPSPAM, 2010).

However it is not clear whether the number includes informal (illegal) settlement or those that have opted out of the network in favor of other alternatives[2] (Colbran, 2009). In 2005 the total household connections are 143,000, 83% of which are domestic connections (PDAM, 2006). Water customers pay monthly water bills according to their monthly water usage and as part of the water tariff, a sewage treatment fee is collected together with the water price amounting to 30% of the water price.

At present, PDAM Kota Bandung operates at 2,700 liters per second (lps) capacity. There are three main sources of water, namely spring, ground water, and surface water. The major share of water source comes from surface water amounting to 87% of total capacity. Meanwhile, the water originating from spring and ground water contribute 7% and 6% respectively (PDAM, 2006).

The piped water system in this locality is confronted with several drawbacks. The network suffers from high degree of leakage in the pipework leading to 40% water loss from the system which could otherwise be delivered to customers because some distribution network ages 20 years or older. One study by Asian Development Bank (ADB) suggests that fixing visible leak is a priority to boost water capacity in the short term (McIntosh, 2003). Due to the gravitational system, water pressure is uneven depending on the topography and weakens at the end of the distribution lines. This condition is also induced by the practice of leaving taps open to catch whatever water is available. As a result, the network is vulnerable to sewage infiltration making the water unsafe for drinking purpose. Unfortunately, PDAM cannot increase water pressure any further as high-pressure delivery will cause greater water losses from the broken or leaking pipes (Choe, et al., 1996).

Raw water is highly polluted by untreated domestic sewage, solid waste and industrial effluents (Takizawa, 2008). In Citarum River, which is the main source of PDAM raw, water pollution level has compromised public health. This situation is driven by the failure to invest in wastewater collection and treatment as well as to implement legislation pertaining to pollution. Bad raw water quality causes continuous increase in the use of chemical substances (PDAM,

[2] A study in Jakarta revealed that a significant number of households choose not to connect to the centralized network or are in fact connected but are zero consumption customers. These customers simply chose to rely on other water sources' such as deep and shallow groundwater wells with filters, pumps, and pipes, and bought bottled water (Colbran, 2009).

2006). Raw water availability is also problematic in dry season because watersheds are greatly degraded as a consequence of uncontrolled illegal logging[3] in the upstream and human occupation of catchment area (McIntosh, 2003).

Apart from aforementioned drawbacks, PDAM is failed to perform the service at full cost recovery. To date, the municipality applies a two-part tariff consisting of a fixed charge and four increasing block tariffs which structure is varying from Rp 560,- to 4,600,- per m^3 (6 to 51 cent US$ per m^3) (PDAM, 2006). With the existing tariff, the revenue collected from its customers does not cover the operation and maintenance expenses. One report by USAID in 2006 estimates that average water revenues that can be reached is only Rp 2,008/m^3 while the projection of average expense per m^3 of sold water is Rp 3,605/m^3. Clearly, average revenue can only cover 56% of the required average expenses (PDAM, 2006). Although there have been a number of efforts to raise the tariff based on justifiable cost increases, local politicians often interfere tariff setting for political ends (ADB, 2007). Failure to fulfill its operational and maintenance expenses is identified as one of the key failings that hinders reinvestment for rehabilitation and service improvement (PDAM, 2006). Although more than half of Bandung's population is served by piped water, only 60% of that is enjoying 24-hour supplies while for the remaining 40% water is rationed from 1 hour per 2 days up to 18 hours per day.

In national level, an initiative to improve performance has been shown by government's attempt to increase private sector participation. Unfortunately, to date private sector participation (PSP) is limited to out-sourcing of routine repairs, payment collection and billing. A number of donor initiatives to promote PSP have been unsuccessful resulting in the lack of interest from foreign investors (ADB, 2007). The major PSP documented are the two Jakarta concessions[4], a joint

[3] The problems of conserving the catchment area which is mainly located in the northern part of Bandung region are both financial and institutional. Beside the lack of financial resource, the largest share of this catchment area is under the authority of Perhutani (a state-owned enterprise whose role is managing forest resources in the islands of Java and Madura). Conserving this area is problematic as Perhutani is a national institution with limited capacity in the local level to control the ongoing illegal logging.

[4] The Jakarta concessions were signed in 1998 between the Government and two of the largest water services companies in the world: (British) Thames Water International and (French) Ondeo (Suez-Lyonnaise des Eaux) with important targets to be the extension of of the network and increase in coverage of the Jakarta's water supply system. This happened to be one of the largest water supply PSP contracts in the South to date. Under the contract the private consortia were to be responsible for the operation of the water supply system, as well as administration of the customer database and billing. Thames was awarded an exclusive right to existing water supply system in the eastern half of the city, while Lyonnaise des Eaux was given the contract to supply western half of the city (Bakker, 2007). However, the private companies are as inefficient as the former public utility they replaced. Their only incentive is to improve water bill collection, and reduction of illegal private wells, while the coverage ratio and number of connection remain roughly the same (Colbran, 2009). Despite this underperformance, water price in Jakarta is reported to be the highest in South East Asia.

venture in Bali, and a private operator in Batam (ADB, 2007; Bakker, 2007). There are some international companies implementing built-operate-transfer scheme (BOT) under which water produced by private enterprises is sold to PDAM. Little interest has been given to operation and maintenance of secondary city water systems due to regulatory framework deficiency and resistance from PDAM and the general public (ADB, 2007). This is also the case in Bandung locality[5].

The effect of unreliable supply of piped water is detrimental for Bandung's environment. As piped water becomes more and more scarce, ground water is an option to meet household demand of water at the least cost. Ground water is a natural resource available and ready to use without processing as its quality is relatively stable and usually meets health standard. A study in the Metropolitan Bandung[6] area estimates that nearly 70% of domestic water needs are satisfied by the use of groundwater. Owing to improper regulation, excessive and unlicensed groundwater abstractions has lead to water table depletion and land subsidence[7] (Takizawa, 2008).

4 DESIGN OF THE STUDY

4.1 Contents of the Survey Questionnaire

Each questionnaire for the household survey comprised of four basic parts. The first part contained the questions about the existing state of water supply in the household level, including their average monthly water bills. The second part of the questionnaire was the scenario description of the service improvement as providing: 1) 24-hour service, 7 days a week; 2) sufficient water for domestic use; 3) prompt from using storages, electric pumps and private wells; and 4) sufficient pressure in the distribution lines. An open ended elicitation format was employed following the scenario description to obtain household's WTP for uninterrupted service as a water bill surcharge. The third part of the questionnaire asked respondents about their knowledge that a continuous water service with sufficient pressure might reduce the chance of getting waterborne diseases. Finally, the last part sought information about household socio-economic characteristics.

[5] Personal communication with Agung Sugiyanto, a senior officer at PDAM Kota Bandung.

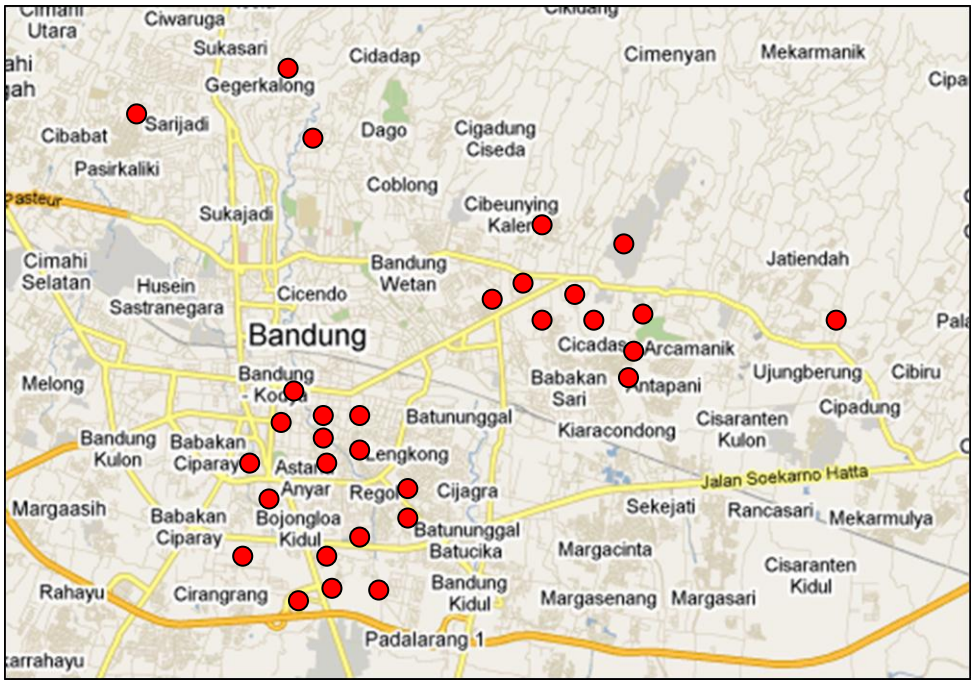
[6] Metropolitan Bandung area is is the metropolitan area surrounding the Bandung City. These areas include Bandung regency, Bandung city, Cimahi city, Sumedang regency dan Garut regency (http://diskimrum.jabarprov.go.id/index.php?limitstart=160)

[7] Land subsidence is defined as sinking elevation of the ground surface; the process may occur over an aquifer that is slowly draining and decreasing in volume because of pore collapse (http://www.alcwin.org/Description_Of_Planet_Dictionary-623-L.htm).

4.2 Experimental Design

For approximately four weeks in March 2011, household survey was conducted in Bandung. Prior to the real survey, focus group discussions and pilot testing were held in Gothenburg, Sweden. By making use of PDAM distribution map, 31 sub-districts (*kelurahan*) in Bandung were selected purposively (Figure 1), with the intent of representing the samples of households receiving intermittent supply. In these sub-districts water is rationed from 1 hour per 2 days up to 10 hours per day[8]. The areas encompass the northeastern, southeastern northwestern parts, some of which are situated in the Bandung's suburban areas. The targeted sample was restricted to the adult population (those over 18 years old) of all the areas under consideration.

Figure 1 Map of the Survey Areas



Source: Google Map

Note: The dots are unscaled representation of the survey areas

Respondents were randomly assigned to two treatment groups, i.e. the PDAM and Private group. The two groups were given the same arrangement of questionnaire as outlined in 3.2 with the

8 Note that the study areas were restricted to the sub-districts where water is rationed from 1 hour/2 days up to 10 hours/day. But in reality when the field work was performed there were households whose water availability was more than 10 hours/day but still in intermittent basis and they were included in the survey. The plausible explanation is because water availability fluctuates between rainy and dry seasons, or water pressure varies dependent upon geographical areas.

distinctive feature rested in the scenario section and trust question. In the PDAM group, the scenario read:

> ‘Suppose that PDAM will improve the piped water service in your neighborhood to provide a 24-hour of water for everyday…’
> ‘Suppose that you can pay a fixed cost to switch from your current intermittent water supply to a 24 hour water supply provided by PDAM, how much at the maximum would you be willing to pay per month in addition to your current water bills?’

While the private treatment group received the other version which read:

> ‘Suppose that there is a possibility for a private company to improve the piped water service in your neighborhood to provide a 24 hour-water supply for everyday….’
>
> ‘Suppose that you can pay a fixed cost to switch from your current intermittent water supply to a 24 hour water supply provided by a private company, how much at the maximum would you be willing to pay per month in addition to your current water bills?’

The researcher found it challenging, however, to explain the possibility of private sector to deliver piped water to users as there were a number of possible schemes in PSP in which built-operate-transfer was the most common one. Most respondents asked whether they would use the existing distribution lines or there would be completely new lines. This question was rather unanticipated; hence for the second group the scenario was to keep the present distribution lines under private sector management. The decision was made to ensure that the results produced by two treatment groups were comparable.

Appendix 1 provides the complete field work procedure and survey implementation.

4.3 Handling the Data

Prior to the statistical analysis a basic inspection of the data was performed. The first step was to check the credibility of WTP responses. WTP amounts that are unrealistically large, given the income of the households, should be treated as data entry errors or signal that the respondent has given little consideration to his/her budget constraint. Carson suggests that when the commodity being valued is a public policy affecting environmental quality, reported WTP figures should not

exceed five percent of household income (FAO, 2000). In this survey, income is presented as intervals, hence to allow a credibility check a lower and upper limit was set and all WTP responses were definitely realistic.

The second stage of data cleaning was the protest zeros. A protest zero is a zero response to the valuation question expressed by a respondent who actually has a positive WTP amount for the commodity because he/she disagrees with some aspects of the scenario. The questionnaire facilitated 6 categories for zero response. Prior to statistical analysis zero response were refined to separate the genuine zeros from the protest zeros, and the later were excluded from the analysis.

There were also 6 respondents reporting negative willingness to pay to the valuation question, mostly because they perceived that the metering system was incorrect. Thus, in the econometric analysis negative WTP was treated as genuine zero.

Finally the last step was sorting the data in the *hour* variable provided within the questionnaire. This is a categorical variable containing 'other' in the fifth category which could be problematic for the statistical analysis. Out of 200 samples, 34 household reported 'other' as their answer to the question of water availability. These responses were scrutinized and grouped. The first group consists of 17 responses in which 'other" means water availability more than 13 hours per day, while in another 15 respondents did not know how many hours per day they acquired water. For the purpose of econometric analysis the later was not included.

5 RESULTS

5.1 Socio-Economic Profile of the Sample

Table 1 summarizes the socio-economic characteristics of the total sample of respondents.

Table 1 Descriptive Statistics of Sample

Variable	Description	Mean	Std.	Min	Max
Sex	=1, if male	0.33	0.47	0	1
Age	Years	46.62	12.85	19	86
Family	Number of people in the HH	5.67	2.76	1	20
Child	Number of children in the HH	2.05	1.57	0	11
Income	Total HH Income	2.61	1.05	1	5
	=1, if ≤ Rp 500,000,-				
	=2, if Rp 500,001 – 2,000,000,-				
	=3, if Rp 2,000,001 – 3,500,000,-				
	=4, if Rp 3,500,001 – 5,000,000,-				
	=5, if ≥ Rp 5,000,000,-				
Education	Completed level of education	3.04	1.2	1	5
	=1, if completed primary school				
	=2, if completed junior HS				
	=3, if completed senior HS				
	=4, if completed diploma degree				
	=5, if completed university				
Provider	=1, if PDAM (Government)	0.5	0.5	0	1
Hour	Water supply per day	2.4	1.34	1	5
	=1, if ≤ 3 h/day				
	=2, if 3 – 6 h/day				
	=3, if 7 – 10 h/day				
	=4, if 11 – 13 h/day				
	=5, other				
Knowledge	=1, if know about the health issue	0.13	0.49	0	1
Trust	Trust to provider	3.02	1.07	1	5

Female constitutes 67% of the total sample. This might be because men were at work during the survey. However, even if the researcher found both men and women in the house, the men tended to leave women to respond since in general women were accustomed to deal with the matter every day. The majority of respondents fell under the second lowest income level for three plausible reasons. First, because it was hard to get the higher income households to participate in the survey. Second, there was a tendency that the study areas were either densely populated areas inhabited by the lower income households to a very large extent or areas located

quite distant from the main streets where PDAM laid its main pipes[9]. Third, some wealthier residents had opted to switch to privately owned semi-deep wells – usually called 'jet pump'.

The average member in the household being surveyed is 5.67 persons. Fifteen percent (15%) of them live in a building with two or more households. The implication of this is quite significant to the income measurement as respondents in that particular condition are unable to estimate the total household income. Consequently, the responses obtained are rather invalid measurement of total household income.

The mean number of children in the family is 2.05. Forty eight percent (48%) of respondents are senior high school graduates, whereas 12% have a diploma degree[10] and 7% have earned university degree. (See Appendix Table A.1 for the full descriptive statistics).

It is very likely, however, that the socio-economic features of the sample do not resemble those of Bandung population as the survey fails to gain an adequate participation from the higher income households residing in the targeted *kelurahans*.

5.2 Water Supply Condition of Sample Households

Among the 200 person interviewed in the household survey, 31% of sample received piped water less than 3 hours a day[11], these include households receiving water less than 6 hours for every 2 days. All respondents reported that they were engaged in at least one coping strategy. In these *kelurahans* the most common coping strategies were installing storage tanks, electric pumps, and drilling wells. All respondent's houses were equipped with storages which came in the forms of underground or roof top storage, barrel, and bucket, whereas only 3% of respondents reported collecting water from public taps. Reliance of vended water varied across *kelurahans*, but overall 9% of all households reported purchasing vended water at least occasionally. Approximately 20% of households had a private well and another 36% respondents installed electric pumps

[9] There are two disincentives for PDAM to rehabilitate the network in densely populated neighborhoods. First, in highly dense and disordered homes, higher installation cost per household connection is required because installing connections might be more time consuming (notably if conventional bellow ground infrastructure is used). Second, water customers in these neighborhoods are classified in the lowest tariff band which is well below the production cost, meaning that increasing water availability in these particular homes will decrease the average revenue per cubic meter water sold (Bakker, 2007).

[10] Diploma programs are a series of classes focusing on both theory and practice in a particular field. This program is concentrating more on a particular area, such as diploma program in hospitality, nursing or marketing (http://www.intstudy.com/study_abroad/nuscert02.htm). The degree is attained after 1 – 3 years of study.

[11] Seventeen percent (17%) of respondents fell under 'other' category. These are households whose water supply is considerably irregular or those who were unable to specify how many hours/day they received water since they install an automatic device which opens the taps automatically whenever water comes and closes them after the storage is full. Also included in this group is household receiving more than 13 hours/day water delivery.

without which piped water could not be collected. It was also evident that a very large proportion of sample households adopted more than one measure at the same time. As an example, households in *kelurahan* Cigending spent their incomes on more than one source to meet their demands; i.e. groundwater abstraction, vended water and the utility piped water[12]. Additional cost therefore diverged depending upon the choice of coping strategies. It is also worth noted that the answers to water availability and coping strategy questions could have been different had the survey been conducted in dry season.

Fifty five percent households rated current water service as unsatisfactory. Respondents reported monthly water bills ranged between Rp 12,000 – 600,000,-, and the mean water bill for total respondents was Rp 74,530,-.

5.3 Knowledge and Trust Responses

The survey results brought evidence of a substantial lack of knowledge about the link between intermittent supply and water borne diseases; 87% of all respondents reported that they had not heard or known about the issue. The five scale measurement of trust used in this survey did not measure respondent's trust to government/private enterprise related to corruption issue as intended by the researcher. Rather it measured respondent's faith in PDAM/private sector capacity of providing a 24-hour service. Most households in both treatment groups perceived that water resource was the main cause to intermittent supply rather than corruption issue.

The question read as follows:

'Do you believe that if you actually pay the money, PDAM/a private company will actually provide your household with a 24- hour water service with the characteristics described earlier?

For all respondents irrespective of their treatment groups, 55% of households assigned score 3 to the trust variable, 22% believed or strongly believed and another 23% disbelieve or strongly disbelieve that PDAM or private company was capable to deliver an uninterrupted supply. Comparing trust score between two treatment groups, the chi-square test revealed that there was no statistically significant difference in the score between groups (see Appendix Table A.6).

[12] There are some possible reasons that some households utilize more than one source of water: (i) the use of piped water is rationed implying that additional water must be drawn from alternative source; (ii) it is relatively cheap to take only a certain amount of water from a specific source, for example household may have limited capacity to draw cheap water from a well therefore choose to obtain the rest from more expensive source such as piped water; or (iii) that different source of waters are used for different purposes (Nauges & Whittington , 2009).

5.4 Willingness to Pay Result

Based on the responses to the open ended WTP questions, two types of analysis are employed namely total mean WTP, when all WTP responses for both groups are aggregated; and mean WTP based on service provider (the two treatments) as presented in Table 2. The first analysis reveals that total mean WTP including the protest bids is Rp 20,131,-. However, when protest bids are omitted the figure rises to Rp 22,156,- corresponding to 29.7% increase from the average current water bills and the median is Rp 10,000,-.

The substantial difference recorded between the mean and median WTP suggests that distribution of WTP is asymmetrical. In such cases, median might offer a better WTP estimate than the mean. As a matter of fact, there is no single 'correct' measure of WTP, thereby both can serve as benefit estimation depending on the goal for which it is being used (Carson, 2000). For that reason both estimates are presented. On the one hand, mean WTP is the conventional measure used in cost-benefit analysis, while on the other hand median WTP which is related to the flat amount that will gain a majority acceptance, is usually a standard public choice criterion (Carson, 2000).

Table 2 Two Analysis of Average Willingness to Pay

Total Average Willingness to Pay		
Including protest bids	Rp 20,131,-	
Excluding protest bids	Rp 22,156,-	
Average Willingness to Pay Based on Service Provider		
	Provider	
	PDAM (Government)	Private
Including protest bids	Rp 20,897,-	Rp 19,390,-
Excluding protest bids	Rp 24,422,-	Rp 22,546,-

A surcharge of 29.7% is fairly high and the magnitude can be greater if a larger number of high income households were included in the survey. As a comparison, a study by Genius et al (2008) in Rethymno, Greece revealed that WTP for continuous supply and improvement of tap water quality was associated with 17.67% of average water bills. In line with that, Fujita et al (2005) found that estimated household affordability to pay (ATP) calculated based on the household incomes and expenditures survey data for improved water and sanitation was roughly 10% - 20% lower to 20% higher than the current average payment level.

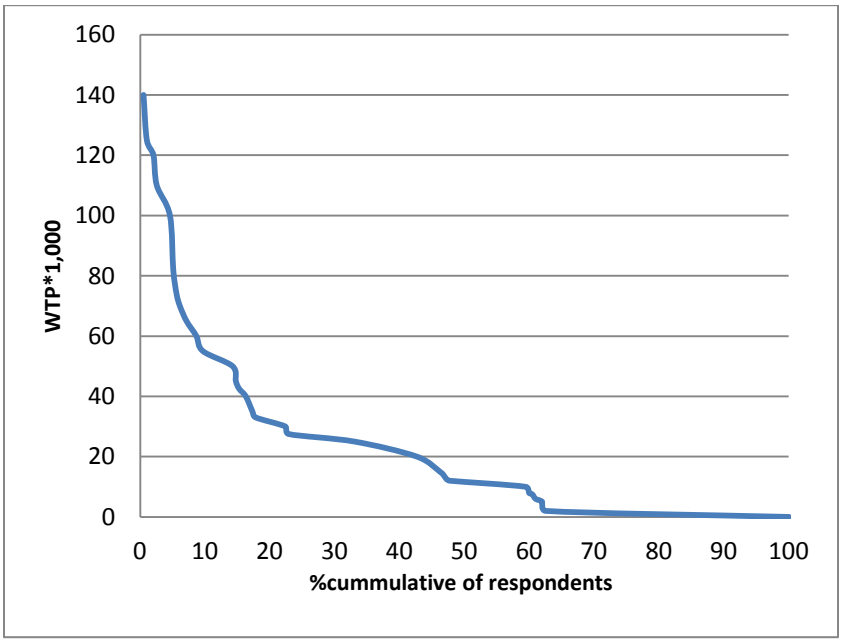
An independent-samples t-test is exercised to compare the mean willingness to pay between the two treatment groups and no significant difference of mean WTP is found between them (see Appendix Table A.5). However, the mean willingness to pay in the private treatment group is slightly lower than that of PDAM (Government) group as displayed in Table 2. Private group also has 10% more zero WTP than does PDAM. This might be due to respondent's preference to status quo, since the notion of 'private sector' in water service is somehow a novelty to respondents. Even though small-scale private water providers or self-provision at the community level exist at least in some *kelurahans*, their capacity of delivering a continuous supply is still questionable and the water quality is perceived by respondents as lower than that of municipal water. In addition, there is also a non-negligible resistance revealed by respondents to private role stemmed from the belief that private operator will charge water at higher price.

Figure 1 graphs household willingness to pay data for uninterrupted water supply in Bandung, where the horizontal axis represents the cumulative percentage of households while the vertical axis is the monthly water bill surcharge. It is clear from the graph that more than 60% of households are willing to pay for the service improvement, nonetheless, still fewer than 20% of respondent are willing to pay more than Rp 40,000,-. High rates of positive willingness to pay confirm that respondents understand very well the scenario in the questionnaire or the good under valuation. This argument is supported by the fact that a significant number of respondents once experienced 24-hour supply of water. Further, the debriefing question affirms that convenience and reduction to electricity consumption[13] are the most common grounds for paying; conversely, the desire to reduce health risk is less salient. This is not surprising as the majority of respondents are unaware of the health risk related to the current water service. Provided that 58% of household's income fell under the first and second lowest category, the finding refutes the claim that the poor[14] are not willing to pay anything for uninterrupted supply.

[13] This is particularly factual for household with additional electric pumps installed to draw water from distribution lines or to transport water from underground storage to in-house storage.

[14] A standard by World Bank for 'poor' category of household is used to refine the household income data, i.e. $2 PPP per capita/day. This gives a figure of approximately Rp 2,000,000,- for a household with 5.7 members. Thus, the households giving 1 and 2 responses for income measure are then classified in the 'poor' category.

Figure 1 Distribution of WTP Responses for a 24-hour Water Supply



In spite of the high rate of positive WTP response, still 40% of the sample declined to contribute for the improvement[15]. Table 3 below summarizes the analysis of zero WTP.

Table 3 Frequency and Description of Zero WTP

	Responses	Frequency	Percent
1.	The current service is satisfactory	5	6.8
2.	The current tariff is sufficiently high, I cannot afford more	30	40.5
3.	The government should provide water	9	12.2
4.	I don't believe that the investment will be made successfully	10	13.5
5.	I will pay if the water quality is improved	4	5.4
6.	Other	16	21.6
	Total	74	100

The real zero WTP value herein is represented by responses number 1, 2, 5 and 6 while the responses number 3 and 4 are accounted as protest bids and they are not included in the econometric analysis.

[15] High zero responses may be a consequence of the open-ended valuation question. In spite of the more informative nature of open-ended question as a maximum WTP estimate, this elicitation format is subjected to several problems, such as large non-response rates, zero answers and protest answers (Mitchell & Carson, 1989). Respondents encounter a difficulty answering the question since in real market situation, buyers are usually confronted with a fix cost then decide whether or not to buy the good accordingly (Bateman, Carson, et al., 2002).

Below are responses included in 'other' (number 6):

a. The piped water I'm receiving is sufficient, I don't need a 24-hour supply
b. Collecting or storing water is ok, I'm used to the situation

5.5 Econometric Analysis of WTP

The econometric analysis of the WTP is divided in two parts in which the first one focuses on the probability of stating a positive WTP while the second part analyzes the determinants for WTP given that WTP is positive (i.e. does not include those respondents with zero WTP). Hence, the analysis is conducted assuming that there are two decisions, first the decision to pay anything (P(WTP>0)), and secondly given that households have decided to pay something how much they will pay (WTP|WTP>0). A more advanced econometric approach of the analysis is unfortunately out of scope of this paper (see for example Carlsson, et al. , 2010 for estimation using a Tobit type 2 model on WTP data).

The probability to pay anything (P(WTP>0)) is estimated using a logit estimation (STATA). The dependant variable is a dichotomous variable equal to 1 if WTP>0 and equal to 0 if WTP=0. The results are presented in Table 4, and as can be seen only education has a significant effect on the likelihood of stating a positive WTP. Less educated respondents are less likely to have a positive WTP. Other variables, such as sex, family size and water availability are not contributing factors to the odds of reporting a positive WTP. The output from chi-square test indicates that the likelihood to state positive WTP does not differ statistically between the two treatment groups (see Appendix Table A6).

Table 4 Logistic Regression Model for WTP>0 (Marginal Effect)

Variable	dy/dx	Std. Err.	P>|z|
Family	-0.0038923	0.01783	0.827
Sex*	-0.0599534	0.07989	0.453
Children	0.0235724	0.03189	0.46
Education	0.1012736***	0.03253	0.002
Hour	-0.0399837	0.026	0.124

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Note: (***) significant at 1%

To obtain the determinants of WTP (WTP|WTP>0), this inquiry employs an ordinary least square (OLS) regression and the result is summarized in Table 5.

Table 5 Ordinary Least Square for WTP>0

WTP	Coef.	Std. Err.	P>t
Sex	7496.053	5769.445	0.197
Age	161.2287	214.9508	0.455
Family	3536.334***	1309.856	0.008
Children	-4213.075*	2313.612	0.071
Education	7619.848***	2248.814	0.001
Hour	-2879.824	1973.898	0.148
Knowledge	8758.486	7211.526	0.227
Trust	-1178.171	2776.497	0.672
_cons	-3536.427	16989.04	0.836
R-squared	0.2278		

Note: (***) significant at 1%, (*) significant at 10%

The regression yields a relatively low R-square, showing that approximately 23 percent of the variance in willingness to pay is explained by the model. This could be due to the small sample size and the possibility of omitted variables such as income (which could have explained the dependent variable).

Unlike our hypothesis, the *sex* variable in this model has a positive coefficient, indicating that men are willing to pay more than women are, however the coefficient is not significant. This model also predicts that family size has a positive effect on the WTP, which also makes sense as greater number of family member demand more water. In similar vein, higher education level encourages people to report higher willingness to pay. Even though various studies report different effect of number of children on willingness to pay, the present model yields a negative coefficient, which means that smaller number of children in the family corresponds to greater willingness to pay. The variables measuring age, water availability, knowledge about health effects, and trust are all insignificant, and hence do not seem to affect WTP.

The two regression models found that education is a determinant for both the decision to pay anything and how much households are willing to pay. Whereas family size and children are more important for determining how much respondents would like to pay. Interestingly, duration of water supply (represented by the *hour* variable) seems to be unrelated either to the likelihood of stating positive WTP or to the magnitude of WTP.

5.6 Validity of the Findings

A large body of literature has proved the usefulness of CV studies for eliciting household preferences for water improvement in developing nations. However this needs to be tested from one case study to another. Although validity testing is beyond the scope of this study, some potential biases arising from the hypothetical nature of CV study, the choice of elicitation format, or the environment at which the study is performed merit a discussion.

First of all, there is no indication of scenario misspecification error which might deter the validity of the findings. Bias in this category occurs when a respondent does not respond to the correct valuation scenario because respondent does not understand as the researcher intends it to be understood (Bateman, Carson, et al., 2002). As discussed earlier, the chance was minimized because to a large extent respondents already had experiences with continuous, on demand and high pressure delivery. This implies that the potential benefits gained by household through which the upgrading will provide are tangible. Indeed, to make the scenario credible for the second treatment group, it should reflect the private sector involvement that is being considered by the local water utility. Thus, a consultation with PDAM is crucial prior to scenario development.

There is an observable rounding error which is quite problematic due to open-ended WTP bids. Oftentimes households stated their WTP to a certain rounded figure (FAO, 2000) using existing water bill as a reference point. For example if the reported water bill is Rp 80,000,- then the stated WTP would be Rp 20,000 to round the figure to Rp 100,000,-. Rounding error produces a bias response as the stated WTP does not represent the correct value of the the public good under consideration.

Strategic behavior might exist during the survey as in many occasions respondents perceived that the researcher worked for PDAM or private company. This bias is present when a respondent gives a WTP amount that deviates from her true value in an attempt to influence the provision of the good and/or the respondent's level of payment for the good (Bateman, Carson, et al., 2002). In an extreme fashion, understatement can lead to zero WTP. Unfortunately, the assessment of the extent to which these biases influence the amount of WTP is hardly possible.

The environment at which the study was performed should be taken into consideration when assessing the validity. In Indonesia, where paternalistic approach governs most policy making

process, people are not used to be asked to reveal their individual preferences, notably in the case of water provision. The problem with this is that people will hesitate or decline to answer.

6 CONCLUDING REMARKS AND POLICY IMPLICATIONS

Using 200 sample households, this contingent valuation study proves that providing 24-hour supply in Bandung will generate a social benefit. To a very large extent, respondents value the cost associated with intermittent supply and they are willing to pay to avoid it. More than 60% of respondents states positive WTP with the mean value of Rp 22,156,-/month which corresponds to 29.7% increase from existing average water charges, and the median WTP is Rp 10,000,-. In this thesis, both mean and median values of WTP are presented to permit policy makers to consider which can be best used for water policy. In line with that, a further inquiry over the costs of this investment should take place to examine the economic feasibility of the upgrading to be provided.

The econometric analysis shows that people with higher education, larger family size and households with children will be willing to pay more. On the other hand the decision for paying or not paying anything for the service improvement is determined only by education level. Households attaining higher education level are more likely to have a WTP greater than zero.

Despite the fact that households borne additional costs, still a significant number of respondents are not willing to pay anything. In these particular areas, inability to pay seems to be the strong motive to state zero WTP. From the perspective of water policy, an assessment of affordability of price is pivotal because water is not only an economic commodity but also a social and cultural good (UN, 2002). If PDAM intends to raise water tariff those three aspects should be taken into consideration. One possible solution is to impose different tariff structure based on supply duration. For example, PDAM can raise tariff only for those who currently receive 24-hour supply to enable a full cost recovery while at the same time improve the service in the area where supply is rationed. Even though there are some households that may be comparatively worse off with the arrangement, because their water bills rise, the population in general would benefit more from an equal distribution of water.

The investigation finds that sample households are willing to pay slightly higher to PDAM than private company (even if the difference is not significant). This can be important for policy implication if Bandung's local government attempt to draw private sector participation for in-

house water provision. Respondents seem to prefer status quo when it comes to who would provide water. Hence, financial, technical and institutional development in PDAM can be a better option to address the problem of intermittent supply.

It is also evident that 87% of households are unaware of the hazard inherent in the non-continuous supply. Undoubtedly, hygiene education is crucial for both policy makers and residents, because such system would put piped water users at risk.

This study has shown that the CVM can be employed to provide the government with fruitful information on water services, thereby permitting efficient resource allocation among various public service alternatives. However, caution must be given to potential biases especially if WTP will be applied as the basis for tariff setting.

It should also be taken into consideration that the outcome in a contingent valuation study is also very sensitive to the way in which the questionnaire is set up. For this reason, comparison with the outcomes produced from different regions or with different methodology such as revealed preferences is always recommended. Unfortunately, comparing the present estimate to other estimates is difficult because there have not been many studies using contingent valuation in Indonesia.

7 DIRECTION FOR FUTURE RESEARCH

This part is dedicated to what have been learned from the pilot research, what have been missing and how a future contingent valuation study for 24-hour water delivery could be better administered.

A future contingent valuation study should be conducted both during the wet and dry seasons, since water availability and coping strategies vary significantly between seasons. This signifies that the WTP reported by households can be dissimilar. Moreover, whenever possible a further study should be conducted in a comparable city to verify the usefulness and the accuracy of the contingent valuation results.

Even though in-person interview offers the utmost reliability of contingent valuation study, this technique is very expensive to implement. A mail survey can be an option with additional advantage of giving respondents time to think and gaining more participation from the higher

income households and the working class. However, a number of studies showed that giving time to think usually led to a lower WTP result.

But, whichever survey technique is chosen, the questionnaire itself necessitates a development. Acknowledging the shortcomings of open-ended elicitation format, the use of the close ended format such dichotomous choices, payment cards, or bidding game is recommended to reduce biases and zero bids. The real study can utilize the WTP variations obtained from the thesis to construct the bids. There are many ways of eliciting income information that can be introduced to give a more accurate measurement such as electricity bill, the number of toilets, etc. The coping cost has not been deeply explored in this thesis, therefore understanding how household with different coping strategies decide whether or not to pay anything can be interesting to policy makers.

To investigate whether or not water users perceived that intermittent supply relates to corruption, a well designed survey should be exercised (see for example Davis, 2004). Because, it is almost impossible to ask respondents with such questions and gain their truthful opinions without allowing an opportunity to develop a 'relationship' with the interviewer.

There is still a room for much more research on the application of CVM to projects in developing nations. The most closely related issues are of course sanitation improvement and watershed protection, which are integral parts of water resource management and yet not widely explored.

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Appendix 1 FIELDWORK PROCEDURES AND SURVEY IMPLEMENTATION

The Content of the Questionnaire

The questionnaire consists of four independent sections and designed to be completed in 20 minutes. The first section focuses on the household's existing water supply situation and its level of satisfaction. In this section respondents are asked about water availability in their homes in terms of hours/day and also their strategies to deal with unreliable supply of water. This question was introduced to remind households that they spend a certain amount of money or time as a consequence of their current water situation. Then the questionnaires also ask household expenditure on water for the last 12 (twelve) months. This question is important to force respondents to in some way to consider the relevance of budget constraint prior to giving any valuation answer (Santagata & Signorello, 2000). Following that is an attitudinal question which asks whether or not households were satisfied with the current situation. The purpose of the question is to measure to what degree households are satisfied with the current distribution system and not to measure household satisfaction in relation to the quality of piped water.

The second section is the scenario where the good under valuation is carefully explained. The scenario describes what a 24-hour water service is, who will be responsible for the delivery of service, what advantages they will get from the project, and how household will contribute. It is important to explain to the respondents that the improvement will *not* increase the water quality. Open- ended elicitation format is used to ask how much households would pay at maximum for a 24-hour water service in addition to their current water bills. Based on the focus group discussion and pilot testing open ended question worked properly because respondents seemed to be able to state their willingness to pay based on the bills they usually pay to the water utility. Putting it in other words, they have a reference point to consider before stating their maximum WTP. To check the consistency of respondent's WTP answer, a follow-up question asking why they are willing or not willing to pay was then presented.

The third section seeks information about the respondent's knowledge about health issue tied to intermittent water supply, i.e. whether they are aware that a continuous water supply can prevent infiltration of sewage thereby may reduce the chance of getting waterborne diseases.

Subsequently, the trust question is introduced to measure respondent's believe to the offered water provider.

Finally, the last segment includes questions about the socio-economic characteristics of households such as age, gender, income level, family size, number of children as well as education level (Alberini, Kahn, & Corporation, 2006). The socio economic part is located at the end the questionnaire because income is a delicate issue; people are very often reluctant to report their income. Hence with such arrangement the risk that respondents skip the most important part, which is the valuation question, is diminished.

Selection of the Study Area and the Participants

The study areas are constrained to the regions where according to PDAM map water is rationed at the maximum 10 hours/day. These areas were chosen based on focus group discussion and pre-test. From focus group discussion and pre-test, it was felt that respondents who received an 'almost' continuous supply had a little demand for continuous water supply. Respondents with this characteristic seemed to be much more interested in obtaining water with the same quantity but of better quality, preferably potable water.

This research focuses on the households that owned or rent their houses and individually connected to the municipal piped water system. Renters who have individual connections were also surveyed, but renters whose connections were shared with land lords were not included in the survey. At first glance, one might think that these households should be asked about their demand for 24-hour service. However, difficulties arise because they pay a certain share of water bills decided by the house owner, and in many cases this share is incorporated with the electricity bills paid to their landlord. Hence, they are somehow not in any position to make a decision for the offered improvement. Two hundred (200) samples were collected and their responses were analyzed.

The Procedure and Survey Implementation

The household questionnaires were developed over two weeks of pre-testing and focus group discussion. The focus group discussion was carried out informally with Indonesian students, to learn: (1) how water is distributed in their homes; (2) are they satisfied; (3) is a 24-hour supply

demanded; (4) would they pay for it if provided and (5) their coping strategy might affect their WTP.

Following the focus group discussion was the pre-testing. In contingent valuation study, pre-test is a tool to understand how real people would react to the questionnaires, whether there are any misunderstandings of the questions by respondents and whether respondents understand the questions as intended by the researcher (Alberini, et al., 2006). Due to limited resources, the focus group discussion and the pretest were carried out with 7 (seven) Indonesian post graduate students who were residing in Gothenburg and Borås. Six (6) of them are studying in Chalmers and 1 were studying at the College of Borås. These students were restricted to those who had individual connections to the municipal water utility. They were selected because they were accustomed to piped water condition; additionally they are familiar with the currency being used in the valuation. Within the sample there are 5 males and 2 females.

Initially, the scenario included the technical part in which respondents were given information about how the investment would be used (minimizing leakage, rehabilitation of old and damaged distribution lines, preparation of new installations, increasing water debit, and improvement of distribution system). But during the pretesting, it appeared that respondents did not really bother going into the technical details, instead they paid attention more into the benefits offered by the new system. For that reason, the questionnaire was revised accordingly into a more compact and simplified form. During the real survey, however, the technical details were explained only to respondents who demanded more explanation.

The researcher realizes that the sample used in the pre-test is a bias sample, because they do not resemble the real household. In a real contingent valuation (CV) study, the pre-test should be a set of units from the target group of people to which the study was intended (Alberini, et al., 2006). Despite that fact that the pre-test sample is biased, the information gathered from the pre-test was valuable for the questionnaire development.

The final survey was performed in Indonesia during the rainy season from March 3rd to 30th, 2011 from approximately 09.00 – 17.00, by in-person interview at the respondent's homes. Some of the surveys were carried out during the weekends to gain more participation from the working class, higher income household and male respondents.

Samples were extracted from the population and then randomly assigned to one of the two treatments, i.e. either the PDAM group or the private group, and Table A.1 summarizes the total respondents completed for each *kelurahan*. It was assumed that the socio-economic characteristics of respondents do not diverge significantly. The major difficulty in the survey was to find the exact area with the specified water service characteristics. This occurred because there has been a substantial change in the state of water distribution not recorded in the distribution map. In some parts of the targeted area households have opted out from the system because they do not receive water; on the other hand there are a number of households in the targeted area who stated that they have received 24-hour supply. The effect is substantial for the distribution of samples in each *kelurahan*.

For each respondent the researcher read the questions aloud and took notes on his/her answer. When respondents misunderstood some part of the question, the question was then redelivered. This also applies to the scenario description; each respondent was asked whether or not they could understand it and if they did not or misunderstood, the scenario was reread. The researcher found, however, that measuring trust was not a simple task. This was particularly true for the private group. Respondents usually stated that they had not had any experience with private provider and therefore hard for them to imagine and further put it in a scale measurement.

Table A.1 Completed Samples for Each *Kelurahan*

No.	*Kelurahan*	∑sample	Freq (%)	No.	*Kelurahan*	∑sample	Freq (%)
1	Ancol	5	2.5	17	Karasak	6	3
2	Antapani Kidul	8	4	18	Kebon Lega	5	2.5
3	Antapani Tengah	8	4	19	Mandalajati	5	2.5
4	Balong Gedhe	6	3	20	Mekarwangi	5	2.5
5	Ciateul	6	3	21	Padasuka	5	2.5
6	Cibaduyut	6	3	22	Panjunan	5	2.5
7	Cibaduyut Wetan	5	2.5	23	Pasir Layung	5	2.5
8	Cicadas	6	3	24	Pasir luyu	3	1.5
9	Cicaheum	11	5.5	25	Pelindung Hewan	6	3
10	Cigending	6	3	26	Pungkur	5	2.5
11	Cikawao	6	3	27	Sarijadi	9	4.5
12	Cikutra	20	10	28	Situsaeur	6	3
13	Ciseureuh	3	1.5	29	Sukamaju	6	3
14	Gerlong	6	3	30	Sukapada	11	5.5
15	Hegarmanah	5	2.5	31	Wates	6	3
16	Karanganyar	5	2.5				
	Total	**112**	**56**		**Total**	**88**	**44**

Appendix 2 STATISTICAL ANALYSIS

Table A.2 Summary Statistics of Responses

	Variables	Variable	Mean or Freq (%)
Socio-economy	Sex	male	33
		female	67
	Average age		46.16
	Average number of family member		5.67
	Average number of children in the family		2.05
	Income	up to Rp 500,000	8
		Rp 500,001 - 2,000,000	49.5
		Rp 2,000,001 - 3,500,000	22.5
		Rp 3,500,001 - 5,000,000	11
		> Rp 5,000,000	8
		no response	1
	Education	primary school graduate	12
		junior high school graduate	15.5
		senior high school graduate	47.5
		diploma graduate	18
		university graduate	7
Service Characteristics	Duration of water flow	less than 3 h/day	31
		3-6 h/day	24.5
		7-10 h/day	15.5
		11-13 h/day	12
		other	17
	Coping strategies*	private well	20
		purchase vended water	9
		electric pump	36
		water storage	100
		public taps	3
	Satisfaction	satisfactory	45
		unsatisfactory	55
	Average water bills (Rp/month)		74,530
Other	Knowledge	yes	13
		no	87
	Trust	1-2	23.56
		3	54.60
		4-5	21.84

*Note: *Households might engage in more than one coping strategies*

Table A.3 Logistic Regression

Iteration 0: log likelihood = -101.06499
Iteration 1: log likelihood = -94.155978
Iteration 2: log likelihood = -94.007784
Iteration 3: log likelihood = -94.007494
Iteration 4: log likelihood = -94.007494

Logistic regression

	Number of obs	167
	LR chi2(8)	14.11
	Prob > chi2	0.0149
Log likelihood= -94.283586	Pseudo R2	0.0698

wtp	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Fam	-0.0195313	0.0894442	-0.22	0.827	-0.1948388	0.1557762
Sex	-0.294494	0.3849119	-0.77	0.444	-1.048907	0.4599195
Child	0.1182846	0.1601477	0.74	0.46	-0.1955992	0.4321684
Edu	0.5081832	0.1679125	3.03	0.002	0.1790808	0.8372856
Hour	-0.2006353	0.1312556	-1.53	0.126	-0.4578915	0.0566209
_cons	-0.0935876	0.6424505	-0.15	0.884	-1.352767	1.165592

Marginal effects after logit
y = Pr(wtplog1) (predict)
= 0.72519839

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Fam	-0.0038923	0.01783	-0.22	0.827	-0.038835	0.03105	5.74251
Sex	-0.0599534	0.07989	-0.75	0.453	-0.216535	0.096629	0.329341
Child	0.0235724	0.03189	0.74	0.46	-0.038929	0.086074	2.06587
Edu	0.1012736	0.03253	3.11	0.002	0.037517	0.165031	2.97006
Hour	-0.0399837	0.026	-1.54	0.124	-0.090935	0.010968	2.39521

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Logistic model for wtplog1, goodness-of-fit test

number of observations = 167
number of covariate patterns = 141
Pearson chi2(135) = 140.61
Prob > chi2 = 0.3531

Table A.4 Ordinary Least Square Regression

Source	SS	df	MS	Number of obs	113
				F(8, 104)	3.83
Model	2.13E+10	8.00E+00	2.66E+09	Prob > F	0.0005
Residual	7.21E+10	1.04E+02	693311806	R-squared	0.2278
Total	9.34E+10	112	833675213	Adj R-squared	0.1684
				Root MSE	26331

WTP	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Sex	7496.053	5769.445	1.3	0.197	-3944.974	18937.08
Age	161.2287	214.9508	0.75	0.455	-265.0268	587.4842
Fam	3536.334	1309.856	2.7	0.008	938.84	6133.828
Child	-4213.075	2313.612	-1.82	0.071	-8801.054	374.9044
Edu	7619.848	2248.814	3.39	0.001	3160.365	12079.33
Hour	-2879.824	1973.898	-1.46	0.148	-6794.137	1034.489
Know	8758.486	7211.526	1.21	0.227	-5542.241	23059.21
Trst	-1178.171	2776.497	-0.42	0.672	-6684.068	4327.727
_cons	-3536.427	16989.04	-0.21	0.836	-37226.33	30153.48

Table A.5 Table Two-sample t-test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	100	19390	2846.658	28466.58	13741.61	25038.39
1	97	20896.91	2641.069	26011.51	15654.43	26139.39
combined	197	20131.98	1939.796	27226.33	16306.43	23957.53
diff		-1506.907	3888.481		-9175.785	6161.971

diff = mean(0) - mean(1) t = -0.3875

Ho: diff = 0 Degrees of freedom = 195

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.3494 Pr(T > t) = 0.6988 Pr(T > t) = 0.6506

Table A.6 Chi-squared Analysis to Compare Trust Score between Treatment Groups

	pro		
trst	0	1	Total
1	6	12	18
2	11	15	26
3	49	50	99
4	11	7	18
5	15	9	24
Total	92	93	185

Pearson chi2(4)=5.0091 Pr=0.286

Table A.7 Chi-squared Analysis to Compare the Probability to State WTP>0 between Treatment Groups

	pro		
wtp	0	1	Total
0	41	31	72
1	53	61	114
Total	94	92	186

Pearson chi2(1) =1.929 Pr = 0.165

Appendix 3 QUESTIONNAIRE

What is your opinion on your water supply?

My name is Nining Widiyati. I am writing my master's thesis at the Department of Economics at the University of Gothenburg. You have been selected to participate in a study regarding water supply issues. We would like to find out your opinion about this question. Your opinion is important and there is no right or wrong answers. I will ask you a few questions and it will take approximately 10 minutes. Please select the alternative which best corresponds to your opinions. Please note that your answers are completely anonymous! Your participation is of course voluntary.

Thank you! Your response is very valuable to us.

Now we will ask you some questions regarding the piped water service currently received by your household.

Q. 1. How many hours a day is piped water distributed to your area?
1) Less than 3 hours a day
2) 3 – 6 hours a day
3) 7 – 10 hours a day
4) 11 – 13 hours a day
5) Other _____

Q. 2. What is your main measure to cope with the intermittent water supply?
1) I use water from my private well
2) I buy water from a water vendor
3) I use electric pump to draw water
4) I store water in containers
5) I fetch water from the public tap
6) Others, please specify:_____

Q. 3. How satisfied are you with the current water supply situation?
1) Very satisfied
2) Satisfied
3) Unsatisfied
4) Very unsatisfied

Q. 4. Please recall your household expenditure on water for the last 12 months. What is your average water expenditure in a month? Rp_____

Suppose that **PDAM/A PRIVATE COMPANY** will improve the piped water service in your neighborhood to provide a 24 hour-water supply for everyday. After the upgrading your household would have the following benefits:

1. Water will be available 24 hours a day and 7 days a week in your household;
2. The amount of water will be sufficient to fulfill your domestic use;
3. The system will be reliable, and you don't need to worry about opening and closing the tap to store water in the containers everyday or use water from private wells;
4. The pressure in the line would be such that no electric motor, water storage tanks would be necessary.

However **PDAM/A PRIVATE COMPANY** require investments and financial resources to achieve the goal.

We would like to know your attitude towards paying for such water supply improvement program. But before answering the payment question please consider:

That your current income also needs to cover other expenditures such as housing, food, electricity, clothing, entertainment, and saving etc; and also consider the problems in the current water supply service and your current expenditures on storing water; these expenditures can be reduced if the projects can be implemented.

Q. 5. Suppose that you can pay a fixed cost to move from your current intermittent water supply to a 24 hour water supply **PROVIDED BY PDAM/A PRIVATE COMPANY**, how much would you maximum be willing to pay **PER MONTH IN ADDITION TO YOUR CURRENT WATER BILLS**?

Rp _____

Q. 6. What is your main motivation for willing to pay?

1) Reduced health risk
2) Convenience
3) Other_____
_____

Q. 7. **ONLY FOR THOSE WHO ANSWER 0 (ZERO)**: What is your main reason for not willing to pay?

1) The current service is satisfactory;
2) The current water tariff is high enough, I cannot afford more;
3) It is the government who should provide clean water for all citizens;
4) I will only pay if water quality is also improved;
5) I do not believe that the investment to improve the water supply will be made successfully;
6) Other_____

Q. 8. Do you know that a full water pressure in the pipe line can prevent infiltration of sewage, and may reduce the chance of getting waterborne diseases such as dysentery, cholera, and diarrhea?

1) Yes 2) No

Q. 9. Do you believe that if you actually pay the money, PDAM/a private company will actually provide your household with a-24 hour water service with the characteristics described earlier?

1 2 3 4 5

Strongly disbelieve Strongly believe

Q. 10 Do you believe that when the project is in fact implemented, PDAM/a private company will be able to sustain the 24 hour water supply in the long run?

1 2 3 4 5

Strongly disbelieve Strongly believe

Questions about your background

Sex : a. Male b. Female
Age : _____years
Income of household :

1) Less than Rp 500,000,- 2) Rp 501,000 – 2,000,000,-

3) Rp 2,000,001 – 3.500.000,- 4) Rp 3,500,001 – 5,000,000,-

5) Above Rp 5,000,000,-

Number of family member : _____persons
Number of children : _____persons
Education :

1) Preliminary school graduate 2) Junior High School graduate

3) Senior High School graduate 4) Diploma graduate

5) University graduate

Do you have anything you would like to add?