Water Resour Manage (2018) 32:4123–4138
https://doi.org/10.1007/s11269-018-2049-7

Investigating Attitudes towards Water Savings, Price Increases, and Willingness to Pay among Italian University Students

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Received: 28 March 2017 / Accepted: 16 July 2018 /
Published online: 19 July 2018

Abstract Knowledge of attitudes towards water conservation, potential reactions to incorporating supplementary costs into water prices, and the willingness to pay for water services is vitally important to decision makers wishing to implement policies that effectively promote more conscious water consumption and mitigate increasingly important water scarcity issues. This study aims to examine the relationships among these dimensions and their potential explanatory factors—such as family values, knowledge about problems related to water scarcity, attitude and propensity to pro-environmental behavior, and social pressure that individuals receive to behave in a certain manner—through a sample survey on 429 students enrolled at the University of Pisa (Italy). A set of hypotheses were formulated among eight latent variables that reflect the previous constructs and were tested through a structural equation model. As for key findings, we highlight the importance of family values as the main determinant of pro-environmental behaviors, which result in more responsible water use, greater support for price increases to encourage water saving practices, and a greater willingness to pay more for improved water and water service quality. Policymakers should consider these findings when developing policies and strategies to incentivize effective water saving practices among younger generations.

Keywords Water saving · Water sustainability · Willingness to pay · University students · Structural equation models

1 Introduction

One of the most pressing issues in the world today is the need to conserve and preserve natural resources (Gregory and Di Leo 2003; Saurí 2013). In the near future, water resources will be under further pressure, and policymakers will face the challenge of balancing the increasing

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demand for water and protecting ecosystems' sustainability. Sustainable activities are those where the needs of the present generation are met without compromising the needs of future generations (World Commission on Environment and Development 1987).

Given the relevance of water resources and concerns for water scarcity, research has attempted to delineate the determinants of water consumption (Romano et al. 2015a). Three dimensions appear particularly relevant: i) habits of water consumption/saving, ii) the interaction of consumption with water prices, and iii) individuals' willingness to pay for better use of water resources.

The objective of this study is to develop a theoretical model to investigate whether attitudes towards water saving and potential reactions to supplementary fees to water prices in order to reduce consumption are related, and whether they influence willingness to pay for water services. To explain this system of relationships and dependencies, further constructs based on existing literature were introduced as potential explanatory factors. Among others, family values, knowledge about the risks of water scarcity, attitude and propensity to pro-environmental behavior, social conditioning that individuals receive to behave in a certain manner, and possible concern for environmental issues have been identified as relevant factors and measured as latent variables. Several hypotheses were formulated and tested through a structural equation model (SEM). Knowledge and understanding of the relationships among these dimensions are vital to implement policies that can effectively promote conscious water consumption and mitigate water scarcity.

The analysis was conducted by a sample survey on university students. Previous studies on environmental attitudes/behaviors have used university students as units of observation (Cotton et al. 2016; Meyer 2016), but these analyses concentrated on recycling and electricity conservation and did not cover the psychological aspects of such attitudes in detail. In these studies, the surveyed population is made of a specific sub-group (students), and therefore some caution should be used in generalizing the results (something that is explicitly mentioned in Meyer 2016). However, it is also true that the behavior of young educated individuals is particularly relevant from a social perspective: it provides insights on a population group that will be particularly relevant in the future. Problems and issues in water consumption related to this category of individuals are likely to be translated to the current and future society.

Our study also provides an analysis of the psychological aspects related to water consumption, which is something that has not been done often (see Fielding et al. 2013) and has never been done with university students.

The focus of this empirical study is an urban area of the developed world: the central Italian city of Pisa. Cities in the developed world are of great interest for water conservation research because traditionally they are large water users, and currently, water consumption per capita is declining (Saurí 2013). Moreover, studies of water conservation in the developed world have mostly focused on North America and Australia, with scarce and controversial evidence from Europe.

The area of analysis is particularly suitable and representative because it is considered average in terms of population and water consumption as compared to the rest of Italy. According to ISTAT (2017), the average daily water consumption per capita in the Pisa province was 239 l (the Italian average is 236 l) and domestic consumption was 163 l (161 l is the average). Water leakage in Pisa amounted to 41.8% (39.3% is the average). Pisa is also an average-sized town (90.488 inhabitants), and its province has a density of 172.5 inhabitants per square kilometer, which is close to the national average (200.6).

An expanded theory of a planned behavior model—one of the most widely researched models for predicting behavioral intentions by social psychologists (Ajzen 1985, 1991)—

provided the theoretical framework for identifying beliefs, attitudes, norms, facilitators, and barriers of household waste/water/energy practices. Our SEM estimation confirms the importance of family values and also highlights the direct and indirect impacts of subjective norms on responsible environmental behavior.

The paper is structured as follows: Section 2 describes the materials and methods used; Section 3 is devoted to the results, and Section 4 provides the discussion and concluding remarks.

2 Materials and Methods

2.1 Background and Research Hypotheses

2.1.1 Effects of Family Values, Knowledge About Water Use, and Subjective Norms

Researchers investigating the role of household norms in household decisions have found a link between the use of norms and responsible environmental (or pro-environmental) behavior (Grønhøj and Thøgersen 2012), i.e., behavior that consciously tries to minimize the negative impact of one's actions on the natural world (Kollmuss and Agyeman 2002). Decisions on water consumption can also take the form of joint decisions within the household (see Rungie et al. 2014), such that the characteristics of the household appear to be particularly relevant. Aitken et al. (1994) found that water consumption depends mainly on family size and household values. In fact, if the dominant family culture propagates a lifestyle that is unsustainable, pro-environmental behavior is less likely to occur (Rajecki 1982). Gregory and Di Leo (2003) substantiated the role of personal involvement and habit formation in explaining water consumption.

Chawla (1998) found that among the factors increasing people's awareness of the environment, one of the most frequently mentioned is pro-environmental values held by the family. Thus, family values and relatives' habits exert important influences on members' lives, play a role in shaping their behaviors and beliefs through expectations or pressures, and impact daily routines and water use. However, empirical results show that it is unclear whether declared environmental values translate into conservation behavior (Saurí 2013 and cited references). With these considerations in mind, the following hypotheses are posited:

H1: Family values have a positive influence on responsible environmental (or pro-environmental) behavior.
H2: Family values have a positive influence on members' concern for the environment.

Apart from family values, actual knowledge of the problems and risks related to water scarcity are also relevant. Specifically, what matters is understanding the "water footprint" of goods and services used by individuals or firms. The water footprint measures the amount of water used to produce each good and service consumed, and it is, therefore, a measure of humanity's appropriation of fresh water in terms of volume of water consumed and/or polluted (Hoekstra and Chapagain 2007). In such context, Pelletier et al. (1998) suggest that environmental knowledge is a prerequisite for environmentally conscious action, even if the knowledge itself does not always lead to environmental action. Given these considerations, the following hypotheses are posited:

H3: Knowledge of water use has a positive influence on responsible environmental (or pro-environmental) behavior.
H4: Knowledge of water use has a positive influence on concern for the environment.

Together with family values and knowledge, perceived social pressure to perform or not to perform a behavior may influence the pro-environmental behavior of individuals and their concern for the environment. "*Subjective norms*" is a concept in the theory of planned behavior (Ajzen 1991), which refers to the perceived social pressure that individuals receive to behave in a certain manner, and the belief that people will approve and support that particular behavior. Thus, subjective norms can be very useful in understanding and predicting individual behavior. Therefore, the following hypotheses are posited:

H5: Subjective norms have a positive influence on responsible environmental (or pro-environmental) behavior.
H6: Subjective norms have a positive influence on concern for the environment.

2.1.2 Effects of Responsible Environmental (or Pro-environmental) Behavior and Concern for the Environment

Water saving is a part of broader environmental concerns and, therefore, these two aspects should be correlated. Corral-Verdugo et al. (2003) affirmed that "water conservation represents one of the most important pro-ecological activities to be modelled and developed for a sustainable way of life on this planet." Some people engage in water-conservation practices to save water, cooperate with a conservation campaign, or pay less for the consumed resource (Corral-Verdugo et al. 2003). For other people, the choice to conserve water may be due to a desire to react to the threat of reduced water availability (Baldassare and Katz 1992). Some authors posit that attitudes and beliefs form an imprint on behaviors such that there is a close relationship between commitment to environmental values and water conservation practices (Gilg and Barr 2006; Hurlimann et al. 2009; Willis et al. 2011). Thus, empirical studies highlight lower consumption among environmentally committed people (Welte and Anastasio 2010; Dolnicar et al. 2012). Grafton et al. (2011) found that environmental concerns have a statistically significant effect on some water-saving behaviors, such as adopting a low volume/dual-flush toilet. Thus, the following hypotheses are posited:

H7: Responsible environmental (or pro-environmental) behavior has a positive influence on water saving and saving practices.
H8: Concern for the environment has a positive influence on water saving and saving practices.

2.1.3 Relationships Between Attitudes Toward Water Saving, Water Price Increases, and Willingness to Pay for Water Services

The price of water is another strong factor that can affect water consumption. Prices and other economic incentives are powerful means of changing water use behavior (Saurí 2013). The European Water Framework Directive is based on the idea that water pricing acts as an incentive for the sustainable use of water resources. Thus, it requires that the water price charged to consumers reflects the true costs (full cost recovery principle). As previously stated, *water saving (and saving practices)* refers to any valuable activity that aims to reduce water consumption, loss, and waste. However, in many developed countries (especially in Europe), price increases cannot be justified under the concept of saving because water consumption is generally declining (Saurí 2013). Moreover, essential uses such as drinking and cooking tend to be insensitive to price, with elasticity approaching zero. Many factors may distort the efficacy of price as an instrument to promote water saving, making it a complex instrument: on one hand, after accounting for confounding factors, price seems to have some effect on consumption (see for example Nataraj and Hanemann 2011); but on the other hand, this effect may differ depending on household income (see Wichman et al. 2016), and thus the actual outcome in terms of water consumption may be difficult to predict. It is safe to assume, however, that individuals more sensitive to water saving are willing to accept the introduction of additional fees for excessive use of water resources. Therefore, the following hypothesis is proposed:

H9: Water saving has a positive influence on increased water prices.

Water quality issues, such as leakages, service quality, disruptions to supply, and the physical and chemical quality of the water supplied, are extremely relevant for citizens and regulators. Leakages cause wasted water, energy, and chemicals; furthermore, reducing leakages is considered crucial for water resource conservation and maintaining favorable water balances in river basins. As highlighted by Saz-Salazar et al. (2016), leakages have the effect of degrading water quality, and when the water price does not allow utilities to comply with the full cost recovery principle, there may be inadequate investment in repairing and improving infrastructures to reduce the volume of leakages.

It is important in this perspective to assess and measure the willingness to pay to obtain better, more efficient, and more environmentally conscious water services. Economists have traditionally addressed water quality evaluation by investigating individuals' willingness to pay (WTP) for the hypothetical provision of a public good (or environmental good). The WTP is the maximum amount a consumer is willing to pay for a given quantity of an item (Kalish and Nelson 1991; Varian 1992). Thus, evaluating consumers' WTP for improving potable water quality and reducing leakages is a task performed by many scholars throughout the world (Genius et al. 2008; Veronesi et al. 2014; Saz-Salazar et al. 2016). Therefore, we posit the following hypothesis:

H10: Increased water price has a positive influence on willingness to pay to improve water quality and reduce leakages.

2.1.4 Effects of Individual Characteristics and Personal Experiences

Corral-Verdugo et al. (2003) found that water consumption exceeds the expected and desired consumption, and they, therefore, suggest that encouraging citizens to conserve water might be successful; for this reason, it is desirable to instigate citizens to change their views of water as an unlimited resource. Several studies show that providing specific "behavioral knowledge" regarding water scarcity and how to save water can lead to water conservation behavior (Corral-Verdugo et al. 2003). Renwick and Green (2000) found that public education campaigns effectively reduced water usage. Moreover, Martinez-Espineira and Nauges (2004) affirmed that information campaigns should be preferred to water pricing strategies once a given threshold of water consumption is reached.

Meyer (2016) found that increases in pro-environmental behavior are due to factors outside of formal curriculum. Thus, articles, documentaries, and conferences can increase saving practices and environmental concern. In any case, it is necessary to increase the level of information disseminated about consumption, which may be achieved by, for example, metering and billing by apartment instead of by building (Inman and Jeffrey 2006; Barraqué 2011). Moreover, having a greater awareness of water billing levels or personally paying for water can influence water saving practices, as well as increase support for additional fees based on consumption with the aim of reducing water waste.

Alternatively, environmental concerns and behavior can also be affected by demographic characteristics. Several studies have found that women have stronger environmental concerns than men (see Meyer 2016 for a review of these studies). However, Cotton et al. (2016) recently found no significant differences between male and female students regarding perceptions of their own energy usage. Therefore, we posit the following hypotheses:

H11: Having read an article, viewed a documentary, or participated in a conference on water scarcity in the last year has a positive influence on concern for the environment.
H12: Having read an article, viewed a documentary, or participated in a conference on water scarcity in the last year has a positive influence on water saving and saving practices.
H13: Gender differences may exist in water saving and saving practices.
H14: Being aware of water bill variations from year to year has a positive influence on water saving and saving practices.
H15: Greater water bill awareness has a negative influence on increased water prices.
H16: Having responsibility for water bill payment has a positive influence on increased water prices.
H17: Having responsibility for water bill payment has a positive influence on citizens' willingness to pay to improve water quality and reduce leakages.

The path diagram in Fig. 1 in appendix provides a pictorial representation of the hypothesized relationships: the main dimensions (or constructs) investigated are enclosed in circles and are defined in terms of latent variables, rectangular boxes represent observed variables, and one-headed arrows indicate directional relationships among latent variables or among latent and observed variables. For each hypothesis, the expected sign of the relationship is shown in brackets.

2.2 Data Collection and Variables

2.2.1 Sampling and Questionnaire

Data were collected by selecting a simple random sample of 429 subjects from the target population, consisting of 44,159 students under the age of 32 enrolled at the University of Pisa during the 2015–2016 academic year. Selected subjects were interviewed using a well-structured questionnaire at the University's Computer Assisted Telephone Interviewing (CATI) Laboratory in May and June 2016. The questionnaire was divided into six sections:

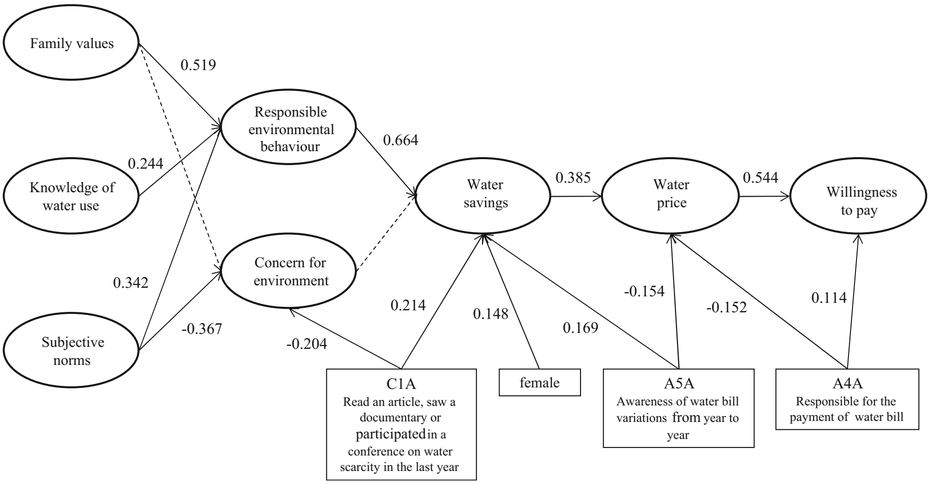

Fig. 1 Path diagram of the theoretical model

student condition and housing situation (A); daily experience of water use (B); knowledge and awareness of environmental issues (C); family habits (D); attention to environmental issues and attitudes towards water saving (E); and social and demographic data (F). The survey data were matched with data from the administrative archives of the University of Pisa, where further information on students' personal characteristics is recorded.

2.2.2 Measurement of Variables

Eight constructs were defined to describe the system of dependencies. Each construct was treated as a latent variable and measured by its respective observed indicators (see Table 2). All measures for the attribute constructs were drawn from studies in the relevant literature and adapted to specific items measured on 7-point Likert scales.

- *Family values* (FAMBA): family values and relatives' habits exert important influences on many aspects of family members' lives; they play a role in shaping behaviors and beliefs through expectations or pressures. *Family values* is measured by the following two indicators: you think you live in an eco-friendly family (d301); your family thinks it is important to put into practice actions that make housing eco-sustainable (d302).
- *Knowledge of water use* (KNWATUSE): this crucial element concerns the awareness of water use. People consume lots of water for their daily activities, both directly (for drinking, cooking, and washing) and even more indirectly (for growing food or in producing consumer goods). Water footprints have become a popular indicator of both direct and indirect freshwater use by a consumer or producer. Based on these concepts, *knowledge of water use* in this study aims to assess the degree of awareness of indirect consumption in the production of goods. It accomplishes this aim by proposing some statements which quantify how much water is needed to produce typical foods or is wasted by employing the following three indicators: producing a standard cup of coffee requires 150 l of water (entire production process) (c501); producing one kilogram of beef requires 15,000 l of water (entire production process) (c502); and for every 100 l of water, 40 l do not reach their destination because of losses (in the aqueducts) (c504).

- *Subjective norms* (SUBNORM): is a concept in the theory of planned behavior that refers to the perceived social pressure that individuals receive to behave in a certain manner and the belief that people will approve and support that particular behavior. *Subjective norms* are measured based on perceived behavioral expectations in terms of the following two indicators: you think making an effort to reduce water consumption is indicative of good education and culture (e107), and you feel morally obliged to use water carefully (e108).
- *Responsible (or pro-environmental) environmental behavior* (RENVBEH): has been defined as a behavior that consciously tries to minimize the negative impact of one's actions on the natural world (similar concepts have also been termed "ecological behavior" or "sustainable behavior"). Among such environmentally responsible behaviors, energy saving and waste recycling can be pursued by people in their daily activities. *Responsible (or pro-environmental) environmental behavior* is measured by the following three indicators: separating waste for collection (paper, glass, plastic, organic waste, used clothing) (b901); buying books/sheets produced with recycled paper (b902); and reducing heating in unused rooms (b903).
- *Environmental concern* (ENVCON): is an evaluation of human behavior in terms of its consequences for the environment. Based on the New Ecological Paradigm (NEP) Scale (Dunlap and Van Liere 1978; Dunlap et al. 2000)—the most widely used instrument to assess general environmental beliefs—a limited number of generalized items were gathered about human–environment relations, centered on the need for "natural balance" and to limit human activity on earth or the related right to modify the environment. Therefore, *environmental concern* is measured in terms of the following three indicators: human beings have the right to change the natural environment to meet their own needs (e101); the natural balance is strong enough to resist the pressure of modern industrialized countries (e104); and the "ecological crisis" that humanity faces has been highly exaggerated (e105). Consequently, this construct defines a concept of environmental concern for low values of the scale, whereas high values are associated with more disinterested and less sensitive attitudes.
- *Water saving practices* (WATCONS): refers to any valuable activity aimed at reducing water consumption, loss, and waste. Many factors can contribute to the adoption of a water saving behavior, including price and economic incentives, environmental threats, social desirability, and intrinsic motivations and satisfactions. Furthermore, simple and careful daily activities can foster water saving. Some of these were used as indicators of *water savings practices*: close the tap while you brush your teeth (e203); always close the tap when washing dishes (e204); and rinse fruit in a bowl instead of under running water (e205).
- *Additional water price* (ADDWATPR): has been introduced primarily to evaluate the potential reaction to incorporating supplementary costs or a fee aimed at encouraging waste reduction, as well as considering whether current pricing favors this practice, given that water demand is rather price inelastic. Thus, the following three indicators of *additional water price* were employed: current water prices encourage waste reduction practices (e302); those with higher water consumption should pay higher prices (e303); and it would be appropriate to increase water prices to encourage people to reduce their consumption (e304).
- *Willingness to pay* (WILLTPAY): is a concept that helps decision makers understand household preferences (such as safe and reliable drinking water) and design appropriate investments and policies for recovering maintenance costs and making investment projects sustainable. The following two indicators were used to measure *willingness to pay*: would you be willing to pay more for water companies to provide better quality tap water (e305);

and would you be willing to pay more for services to reduce losses from wasteful water pipes (e306).

Moreover, some observed variables were also included to represent individual characteristics and personal experiences: female (a dummy variable); C1A (a dummy variable indicating whether the student read an article, saw a documentary, or participated in a conference on water scarcity in the last year); A5A (a dummy variable indicating whether the student is aware of water bill variation from year to year); and A4A (a dummy variable indicating whether the student is responsible for paying the water bill).

2.3 Methodology

The SEM is a multivariate technique used to test a theoretical model specified by a complex system of relationships among observed and latent variables, expressed by a system of equations. SEMs are characterized by two components: a structural model and a measurement model (Bollen 1989). The structural model specifies the dependencies among the latent variables and the regressions among the latent and observed variables (or indicators). The measurement model defines the relationships between the observed responses and the latent variables through a confirmatory factor model (CFA). In particular, CFA is an indispensable analytical tool for construct validation because it allows for the assessment of reliability, convergent, and discriminant validity of the latent constructs.

The structural model can be expressed as follows (Muthén 1984):

$$\boldsymbol{\eta} = \boldsymbol{\beta}\boldsymbol{\eta} + \boldsymbol{\Gamma}\mathbf{x} + \boldsymbol{\zeta},$$

where $\boldsymbol{\eta}$ is an $m \times 1$ vector of endogenous latent variables; $\boldsymbol{\beta}$ is an $m \times m$ matrix for endogenous latent variables; $\boldsymbol{\Gamma}$ is an $m \times k$ matrix of regression coefficients among latent and observed variables; $\mathbf{x}$ is a $k \times 1$ vector of exogenous observed variables; and $\boldsymbol{\zeta}$ is an $m \times 1$ vector of errors. The measurement model is:

$$\mathbf{y} = \boldsymbol{\Lambda}\boldsymbol{\eta} + \boldsymbol{\varepsilon},$$

where $\mathbf{y}$ is a $p \times 1$ vector of observed variables; $\boldsymbol{\Lambda}$ is a $p \times m$ matrix of factor loadings; and $\boldsymbol{\varepsilon}$ is a $p \times 1$ vector of residuals. Because data consist of p categorical observed variables arising from the responses to the questionnaire, the measurement model is specified by defining an underlying, normally distributed latent variable for each response. Here, the latent responses are linked to observed categorical responses via threshold models, yielding probit measurement models. The model parameters are then estimated with a three-stage, limited-information procedure, as described by Muthén (1984), using a weighted, least-squares fit function. The analysis was carried out with M*plus* 7.31 software (Muthén and Muthén 1998–2010).

The model's goodness-of-fit was evaluated based on the most commonly used criteria (for more details, see Bagozzi and Yi 1988): absolute and relative model chi-square, as well as fit indices such as the comparative fit index (CFI), Tucker-Lewis index (TLI), and root-mean-square error of approximation (RMSEA). To assess model adequacy, the "rules of thumb" conventional cutoff values were considered as specified in Hair et al. (2010): values of at least 0.95 were considered a good model fit both for CFI and TLI, whereas values of at least 0.90 indicated an acceptable fit; a value not exceeding 0.06 was needed for RMSEA; and values between 2 and 5 were needed for the relative model chi-square. However, because the chi-square test is sensitive to slight model misspecification and sample size when the number of observations is higher than 250, more attention was given to the relative chi-square index and the other fit indices to assess model adequacy.

The internal structure of the model was assessed by analyzing different types of measures: values and significance of all estimated standardized factor loadings, individual item reliability, composite reliability (CR), and average variance extracted (AVE) of the latent constructs (Bagozzi and Yi 1988). In particular, standardized factor loadings of at least 0.5 are desirable and suggest that the observed indicators are strongly related to their respective constructs; CR is an indicator of convergent validity, and estimates equal to 0.7 or higher suggest good reliability even though values of at least 0.6 are deemed acceptable; and finally, AVE represents the average amount of variance that a construct explains in its indicator variables relative to the overall variance of its indicators, for which a value of 0.5 or higher suggests adequate convergence (Hair et al. 2010 and signifies that, on average, the variance due to measurement error is less than the variance captured by an underlying factor.

3 Results

3.1 Measurement Model

The latent structure underlying the 21 indicators arising from the questionnaire was preventively explored using an exploratory factor analysis (EFA). From the inspection of the pattern of indicator-factor relationships, the manifest indicators loaded onto the previously identified eight factors in an expected manner, thus supporting convergent validity. After the latent structure was established, the eight-construct representation of the data was assessed by a CFA, the results of which are shown in Table 1 in appendix. Overall, the goodness-of-fit indices are satisfactory, with low average residuals: model chi-square = 262.887 (degree of freedom, hereinafter df = 161, p-value <0.001); chi-square/df = 1.63; CFI = 0.942; TLI = 0.924; and RMSEA = 0.036 (90% confidence interval, hereinafter C.I.: 0.028–0.044).

Assessment of the model's internal structure provides more detailed information about individual parameters: all standardized factor loadings are significant (p-value <0.001) and greater than 0.5, demonstrating that the identified indicators effectively measure their corresponding construct; most of the individual items' measures of reliability are greater than 0.4 (with values ranging from 0.259 to 0.816), even though seven of the 21 observed indicators show an individual reliability just lower (c504, b902, b903, e101, e203, e204, e302); the CRs of the latent constructs range from 0.630 to 0.821 and meet the 0.6 criterion; and finally, the AVEs range from 0.366 to 0.698, with four out of the eight just below 0.5. Overall, the results indicate that the measurement model exhibits an acceptable fit, even for the internal structure, and meets the criteria proposed by Bagozzi and Yi (1988), albeit with some exceptions. In particular, the only constructs with a lower fit are KNWATUSE, SUBNORM, WATCONS, and ADDWATPR, but their values are only slightly below the conventional thresholds.

The measurement model also shows fairly good discriminant validity, because for each construct, the square root of the AVE is greater than the correlation between the corresponding construct and the other constructs in the model; furthermore, all eight factors were moderately or poorly correlated with each other, with correlations ranging from −0.05 to 0.654.

3.2 Structural Model

The relationships among the constructs were tested by the structural model according to the research hypotheses developed in Section 2, and the results after model estimation are shown in Fig. 2 and Table 2 in appendix. Fig. 2 shows the path diagram of the estimated model, whereas Table 2 includes the specification of hypotheses, a synthetic description of the corresponding relationships, parameter estimates, standard errors, *p*-values, and the results of hypotheses testing (whether supported or not).

Overall, the measures of model adequacy indicate an acceptable fit: absolute chi-square = 389.111 (df = 253, *p*-value <0.001); relative chi-square = 1.54; CFI = 0.905; TLI = 0.889; and RMSEA = 0.035 (90% C.I.: 0.028–0.042). As a further measure of model adequacy, the explained variance was examined for each of the five endogenous latent variables. Overall, their values are satisfactory, albeit some differences emerged across the various constructs: RENVBEH: 0.717; ENVCON: 0.130; WATCONS: 0.533; ADDWATPR: 0.176; and WILLTPAY: 0.288. Moreover, no negative error variances, correlations greater than one, extremely large estimates, or non-significant error variances were observed. Therefore, all of these measures suggest confidence in the results.

From the analysis of the standardized regression coefficients in Table 2 and their counterparts shown in the path diagram in Fig. 2, most of the hypotheses formulated in Section 2 seem to be verified and have the expected directional sign. In particular, FAMBA (H_1 supported; beta = 0.521; *p*-value = 0.001), KNWATUSE (H_3 supported; beta = 0.243; *p*-value = 0.014), and SUBNORM (H_5 supported; beta = 0.340; *p*-value = 0.036) are good predictors of RENVBEH, even though the first one seems to be the most influential factor. Moreover, FAMBA and SUBNORM are correlated (rho = 0.595; *p*-value <0.001), as expected, because it is likely that at least part of the influences and pressures that individuals receive as potential conditioning for their behaviors are influences from family members (identified in the path diagram by a two-headed arrow). ENVCON is positively influenced by SUBNORM (H_6 supported; beta = +0.369; *p*-value = 0.001), whereas the effect of FAMBA is significant only at the 10% level (H_2 not supported, beta = 0.203; *p*-value = 0.073). Therefore, this relationship must be considered with greater caution. Instead, those who read an

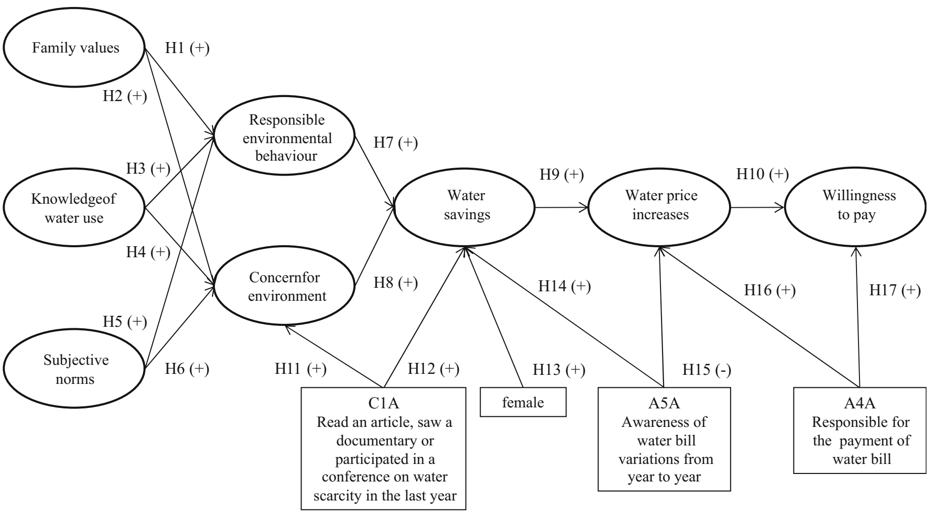

Fig. 2 Path diagram of the estimated model

article, saw a documentary, or participated in a conference on water scarcity in the last year are more concerned about the possible consequences of human behavior towards the environment (H_6 supported; beta = +0.204; p-value = 0.001). No evidence was found for the effect of KNWATUSE on ENVCON (H_4 not supported; beta = 0.045; p-value = 0.553).

WATCONS is positively and highly influenced by RENVBEH (H_7 supported; beta = 0.664; p-value <0.001) but not by ENVCON (H_8 not supported; beta = 0.062; p-value <0.465) among the latent constructs. However, some respondents' individual characteristics or experiences affect their attitudes to water saving. In particular, those who read an article, saw a documentary, or participated in a conference on water scarcity in the last year are more inclined to implement saving practices (H_{12} supported; beta = 0.214; p-value = 0.002), as are women over men (H_{13} supported; beta = 0.148; p-value = 0.037) and those who are aware of year-to-year water bill variations (H_{14} supported; beta = 0.169; p-value = 0.029). Therefore, being more informed about the potential consequences of a shortage of water resources or the amount and variations of the water bill seems to lead to more responsible water consumption behavior. Moreover, WATCONS is also indirectly influenced by FAMBA, KNWATUSE, and SUBNORM through the mediation of RENVBEH, which acts as a full mediator of these relationships. Specifically, the one involving FAMBA exerts the strongest effect ($0.521 \times 0.664 = 0.346$), whereas KNWATUSE ($0.243 \times 0.664 = 0.161$) and SUBNORM ($0.360 \times 0.664 = 0.239$) have smaller but not negligible effects. Therefore, based on these indirect relationships, the total effect on WATCONS due to all of the possible influencing factors reaches 1.41.

As to the relationships among WATCONS, ADDWATPR, and WILLTPAY, as well as the individual characteristics and personal experiences that act on them, the hypotheses are confirmed. In particular, ADDWATPR is directly and positively influenced by WATCONS (H_9 supported; beta = 0.385; p-value <0.001). This outcome is consistent with the idea that those who are more sensitive to water-saving behaviors are in favor of introducing differential costs to water prices based on consumption for those who have less virtuous behaviors to encourage reduction in their consumption. In addition, being aware of year-to-year water bill variations has a negative effect on ADDWATPR (H_{15} supported; beta = −0.154; p-value = 0.019), as does being the person responsible for paying the water bill in a household (H_{16} supported; beta = −0.152; p-value = 0.022). Also, there are indirect effects due to FAMBA ($0.521 \times 0.664 \times 0.385 = 0.133$), KNWATUSE ($0.243 \times 0.664 \times 0.385 = 0.062$), and SUBNORM ($0.342 \times 0.664 \times 0.385 = 0.092$) on ADDWATPR, although this time they are expressed through the double mediation of RENVBEH and WATCONS.

Finally, ADDWATPR positively influences WILLTPAY (H_{10} supported; beta = 0.544; p-value <0.001). In particular, this relationship suggests that those who are more supportive of water price increases based on consumption would also be willing to pay more to the water companies to have better quality tap water and reduce losses from water pipes. Furthermore, being responsible for paying the water bill has a positive effect on WILLTPAY (H_{17} supported; beta = 0.114; p-value = 0.048). Here, however, the p-value is slightly lower than 0.05, and caution must be taken into account concerning this relationship.

4 Discussion and Conclusion

Seventeen hypothesis were tested, and only three were not supported by statistical analysis. The results show that attitudes toward water saving and the potential reaction to supplementary fees to water price to reduce water consumption are related and can influence the willingness to pay for water services. Past literature (March and Saurí 2010) showed that socio-economic background and geographical aspects affect domestic water demand: their results come from ordinary least squares estimation performed on municipalities within the same metropolitan area (Barcelona). In addition, family values are often found to be particularly relevant (Rajecki 1982; Aitken et al. 1994; Chawla 1998; Grønhøj and Thøgersen 2012, and Rungie et al. 2014): our study confirms that family values are the most powerful factor affecting responsible environmental behavior by university students. Family values and relatives' habits exert strong influences in shaping behaviors about water consumption and conservation via shifts in household priorities, routines, and financial pressures; this outcome is true not only for adolescents (as in Grønhøj and Thøgersen 2012), but also for young adults.

While our results confirm these previous findings, we also highlight that family values are highly correlated to subjective norms, and thus the influences and pressures that individuals receive about their behavior are from values acquired within and outside of the family, as well as the interaction between the two.

Therefore, it is necessary to raise water conservation awareness and provide information about daily life activities that are useful in reducing water consumption. Policy implications are clear, and decision makers such as utilities managers and policy makers should invest resources in education campaigns to encourage families to behave in an eco-friendly and sustainable way. However, responsible environmental behavior is encouraged not only by family values, but also by subjective norms and knowledge of water use. Therefore, channels outside of the family (conferences, campaigns, education, universities activities, etc.) could also be effective.

Our study found that women have stronger environmental and water conservation concerns than men: this corroborates the findings of previous works (see Meyer 2016 for a review), and we do not confirm the lack of gender differences among students recently found by Cotton et al. 2016. This suggests that decision makers should address water saving campaigns to male audiences to overcome this gender gap.

Finally, being aware of water bill variation and having the responsibility for paying the water bill significantly influence students' water saving behavior and saving practices, their support for water price increases to encourage water saving practices, and their willingness to pay for improved water and water service quality. This confirms previous findings on the existence of a relationship between the price of water and its consumption (Nataraj and Hanemann 2011) and between water improvements and willingness to pay (Veronesi et al. 2014; Saz-Salazar et al. 2016). In Italy, water prices increased significantly in recent years (Romano et al. 2015b), and Tuscany currently has the highest tariffs in Italy (Romano et al. 2014); this may explain why university students that are aware of water bill variation are more supportive of conservation practices. In fact, our study provides further evidence with respect to previous studies: in particular, we find that students who are aware of price variations and students that are responsible for paying the water bill have a lower tolerance for water price increases, even if the additional tariff is devoted only to encourage waste reduction. In contrast, students that usually manage the water bill payment are more willing to pay for improved water and water service quality. Thus, university students are conscious of the need to reduce water waste and improve water and water service quality and that these improvements require additional costs. However, price increases are not considered the most appropriate tool.

Overall, the findings suggest that decision makers could affect water saving and attitudes to water pricing by emphasizing awareness and knowledge about the world water crisis. This suggestion also supports the European Union's proposal of public participation and stakeholder involvement as one of the most relevant principles of water legislation.

It is important to stress that our results come from a survey of students, and therefore some caution should be used when extending our prescriptions to the general population. Almost all previous studies on water consumption focused on specific groups or specific geographic areas; in our specific case, we believe that we provide insights on a particularly important group of individuals (the young and educated), who will be particularly relevant in building and affecting current and future societies. Moreover, other unstudied factors could influence environmental attitudes, such as the nature of the actual water service provision that the students experience. Further research could therefore extend these findings.

Acknowledgements This work was supported by the University of Pisa PRA and the European Union Jean Monnet Project [grant number 553224-EPP-1-2014-1-IT-EPPJMO-MODULE].

Compliance with Ethical Standards

Conflict of Interest None

Appendix

Table 1 Confirmatory factor analysis results

Constructs	Item	Std. factor loading	Individual item reliability	Composite reliability	Average variance extracted (AVE)
FAMBA				0.796	0.661
	d301	0.782*	0.612		
	d302	0.843*	0.711		
KNWATUSE				0.710	0.452
	c501	0.642*	0.412		
	c502	0.823*	0.677		
	c504	0.532*	0.283		
SUBNORM				0.792	0.389
	e107	0.747*	0.558		
	e108	0.870*	0.757		
RENVBEH				0.630	0.657
	b901	0.676*	0.457		
	b902	0.617*	0.381		
	b903	0.509*	0.259		
ENVCON				0.762	0.522
	e101	0.558*	0.311		
	e104	0.770*	0.594		
	e105	0.814*	0.662		
WATCONS				0.680	0.417
	e203	0.601*	0.361		
	e204	0.594*	0.353		
	e205	0.732*	0.536		
ADDWATPR				0.681	0.420
	e302	0.531*	0.282		
	e303	0.720*	0.518		
	e304	0.678*	0.459		
WILLTPAY				0.821	0.698
	e305	0.747*	0.581		
	e306	0.870*	0.816		

*indicates parameters estimates significant at level p-value <0.001

Table 2 Empirical results and hypotheses

Hypothesis	Relationship	Std. coeff. (beta)	Std. error	*p*-value	Result
H_1	FAMBA → RENVBEH	0.521	0.153	0.001	Supported
H_2	FAMBA → ENVCON	0.203	0.113	0.073	Not supported
H_3	KNWATUSE → RENVBEH	0.243	0.099	0.014	Supported
H_4	KNWATUSE → ENVCON	0.045	0.076	0.553	Not supported
H_5	SUBNORM → RENVBEH	0.340	0.162	0.036	Supported
H_6	SUBNORM → ENVCON	0.369	0.115	0.001	Supported
H_7	RENVBEH → WATCONS	0.664	0.083	0.000	Supported
H_8	ENVCON → WATCONS	0.062	0.085	0.465	Not supported
H_9	WATCONS → ADDWATPR	0.385	0.076	0.000	Supported
H_{10}	WATPR → WILLTPAY	0.544	0.060	0.000	Supported
H_{11}	C1A → ENVCON	0.204	0.061	0.001	Supported
H_{12}	C1A → WATCONS	0.214	0.070	0.002	Supported
H_{13}	GENDER → WATCONS	0.148	0.071	0.037	Supported
H_{14}	A5A → WATCONS	0.169	0.077	0.029	Supported
H_{15}	A5A → WATPR	−0.154	0.065	0.019	Supported
H_{16}	A4A → WATPR	−0.152	0.066	0.022	Supported
H_{17}	A4A → WILLTPAY	0.114	0.058	0.048	Supported

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