The link between water access and subjective well-being: Some methods and proposals

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Abstract.- The study of happiness or subjective well-being has traditionally been studied within the disciplines of psychology or sociology. Although economics has contemplated happiness in research terms, it has only recently been studied in any depth. In this paper we offer several proposals in order to investigate the relationship between water access and happiness, suggesting some situations that would merit further research. Moreover, we have included some methodological notes in order to achieve this objective. This relationship can be useful in two ways. Firstly, it can favour the contemplation of water access as a human right. Secondly, it can serve as a framework for the decision-making process carried out by Governments and NGOs in developing countries.

1. INTRODUCTION

Probably the most important objective of every person is to achieve happiness, independently of his/her origin and cultural background. The scientific study of happiness has been confined to the fields of psychology and sociology, whilst in economics, happiness has traditionally been identified in terms of income. However, income has proved to be an imperfect proxy of people's welfare, and other measures need to be taken into consideration in order to study this question more accurately. This was carried out under the consensus of many economists who consider that subjective measures give a satisfactory proxy of individual utility (Di Tella and McCulloh, 2006; Frey and Stutzer, 2002). Happiness, subjective well-being or life satisfaction is the scientific term that refers to people's evaluation of their potential to feel happiness or

unhappiness, their current satisfaction with life or their estimation of their own happiness[1]. An individual evaluates his/her level of subjective well-being with regard to his/her circumstances, but also by comparing himself/herself with other people, his/her past experience and his/her future expectations (Frey and Stutzer, 2002).

Recent literature about subjective well-being uses data obtained by directly asking people about their own subjective well-being with questions such as: "On the whole, are you satisfied with the life you lead?", or "Taken all together, would you say that you are very happy, pretty happy or not too happy". As an answer, the respondent evaluates his/her level of happiness from 0 to 10 or a similar scale in the first question, and in the second question he/she chooses the category in which he/she identifies his/her happiness. The answers about the perception of subjective well-being are normally statistically related to objective variables. The aim is to determine the influence on happiness of variables such as income, relative income, employment status, marital status and sex. Some studies of subjective well-being from an economic perspective include, for example, Clark and Oswald (1994), Easterlin (1974), Easterlin (2001) and Van Praag et. al (2003). A general survey on happiness research can be found in Kahneman et. al (1999) and Frey and Stutzer (2002). Subjective well-being research has also been implemented in developing economies in papers like Graham and Pettinato (2001, 2002), Gough and McGregor (2007), Kingdon and Knight (2006) and Rojas (2008).

Several studies have also focused on determining the impact of political actions on subjective well-being. For instance, Di Tella et al. (2001) analyze the influence of the inflation rate and the unemployment rate on happiness. They also obtain the ratio of compensation between those two macromagnitudes. Those results allow us to answer questions such as: how much, on average, could a country reduce its inflation in order to

tolerate a rise of 1 percentage point in the unemployment rate? Other studies have also sought to value public goods and externalities, by substituting or complementing other techniques like the revealed preference methods and the stated preference methods.[2] Their results contribute to the knowledge of the possible impacts of policies devoted to reducing public goods or bads or to create incentives for public goods. Some works evaluate the influence of environmental degradation on reported subjective well-being are Ferrer-i-Carbonell and Gowdy (2006) Frey et al. (2004) Rehdanz and Maddison (2008) and Welsch (2002; 2006) and, for the influence of noise, van Praag and Baarsma (2005).

This discipline is still new and full of possibilities in terms of understanding the creation of happiness and can serve as a framework for policy analysis. In this sense, in this paper we address the possibility of analyzing the influence that water issues such as accessibility, quality, distribution and management have on the happiness of individuals. This approach to water problems in terms of subjective well-being should provide information to Governments and NGOs regarding economic policy and decision- making. We should point out that the approach proposed in this paper does not consist of merely asking individuals to assess some aspects related to water, but rather to evaluate the effect that these issues could have on their perceived subjective well-being. Hence we evaluate these aspects in utility terms, using reported subjective well-being as a proxy of utility. Assuming reported subjective well-being as an approximation of utility is equivalent to considering that people are the best judges of their perceived well-being (Frey et al. 2004; Rojas, 2008).

The structure of this paper is as follows: In Section 2, we offer a brief overview of access to clean household drinking water throughout the world. In Section 3, we list some proposals that could be of interest in the field of research into water access and

happiness. Some methodological notes which may help to achieve these proposals are made in Section 4. Finally, in Section 5 we offer a series of conclusions.

2. A BRIEF OVERVIEW OF HOUSEHOLD WATER ACCESS

The modern day system of water service distribution for residential use was developed in western countries during the second half of the 19th century[3]. Although the process had started previously, it was in this century when the worldwide implantation of water services was carried out by the public sector. In most western countries, the rise of the modern water service is due to the actions of private companies, searching for business opportunities in this new activity.

Today, over a century and a half after the world wide extension of water services, water access is still a long way from being universally available. Around one hundred million people do not have any water access (United Nations, 2006; WHO and UNICEF, 2006). Although in the western world water access is universal, this situation is quite different in the developing world[4]. The unequal distribution of water access between regions is represented in Figure 1. Some factors which cause more and more people to have no access to water on a regular and consistent basis are high population growth rates, increasing urbanization, lack of investment, corruption and poor governance (Biswas, 2007a).

INSERT FIGURE 1 ABOUT HERE

Another differential fact regarding world water access is the differing extension of the service according to the population nuclei in question. Water services have been more fully developed in urban areas. In rural areas, the deficit in terms of clean drinking water access is more evident (Figure 2).

INSERT FIGURE 2 ABOUT HERE

Even if the lack of water access in the household is more pronounced in rural areas, in urban areas there are still some districts in major cities and even entire populations that lack a water distribution network for residential use. This is the case of Cairo, Mexico City, Sao Paulo, Jakarta or New Delhi. The lack of urban access to water in many countries has been influenced by the rapid rate of urbanization, which has far exceeded the management and financial capacities of governments since around 1960 (Biswas, 2006). Furthermore, there are the problems in terms of the drinkability of the water and restrictions in supply. Some frequent solutions are boiling, chlorinating or filtering the water, using membrane techniques or drinking bottled water.

But the most dramatic situation occurs in rural areas in less developed countries, especially in Africa, where a great number of people still do not have access to clean drinking water (Showers, 2002; Biswas, 2007b). This scarcity of clean water means long daily walks in order to fulfil this basic need. In these circumstances, the influence on people's satisfaction is greater due to the high opportunity costs associated, mainly for women who usually shoulder the burden of this task (Hope, 2006). Moreover, lack of clean drinking water causes illnesses such as diarrhoea. Every day, diarrhoeal diseases which stem from easily preventable causes take the lives of approximately 5,000 young children throughout the world. This dramatic toll can be reduced by providing enough higher quality drinking water and through basic sanitation (WHO and UNICEF, 2005).

3. SOME PROPOSALS TO RELATE WATER TO SUBJECTIVE WELL-BEING

In the previous section, we have briefly described the overall state of water access on a worldwide level. In this section, we aim to deal with several research ideas that could be of interest in order to assess the influence of water related aspects on reported subjective well-being. These aspects acquire even greater importance in the case of developing countries, and can provide some important guidelines for policymakers who aim to maximize happiness. For the implementation of water policies in depressed societies, the success of these policies in terms of increasing people's well-being from the ex ante situation, should depend on the importance of the relationship between the situation which needs to be improved and well-being itself.

As we are dealing with a relative and changing phenomenon, is necessary to analyse cases in which there is a margin for improvement in the provision of the water service or those cases in which there were alterations in the service which clearly affected the population. This analysis should be carried out by comparing those populations that have a different water service over a certain period of time, or a population that has either benefited or been damaged by changes in the water service. In order to determine how household water access can affect happiness, we could suggest situations such as the ones explored below.

3.1. Characteristics of access to clean drinking water

The first proposal is the measurement of the influence of several types of water access on subjective well-being and the comparison of different levels of well-being according to several kinds of water access.

The most evident case is the situation in which individuals need to leave their homes in order to obtain water. It could be hypothesized that the strain on people's well-being increases as the distance to the water source becomes greater. Water access influences

people's health, education, life expectancy, well-being and social development. The time devoted to collecting water from distant sources means a waste of energy and productivity that could be used by children for their education and by adults to work (WHO and UNICEF, 2005). Therefore, reducing the time wasted could improve their subjective well-being, mostly in the case of women, who are the ones who shoulder most of the burden of water collection (UNDP, 2006). This is an opportunity cost that would be interesting to study in terms of happiness.

Whether or not the water service is communal or private could also have an impact on subjective well-being. According to Larson et al. (2006) better educated and higher income households rely significantly more on private water supplies (in comparison with communal water services) and use significantly more water.

3.2. Exclusion from water access

The second proposal consists of the influence on happiness of the exclusion of part of the population from water access. In several cities, there are households that do not have access to the water service enjoyed by others.

An example of this may be provided by investigating the effect on subjective well-being of the lack of water services in outlying districts which are next to districts which do have this service. New neighbourhoods spring up quite rapidly on the outskirts of cities. In psychological terms, it should be difficult to lead a happy life if one lacks access to clean drinking water when there is an infrastructure that provides this very service only a few metres from one's home. It has been argued that people tend to compare their income with that of their neighbours in order to determine their reported subjective well-being (Clark and Oswald, 1994; Luttmer, 2005; Dynan and Ravina, 2007). This could also hold true in terms of assets and opportunities such as access to

clean drinking water. If a water system distributes clean water to a person's neighbours but not to that person, he or she might feel unhappier due to that comparison.

Another different kind of exclusion is due to the termination of the service as a result of non-payment of bills. Low income households may find themselves in this situation if this is permitted by the law in the countries where they live (Kayaga et al., 2003; Kayaga and Franceys, 2007). This situation happens not only in the developing world, but also in the developed countries such as the United States and the United Kingdom (Bakker, 2001).

3.3. Quality-related aspects

The third proposal consists of the measurement of the impact of the quality of the water on subjective well-being. In this case, some evaluation and comparison between happiness in cities with different water quality could be carried out.

This would be particularly interesting in the case of those cities that are geographically close to each other yet have different quality levels in their water supplies. There are situations in which the management of the water service supplies non-drinking water and/or there are constant break downs in supply. Comparison with others in terms of differences in water quality can also influence happiness when these differences are substantial.

Water quality is set to become even more crucial in the forthcoming years. As a consequence of demographic growth, this quality will be negatively affected in many areas by the increase in water demand for various types of use and by climate change (Bates, 2008). In global terms, water quality is not receiving the attention it deserves, although it is a great problem in many developing countries (Biswas, 2001, 2005). In absolute terms, water quality influences happiness as it prevents people from being affected by illnesses such as diarrhoea (WHO and UNICEF, 2005).

3.4. Water management

The study of possible differences in subjective well-being when there are differences in the management of the water service is our fourth proposal.

For example, the influence of the owner of the service (whether public or private) on subjective well-being could be analyzed. There is currently intense debate about the comparative superiority of each management option (Budds and McGranahan, 2003; Castro, 2008). Several organizations such as the World Bank or the Organization for Economic Co-operation and Development (OECD) favour private ownership in the water industry, and there are also several studies that partially support this option, such as Clarke et al. (2002), Estache and Trujillo (2003), Kirkpatrick et al. (2006) and Picazo et al. (2008, 2009)[5]. On the contrary, there are organisms such as the Public Service International Research Unit (PSIRU) that oppose privatization, arguing that several processes aimed at privatization have been quite controversial and have even led some governments to recuperate management of the service. This is the case of Buenos Aires (Casarin et al., 2007) and Cochabamba (Nickson and Vargas, 2002; Assies, 2003). One of the arguments against privatization is the unjustifiably higher prices, lower quality of service, abuse caused by an effective monopoly and higher transaction costs (Lobina and Hall, 2000; Trawick, 2003; Hall and Lobina, 2004; Hall et al., 2005; Wilder and Romero Lankao, 2006). However there is still a considerable gap in knowledge regarding the influence of a particular management option on the happiness of citizens.

Consequently, it is logical to conclude that the happiness of the population can differ if private ownership is related to a multinational company or to a smaller, local one. The latter should have comparative advantages with respect to the former, as they

know the local conditions and can also employ from within the local population (McGranahan, 2004).

We have enumerated several cases that are of interest with regard to knowledge about happiness and water access and there are several proposals that could be explored further. Each one of them has something in common, since they refer to the possible measurement of several water access specifications with regard to the happiness of people. In the following section we deal with some possible methods to measure them.

4. METHODOLOGICAL NOTES REGARDING THE RELATIONSHIP BETWEEN WATER ACCESS AND HAPPINESS

The first prerequisite to carry out studies of water influence such as those described in the previous section is the existence of relevant data in order to implement these studies. The most suitable kind of data is panel data, which allows us to check for unobserved heterogeneity and also takes into consideration several moments in time. Cross section data, on the contrary, consists of a description of a specific moment. This format does not provide such complete information as panel data, but nevertheless it can also be used to implement these studies. Most of the existing data on subjective well-being are cross section data, and some of them are compiled at a household level.

In order to evaluate the effect of water access, quality, infrastructure, etc, into reported well-being, econometric techniques are the most suitable method. Some of these techniques study the influence that a group of variables, called exogenous variables, have on an endogenous variable, in this case the subjective well-being of an individual or household (Wi):

$W_i = f$ (economic variables, social variables, water variables), (1)

The economic variables could be referred to income of the household, relative income of the household, employment status, etc; and the social variables are aspects such as sex, age, marital status, etc. Water variables are related to the aspects of water that can be analyzed and we have attempted to review them in the last section[6].

Depending on how the data on subjective well-being (dependent variable) are considered, the econometric techniques must be different: Firstly, if we consider well-being as numeral variables, the most usual technique is ordinary least squares regression. Using this method, the parameters that relate the dependent and independent variables are estimated by minimizing the sum of the square of the error term and the interpretation of the parameters is straightforward. Secondly, if the subjective well-being variable is measured as ordinal, the most usual techniques are ordered probit and logit regressions[7]. Using ordinal methods, the parameters are estimated by maximizing a chosen probability function, and for interpretation some transformations are required[8]. In this case, marginal probabilities should be calculated in order to assess the probability of changes in the scale of subjective well-being. Empirical evidence stated that both methods give similar results (Ferrer-i-Carbonell and Frijters, 2004).

A further analysis that can be implemented to develop some of the topics above arises when water can be interpreted as a public good (for example, the water quality of a society). Under this premise, it is possible to calculate the compensation price that individuals are willing to pay for an increase in the quality of water. Let us suppose that we introduce an indicator of water quality in function (1) and estimating by ordinary least squares we obtain the parameter β_q for this variable and β_i for income. By doing this, we could calculate willingness of people to pay or the compensation surplus (CS) for an increase in water quality. The compensation surplus is the amount of income necessary so that the utility remains constant (Frey et al., 2004). In mathematical terms:

$$f(income_0, quality_0)=f(income_0\text{-}CS, quality_1), \quad (2)$$

where f(.) refers to the indirect utility function expression given by (1), $income_0$ and $quality_0$ are the initial household income and the water quality variables respectively, and $quality_1$ refers to the level of water quality after the policy aimed to increase it. When these variables are linear in the expression (1), the expression becomes:

$$\beta_q \, quality_0 + \beta_i \, income_0 = \beta_q \, quality_0 + \beta_i \, (income_0\text{-}CS), \quad (3)$$

and the compensation surplus can be calculated by isolating it from this expression. When the relation of those variables is not linear with subjective well-being (it is common to use logarithms to capture the decreasing marginal utility of income, for instance), then formula (3) changes according to this transformation.

5. REVIEW AND CONCLUSIONS

Lack of water is mainly caused by an inefficient supply and not by a deficit in terms of this resource. However, there are few low-income countries that consider water to be key element in their national strategies and budgets. This is thoroughly paradoxical, as economic and social development is closely linked to water availability (Biswas, 2005).

In this paper we propose several issues related to research which links clean drinking water access and subjective well-being. We also offer some methodological notes about how to relate both concepts. This research would be useful for several purposes: Firstly, it will allow us to measure in quantitative terms the influence of the development of water supply systems on subjective well-being. Secondly, it could help to raise awareness among organizations involved in investment projects and lead them to devote more resources to water issues.

In the Millennium Declaration (approved by the General Assembly of the United Nations), the Presidents committed themselves to halving by 2015 the percentage of people that lack access to clean drinking water. This might seem to be a very ambitious objective. The quantification of the relationship between water and subjective well-being could raise awareness and gain greater recognition of the concept of water access as a human right. According to the World Water Assessment Programme (WWAP), there is a close relationship between poverty and the factors which condition access to water (availability, proximity, quantity and quality). Improving access to clean drinking water can contribute to alleviate poverty and improve well-being worldwide.

Political agents face the challenge of distributing a limited amount of resources among several investment projects. If they aim to maximize the happiness of the population, it is essential to know the determinants of happiness. This research could be a useful complement to the tools used in the analysis of questions such as revealed preference methods and the stated preference methods.

In order to illustrate the importance of water for human happiness, we would like to conclude with a revealing anecdote**:** Federico Mayor Zaragoza received a group of African children who were spending some time in Paris when he was Director General of UNESCO. He asked them what they enjoyed there most. A Mauritanian child quickly replied that it was the tap. For this child, it was truly extraordinary to obtain water by merely turning on the tap (Mayor Zaragoza, 2008). It is beyond all doubt that access to clean drinking water can make people happier. The challenge is to find out just how much.

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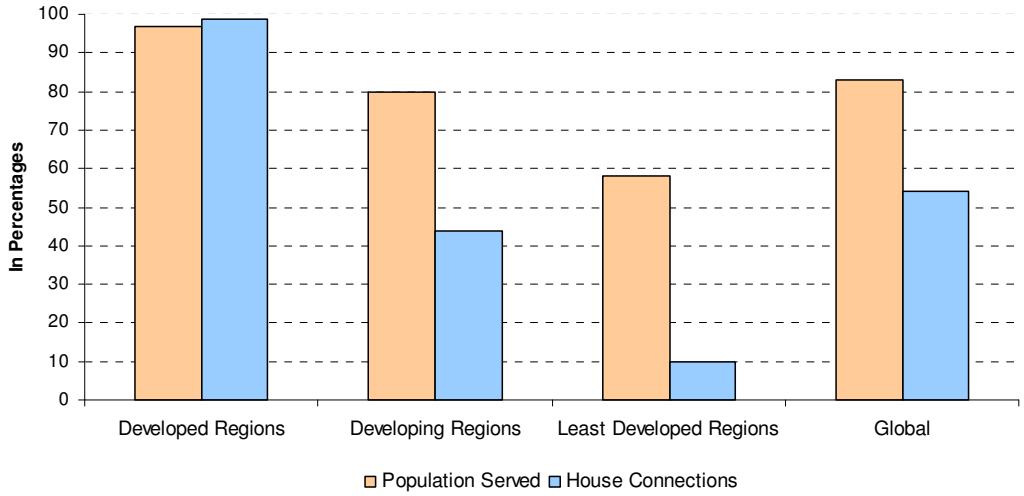
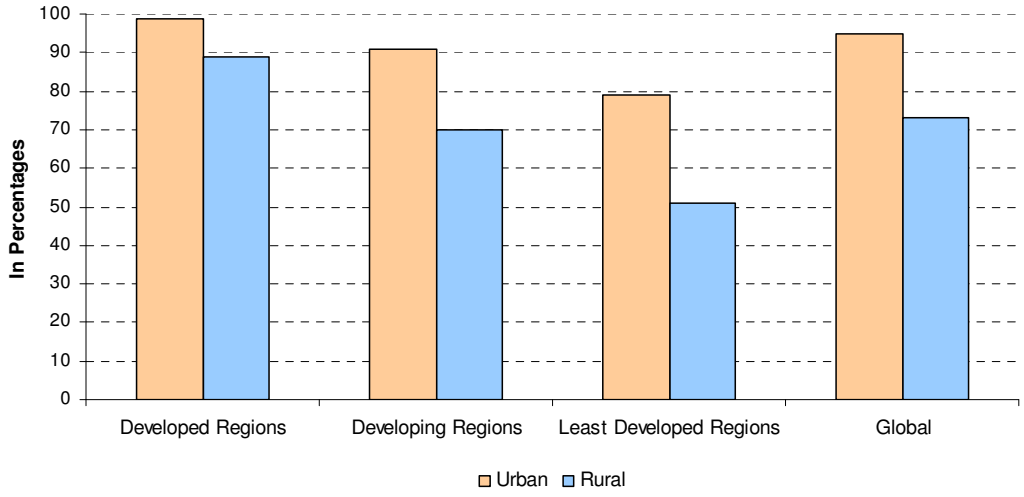
Figure 1: Water Supply Coverage in 2004



Source: WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation http://www.wssinfo.org/en/welcome.html, checked last in January 2009.

Figure 2: Percentage of population served with improved drinking water: urban vs. rural



Source: WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation http://www.wssinfo.org/en/welcome.html, checked last in January 2009.

[1] In this article, we use the terms 'happiness', 'subjective well-being' and 'life satisfaction' to refer to the same concept. This simplification is mostly used in papers on the economics of happiness.

[2] In the first approach, the aim is to infer the monetary value of the public good using complementary and substitute relationships between this and other marketed goods. In the second method, individuals are asked to evaluate the public good in question (See e.g. Frey et al. 2004, Van Praag and Baarsma, 2005).

[3] Research into the development processes in urban water systems in the 19th century is carried out in Hassan (1985), Daunton (1983) and Millward (1991) for the United Kingdom; Guillerme (1988) and Goubert (1988) in the French case; Bigatti et al. (1997) in the Italian case and Matés Barco (2004) in the Spanish case.

[4] Lack of water access is mainly a problem for poor people. According to UNDP (2006), almost two out of three people that lack access to clean water survive on less than $2 a day, whilst one out of three people live on less than $1 a day.

[5] A review of the research that has studied the relationship between the type of management and efficiency in the water industry can be found in González-Gómez and García-Rubio (2008).

[6] If the study is at the macro level and the dataset is made up of countries rather than individuals, the techniques that are explained in this section are equally useful. The variables from equation 1 should be represented therefore at the macro level. For instance, subjective well-being of the country and GDP per capita at purchasing power parity should be used instead of subjective well-being of the individual and income of the household. Data on subjective well-being of the countries worldwide can be found in the World Database of Happiness developed by Ruut Veenhoven, and GDP in the World Development Indicators of the World Bank.

[7] Further information on these techniques can be found in econometric textbooks such as Greene (2003) or Cameron and Trivedi (2005).

[8] Some instructions in order to calculate the impact of changes on independent variables on subjective well-being can be found in Rehdanz and Maddison (2008) and in more detail in Greene (2003).