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ATTITUDES TOWARD PAYMENT FOR RESOURCE USE: THE CASE OF DOMESTIC WATER CONSUMPTION[1]

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ABSTRACT

The interrelationships among socioeconomic variables, attitudes, and domestic water consumption are examined for a sample of 1,892 Israeli urban households. The analysis focuses on willingness to pay more for household water under various conditions, in an attempt to identify factors affecting individual readiness to pay for use of natural resources. The analysis reveals that willingness to pay depends both on the price demanded, and on the purpose of the payment; that the equitability of the system of charges has an effect on willingness to pay; and that particular charge systems are not necessarily effective in attaining their intended ends. Although no relationship is found between attitudes toward water use and actual consumption, the analysis shows that social-psychological variables are important in determining individual readiness to undertake additional expenses which must be incurred as part of efforts to maintain environmental quality.

Introduction

There is a growing awareness among researchers in natural resource use problems of the need to consider perceptual aspects of human behavior toward these resources. Particularly within the field of geography, a significant amount of research has been carried out on perception of the environment [1, 2], and the results make clear that human behavior toward natural resources is mediated by

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knowledge, attitudes, conceptions, pre-conceptions, and misconceptions about such resources. The increasing concern with problems of environmental quality in recent years has resulted in numerous calls for new approaches to resource use [3-5], but at the same time it is recognized that our current knowledge of how individuals perceive their relations to such resources, and of the consequences of such perceptions, is severely limited. Despite the research of geographers on environmental perception, and the more general research of sociologists, psychologists, social psychologists, and anthropologists on the cultural and behavioral consequences of perceptions and attitudes, relatively little has been done to bring these findings to bear on problems of resource use [6].

A number of authors have investigated the relationship between various socioeconomic indicators of family status, on the one hand, and the mean annual per capita household water consumption, on the other [7-10]. These authors have not generally defined their problems in "environmental" terms, though their findings are relevant to consideration of environmental problems. Among the variables typically considered in such studies are family income, family size, education of household head, occupation of household head, lot size, assessed property value, etc. The results of such investigations usually demonstrate that a combination of family size and some measure of family socioeconomic status (income; lot size; house value) explains a major portion of the variation in domestic consumption. Seldom have such investigations included measures of attitudes toward water use, or other social-psychological variables [11]. On the other hand, there have been a number of studies reporting on the attitudes of individuals other than domestic consumers toward water—watershed managers [12], managers of water-using industrial firms [13], public health officials responsible for water quality [14]—with regard to the exercise of their business or professional responsibilities.

The continued growth in demand for domestic water in Israel is accompanied by quality deterioration due to pollution of water sources [15]. Serious thought is being given to large-scale manufacturing of water through sea-water desalination. Measures to improve quality, as well as the establishment of desalination plants, will raise the costs of domestic supply, and it is conceivable that in some situations a lower, but still acceptable level of quality, or of supply, may be preferred to a large increase in price. The willingness to pay for adequate levels of water resource quality and supply is a factor which must be taken into consideration in planning with respect to many aspects of environmental quality, but knowledge in this area is limited to the findings of a few opinion surveys dealing with air pollution [16].

Israel is at present utilizing more than 90% of its available fresh water resources, and demand is growing at about 4% a year [15]. Despite the existence of a central authority for allocating water use among the three major sectors of the water economy—agriculture, domestic, and industry—the operation of some small-scale desalination installations, primarily in Eilat, and plans for under-

taking desalination on a much larger scale, the current rate of growth in consumption is likely to place a heavy strain on the country's water resources. Concern has already been expressed that the overpumping of the coastal aquifers has resulted in the incursion of sea water, leading to unacceptably high levels of pollution in these fresh water reservoirs. Thus, the problems of resource allocation, and the costs of developing alternative sources of supply, are immediate issues for the Israeli economy.

For all these reasons, Israel provides an appropriate setting for a more detailed investigation of public attitudes toward water use. We will be particularly concerned with attitudes regarding willingness to pay more for water under various conditions, both because of what we can learn from them about the Israeli situation, and because of their relevance to proposed solutions for environmental problems in general. While opinion surveys have shown that there is a certain degree of public willingness to pay in order to preserve environmental quality [17], such surveys have seldom dealt in any detail with the specific alternatives available to the respondent, among which he is asked to choose. Yet the general willingness to pay is likely to be greatly affected by specific situations in which the proposed price increase is to take place, and unless these situational effects are taken into consideration it is difficult to evaluate generalized expressions of such willingness. Thus, we concentrate on willingness to pay more for water in a number of clearly defined situations, in order to delineate some of the conditions which must be met in order that particular people in particular circumstances are willing to pay in order to avoid environmental deterioration.

The Present Study

As part of its on-going activities, the Long Range Planning Department of TAHAL–Water Planning for Israel, undertook an investigation of social factors affecting domestic water consumption in the four main urban areas of Israel (Jerusalem, Tel Aviv, Haifa, Beer Sheva). One of the main purposes of the research was to obtain consumption data for segments of the population. This was done in order that projected changes in the distribution of population characteristics could be linked with expected changes in domestic water consumption, thereby permitting rational planning for the extension of the water supply system. Because of Israel's unique situation with respect to utilization of available water resources, it was decided to obtain, via the study, information regarding the reported willingness of Israelis to pay more for water in the future, in the event that increased production or distribution costs necessitated such an increase. To be sure, the decision to raise rates is not made primarily on the basis of consumers' willingness to pay; still, it was felt that there was no information at all available on possible responses to rises in rates on which to base future policy. In addition to attitudes toward increases in the

price of domestic water due to scarcity or to increased production and distribution costs, the willingness to pay more for an improvement in water quality (primarily the reduction of "hardness") was also examined. Finally, data on the water-use installations present in the family's dwelling was gathered, along with estimates of the frequency of their use, the degree to which the family tried to limit its water use, and information relating to the perception of water as a commodity.

Data gathering was carried out in two stages. A sample of 1,892 adult Jewish inhabitants of the Jerusalem, Tel Aviv, Haifa, and Beer Sheva metropolitan areas was interviewed in the fall of 1971, in the framework of the Continuing Survey of Public Problems and Public Opinion, an amalgam survey fielded three times a year by the Israel Institute of Applied Social Research, and the Communications Institute of the Hebrew University. Data on water installations and use, willingness to pay, and other attitudes toward domestic water consumption, as well as demographic, economic, and family characteristics of the sample was obtained by interviews. The total water consumption for the year 1970/71 was obtained for each family from the records of the municipal water departments of the cities in which they lived. This information was added to the data collected from the individual respondents, so that the final file for each respondent included total annual household consumption, as well as per capita consumption for the household, obtained by dividing the total consumption by the number of household members.[2]

Findings

This section will present the findings in the following order: reported water use; limitation of use due to price; willingness to pay more for water; attitudes toward water quality; perception of water as a commodity; effects of different systems of charges; and the relation between social-psychological variables and measured consumption.

RUNNING WATER USE

An index of "running water use" was constructed, based on respondents' reports of whether they shut off the faucet, or leave the water running, while washing dishes and taking showers. About half the respondents reported that they "almost always" shut off the faucet while soaping dishes (52%) or while soaping themselves in the shower (46%). The index based on these two items has three categories: low use (37% of the respondents); moderate use (22%); and high use (41%).

[2] A complete description of the sampling methods employed, and the procedures followed in extracting data on water consumption, can be obtained on request from the authors.

Table 1 shows the effects of two background characteristics—per capita income and household size[3]—on reported use of running water. The two characteristics have a joint effect: for each possible comparison, low income respondents report less use than do high income respondents; and respondents in small families report less use than do those in larger families.

LIMITATION OF USE DUE TO PRICE

Respondents were asked whether they were in the habit of limiting their use of water at home due to its price. More than half of them (54%) replied that they did not limit use "at all" for this reason; and only 26% replied that they "definitely" or "somewhat" limited their use because of price. Table 2 shows that the joint effect of the two background characteristics on reported limitation of use due to price is similar to their effect on reported use of running water. Once again, it is the low-income respondents in small families who are most likely to report such limitation of use, and the high-income, respondents in large families who are least likely to report such limitation.

WILLINGNESS TO PAY MORE FOR WATER

Respondents were asked seven questions about their willingness to pay varying amounts more for water in different circumstances. Items included the possibility of paying IL2.50 and IL5.00 more per month for improved water quality; paying IL5.00, IL7.50, and IL10.00 more per month in order that their household supply not be limited; paying IL5.00 more per month rather than voluntarily limiting water use in the garden; and paying a similar amount rather than limiting dwelling water use.[4] Six of these items (excluding that dealing with limiting use of water for gardens, since many families did not have private gardens) formed a Guttman scale (Coefficient of reproductibility .92), and a new, 7-category variable termed "willingness to pay" was constructed.

Table 3 shows that income and family size are similarly related to expressed willingness to pay more for water as they are to reported water use, and limitation of use due to price. In every comparison, low-income respondents are less likely to have high scores on the willingness scale than are high-income respondents and respondents in small families are less likely to have high scores than are those in larger families.

Analysis of the pattern of responses to the six items forming the scale of "willingness to pay" permits us to infer the relative importance to the

[3] These variables serve as controls because both income and family size have strong effects on use.

[4] The average annual water bill of the households in the sample ranged from IL57 among smaller, low-income families in the Tel Aviv area, to IL102 among larger, high-income families regardless of region. Thus, an increase of IL2.50 per month represents an annual raise of IL36, not an insubstantial proportion of the total bill. It is true, however, that the costs of household water represent a very small proportion of total monthly income.

Table 1. Reported Use of Running Water (Per cent With Lowest Score–1–On Use Scale)

Per capita income	*Number of Persons in Household*	
	1-2	*3 or more*
0-299	57(139)	40(604)
300+	37(382)	26(495)

Table N: 1620
No answer: 272
Total N: **1892**

Table 2. Reported Limitation of Use Due to Price (Per cent "definitely" or "Somewhat" Limiting Due to Price)

Per capita income	*Number of Persons in Household*	
	1-2	*3 or more*
0-299	42(155)	35(642)
300+	23(414)	15(520)

Table N: 1731
No answer: 161
Total N: **1892**

Table 3. Willingness to Pay More for Water (Per cent With Lowest Score–1, 2–On the Willingness Scale)

Per capita income	*Number of Persons in Household*	
	1-2	*3 or more*
0-299	15(144)	24(609)
300+	33(388)	43(499)

Table N: 1640
No answer: 252
Total N: **1892**

Table 4. Perception of Water as a Commodity (Per cent with High Scores Scores–1,2,–On the Water as Commodity Scale)

Per capita income	*Number of Persons in Household*	
	1-2	*3 or more*
0-299	33(133)	30(618)
300+	49(386)	46(501)

Table N: 1638
No answer: 254
Total N: **1892**

Per capita income (IL), number of persons in household, and orientations to domestic water consumption: Use of running water; Limitation of use due to price; Willingness to pay more for water; Perception of water as a commodity; (N) for group.

respondents of each of the uses about which they were questioned. Since the order of scores on the scale depends on systematic differences between responses of individuals having adjacent scale scores, it is possible to examine these differences in order to ascertain which uses are most readily relinquished in preference to paying more for water, and which uses are less readily given up. Such an ordering reveals that respondents were:

Most ready to relinquish: An uninterrupted household water supply rather than pay an additional IL10/month in

	order that it not be limited to 12 hours a day;
	An uninterrupted household water supply rather than pay an additional IL7.50/month in order that it not be limited to 12 hours a day;
	Improved water quality rather than pay an extra IL5/month for such improvement;
Moderately ready to relinquish:	Improved water quality rather than pay an extra IL2.50/month for such improvement;
	An uninterrupted household water supply rather than pay an additional IL5/month in order that it not be limited to 12 hours a day;
Least ready to relinquish:	An extra payment of IL5/month rather than impose voluntary limitation of their use of water at home.

The separate questions were asked in such a way that the respondent did not have to consider the cumulative cost of all the changes to which he agreed, but only the cost of the specific change referred to in the question he was answering at the time.

The ranking indicates that both price and purpose must be considered in evaluating the acceptability of increases in the cost of water supply to domestic consumers. Equivalent increases in price are ranked differently according to their purpose; on the other hand, increases having the same purpose are ranked differently according to their cost.

The joint effects of price and purpose on willingness to pay more for water must be further conditioned by the consumer's felt needs for change in the water supply. In order to obtain information about attitudes toward water quality (Israel's water is fairly hard), respondents were asked how much they were bothered by quality in three specific circumstances: the effect of water on stiffness of clothing and towels after laundering; the scale that is deposited in pots and kettles; and the taste of the water. The proportion of respondents bothered by the effects of the water on laundry was lower than the proportion bothered by the other two situations. Most (44%) were "very" or "fairly" bothered by scale; 32% were similarly bothered by taste; and only 12% by the effect on laundry. Women were bothered more than men (49% vs. 40%) by scale, but not by other characteristics; there were few consistent effects of income or education on attitudes to water quality.

The finding that not all respondents are equally bothered by water quality

must be taken into account when evaluating the greater willingness to pay IL2.50/month more for better quality water than to pay IL5/month more for the same reason. We expected that willingness to pay for improved quality would be related to the degree which the respondent was bothered by existing quality, and Figure 1 shows that this expectation was fulfilled: at each price level, and for each income category, more respondents with the highest scores on the "bothered by water quality" scale[5] are willing to pay the additional amount suggested for an improvement in quality than are respondents with the lowest scale scores. This finding provides clear evidence of the role of social-psychological factors in affecting willingness to pay for changes in water quality; although the survey did not include parallel questions dealing with the importance to the respondent of an uninterrupted supply of water during the day, in order that a similar analysis could be carried out regarding non-economic effects on his willingness to pay more so that such a supply may be guaranteed, the present findings are grounds for expecting that attitudes about the importance of such a supply would also affect willingness to pay to insure it.

PERCEPTION OF WATER AS A COMMODITY

We hypothesized that one of the factors which was likely to affect an individual's consumption behavior, and his willingness to pay more for water, was his general attitude toward water as a commodity.[6] A number of authors [18] have called attention to the tendency of users to view air and water as "free goods," which should be supplied without cost. If such an attitude exists, those holding it should be resistant to increases in the price of water, and should be less likely than those with more of a "commodity orientation" to be careful in their consumption. In an effort to measure such an orientation, respondents were asked four questions:

> Do you think it's reasonable in general to require people to pay for water, or should water be supplied free of charge?
>
> Do you think that all the consumers in the country should pay the same price for water, without reference to differences in the cost of supplying water to consumers in different settlements?
>
> Assume that in the future it will cost more than at present to supply water to consumers. Do you think it reasonable to require consumers to pay more for the water?
>
> Assume that it was decided to improve the quality of the water you get at home, and that such improvements would cost money. Is it reasonable to require individual consumers to pay more for improved water, or is such an improvement the responsibility of the government, and it should bear the cost?[7]

[5] A four-category Guttman scale based on the three items described above, with a coefficient of reproductibility of .90.

[6] It should be clear to the reader that while the data on actual consumption refers to the family as a whole, attitudinal measures and reports of behavior are based on the responses of a randomly-selected adult household member, and are not some "average" response of all the members of the household.

[7] All interviewing was carried out in Hebrew; the wording of the questions as presented here are the authors' translation.

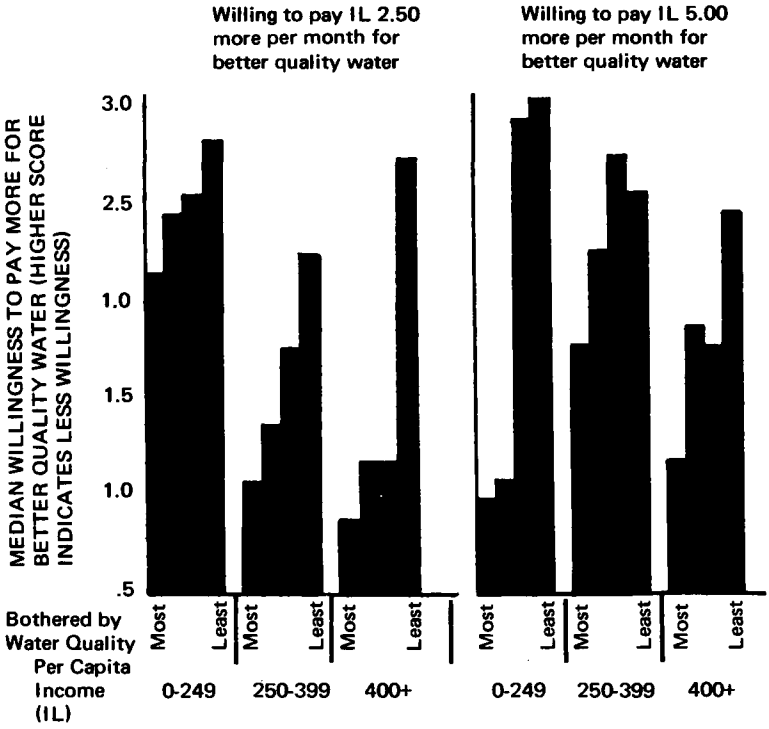

Figure 1. Willingness to pay more for better quality water, by per-capita income, bothered by water quality scale score, and amount of proposed increase.

The degree to which respondents expressed a "commodity orientation"—one which sees water not as a free good, but as an item of consumption which should be paid for—varied according to the question asked. More than four-fifths of the sample (81%) agreed that it was reasonable to ask consumers to pay for water; almost three-fifths (59%) felt that there should be a uniform price throughout the country; respondents were almost evenly divided (48% for, and 52% against) with respect to attitudes about raising water rates if the cost of supplying water rises; and almost three-quarters (72%) felt that any increase in price resulting from the improvement of water quality should be borne by the government, and not by the consumer. Responses to three of the four items were found to form a Guttman Scale (Coefficient of reproductibility .87), and after excluding the second item (uniform charges to different settlements), a new scale of "Perception of Water as a Commodity" was constructed, having six categories ranging from "high" to "low."

Table 4 shows the joint effect of the two background characteristics we have held constant on perception of water as a commodity. The findings are somewhat different from those in Tables 1-3. While low-income respondents are still less likely to have higher scale scores than are high income respondents, the effects of family size in this case are much smaller than those reported with respect to running water use, limitation of use due to price, and willingness to pay more for water.

It is possible to summarize the findings in Tables 1-4 by saying that while income always has an effect on orientation, family size has such an effect only with respect to orientations toward use and toward payment, but not with respect to orientation toward water as a commodity. Moreover, in Tables 1-3 there is an interaction between income and family size: controlling for family size, a rise in income leads to less reported limitation of use and greater willingness to pay more; similarly, controlling for income, an increase in family size has the same effect. Thus, the two variables with the greatest effects on measured absolute consumption have similar effects on orientations toward consumption: wealthier families consume more, and so do larger ones, and they are also more likely to have orientations appropriate to such consumption than are smaller, poorer families.

A main purpose of including questions about the perception of water as a commodity was our expectation that the presence or absence of such an orientation would be related to other attitudes and behaviors regarding water consumption. One such attitude would be willingness to pay: we would expect that respondents having a stronger orientation toward water as a commodity would be more willing to pay for changes in quality or supply than would those who were less likely to have such an orientation. In order to see whether this expectation was fulfilled, the relationship between respondents' scores on two scales–perception of water as a commodity, and willingness to pay more for water–was examined, controlling for level of per capita income (a control made necessary by the effect of income on willingness to pay more for water and on perception of water as a commodity). Table 5 shows that our expectation is fulfilled: within each income level, respondents with the highest score (1, 2) on the scale of perception of water as a commodity are characterized by a greater willingness to pay than are those with lower scores (3-6). This relationship persists even after respondent's level of education is held constant, in addition to per capita income.

In contrast to the finding just reported, perception of water as a commodity is not related to respondent reports of limitation of water use due to price, nor to reported use of running water at home. We expected that a commodity orientation would affect reported use, and the finding that this is not the case suggests that factors affecting use are not identical with those affecting attitudes towards cost, despite the apparent connection between the two (since the more water is used, the greater the cost). Thus, it appears that attitudes toward

Table 5.

Per capita income (IL)	*Perception of Water as a Commodity*		
	High (1, 2)	*Moderate (3, 4)*	*Low (5, 6)*
0-249	28(169)	17(149)	19(246)
250-399	39(170)	23(130)	21(134)
400+	54(290)	26(141)	27(133)

Table N: 1562
No Answer: 330

Total N: 1892

Per capita monthly gross family income, score on scale of perception of water as a commodity, and score on scale of willingness to pay more for water (Per cent of each group with high (1, 2) scores on scale of willingness to pay more for water; (N) for group).

domestic water use form a complex pattern, with the various aspects of such attitudes not necessarily related one to another.

EFFECTS OF DIFFERENT SYSTEMS OF CHARGES

Water for urban household consumption is not uniformly priced in Israel. The charge per cubic meter in Jerusalem and Haifa is uniform, while in Tel Aviv and Beer Sheva the price is progressive—the more you use, the higher the price per cubic meter. Within cities, moreover, there are two kinds of domestic water metering systems: house meters, where the supply of water used by the entire house (in the case of multi-family dwellings, the most common urban residential structure) is metered, and the bill for this amount is divided among the individual consuming units (apartments) in the building; and apartment meters, which measure the amount actually consumed in a particular apartment, or private house. Furthermore, the method of billing consumers in buildings with house metering differs from building to building. Sometimes the quantity is divided equally among the apartments; most often it is divided according to the number of rooms in each apartment.

We expected the system of charges to have an effect on attitudes toward water consumption. Our analysis of these effects is based on comparisons of respondents in cities having progressive water rates with those in cities having uniform rates, as well as comparisons between respondents in buildings having house metering and those with apartment metering. Let us first examine the effects of the type of metering in the respondent's dwelling unit. We would expect respondents with house metering to be less sensitive to price aspects of

consumption than respondents with apartment metering, since the price to the latter of water consumed is related only distantly to their actual consumption. Thus, there would be less opportunity for their patterns of use, and their attitudes toward water, to develop in accordance with "rational" considerations.

Table 6 shows the effect of meter type on perception of water as a commodity, reported use of running water, and reported limitation of use due to price, controlling for per capita income. With respect to perception of water as a commodity, the differences are in the predicted direction, though only among the middle-income group are they anything but small: respondents having house metering are less likely to have high scores on the scale of perception of water as a commodity. With respect to the other two items, the relationship is opposite to that expected: again, the major differences occur among respondents in the middle-income category, but here those with house metering are *more* likely to report a lower degree of running water use, and a greater effort to limit use due to price, than are respondents having apartment metering.

One possible explanation for these findings lies in the different situations in which consumers with house meters and those with apartment meters find themselves. Since the consumer with a house meter does not pay according to the amount of water he uses, he has little opportunity to develop a rational perception of water as a commodity. On the other hand, the discrepancy between use and the resulting cost may nevertheless lead him to attempt to limit consumption in an effort to reduce his costs. Thus, respondents with house meters would be lower on perception of water as a commodity, while at the same time reporting greater water-saving behavior. Our data do not permit the testing of this explanation; nor is it clear why the phenomenon occurs most clearly only among middle-income respondents.

While one effect of different types of metering may be to reduce the connection felt by the respondent between the amount of his consumption and the cost of the water, a different effect is to be expected with respect to his willingness to accept price increases. Whereas respondents with apartment metering pay only for the consumption of their own household, respondents with house metering may actually be paying for the consumption of other families in the same building (in the case of small families living in large apartments), or having their consumption paid for in part by other families in the building (in the case of large families in small apartments). Since the allocation of the building's total consumption is usually based on the size of the individual apartments, families in larger apartments pay a relatively higher share of the total bill than do families living in smaller units, regardless of the size of these families, or the amount of their consumption.

This consequence of the system of house metering should raise problems of equity in the minds of consumers, and especially among those who are clearly over-paying, or clearly under-paying, for water. Three elements enter into establishing a criterion for over- or under-payment: 1) apartment size; 2) number

Table 6.

Meter type	*Per capita income (IL)*	*High (1, 2) on perception of water as a commodity*	*Low (1) on use of running water*	*"Definitely" or "fairly" limit use due to price*
House	0-249	26(158)	47(152)	41(165)
	250-399	34(91)	43(95)	27(99)
	400+	48(146)	42(138)	16(159)
Apartment	0-249	29(357)	45(359)	40(379)
	250-399	42(298)	32(302)	20(315)
	400+	53(358)	30(358)	18(377)
Table N:		1408	1404	1494
No answer:		218	222	132
No data on meter type:		266	266	266
Total N:		1892	1892	1892

Meter type, per capita monthly gross family income, and: perception of water as a commodity; use of running water; limitation of water use due to price (Per cent in each group with high scores (1, 2) on scale of perception of water as a commodity; low score (1) on use of running water; and "definite" or "fair" limitation on water use due to price; (N) for group).

of persons in family; 3) per capita income. By combining the first two variables we get four groups: 1) small families in small apartments; 2) large families in small apartments; 3) small families in large apartments; and 4) large families in large apartments. The first and last groups are subject to relatively equitable charges, in comparison with the other two, since in their case there is a rough correspondence between family size (the variables most closely related to total consumption) and apartment size (the standard for assigning cost). The second group is underpaying, and the third group is overpaying.

But over- or under-payment is also related to ability to pay, for though all households in the second group are underpaying, the wealthier among them are more clearly underpaying than the others, in the sense of being able to assign a lower proportion of their disposable income to the cost of water. Similarly, though all households in the third group are overpaying, the poorer among them are overpaying more than the others, since they must assign a larger proportion of their disposable income to meeting the cost of water. We thus arrive at two groups of households with house metering which are clearly at opposite ends of the "equity spectrum": small, low-income families in large apartments, who are clearly overpaying; and large, high-income families in small apartments, who are clearly underpaying.

It is these two groups that we would expect to differ most noticeably from their counterparts in households having apartment metering, with regard to willingness to pay more for water under various conditions. Those who are underpaying at present should be *more* willing than respondents with similar characteristics but with apartment metering to pay more for water; conversely, those who are overpaying at present should be *less* willing than respondents with similar characteristics but with apartment metering to accept price increases. Since the other groups (besides those clearly overpaying and clearly underpaying) have conflicting characteristics, there is no basis for predicting consistent differences in willingness to pay more for water according to their meter type.

Table 7 shows that our prediction is indeed borne out, and that respondents with house metering who are clearly *underpaying* are more likely than their counterparts with apartment metering to express willingness to pay more for water (43% vs. 26%). The reverse occurs among those who are clearly *overpaying*: none of them are willing to pay more for water, compared to the willingness of 29% of their counterparts with apartment metering to accept an increase. Because of the small number of cases in this group, the results should be viewed cautiously, though their confirmation of the prediction is encouraging.

In all but one of the other comparisons between households of various types, respondents with house metering do not differ from respondents with apartment metering in their willingness to pay more for water by more than three percentage points. The single exception occurs among low-income respondents from large families living in small apartments: although these households are underpaying according to the combination of apartment size and family size, respondents in this group having house metering are eight percentage points *less* likely to express willingness to pay more for water than are the corresponding respondents in households with apartment metering. The difference is not so large, but since the direction is also opposite to that predicted it is puzzling.

Despite this exception, we think it reasonable to conclude that the findings demonstrate that the notion of equity—what Homans [19] called "distributive justice"—must be taken into consideration when examining willingness to pay for changes in environmental quality. While the metering system in Israel may be unusual, the issues it forces us to confront are likely to be more common, and the data suggest that the willingness of people to pay is likely to be affected by their belief that the burden is being spread fairly.

The second form of pricing effects are those due to the application of a progressive as opposed to a uniform rate for water consumed. Our analysis of the effects of rate must be restricted to respondents with apartment metering, since the effect of rate will not be visible to the consumers with house metering.

The effect of the uniform rate in Jerusalem and Haifa, and of the progressive rate in Tel Aviv and Beer Sheva, should be reflected in one of two ways. If progressive rates lead to more concern about the actual amount of water

Table 7.

Apartment size (no. of rooms)	*Family size (no. of persons)*	*per capita income (IL)*	*Meter Type*	
			House	*Apartment*
		0-299	19(36)	16(58)
	1-2			
		300+	28(76)	30(119)
1-2				
		0-299	18(71)	26(153)
	3+			
		300+[a]	43(30)	26(78)
		0-299[b]	0(13)	29(21)
	1-2			
		300+	32(40)	35(98)
3+				
		0-299	21(75)	23(231)
	3+			
		300+	48(56)	46(256)

[a] underpaying most
[b] overpaying most

Table N:	397	1014
No answer:	72	143
	469	**1157**
No data on meter type:	266	
Total N:	**1892**	

Apartment size, family size, per capita gross monthly income, meter type and willingness to pay more for water (Per cent in each group with high (1, 2) scores on the scale of willingness to pay for water; (N) for group).

consumed because of the desire to avoid premium rates for excess use, then respondents in Tel Aviv and Beer Sheva should exhibit greater sensitivity to higher levels of use than respondents in Haifa and Jerusalem. On the other hand, if the overall higher price paid per cubic meter (see below) by consumers in Haifa and Jerusalem as a consequence of the uniform rate, as compared with those in Tel Aviv and Beer Sheva, is of primary importance, the respondents in the former cities should evince greater sensitivity to use factors than those in the latter.

Table 8 shows that once again there is a difference between the effects of pricing on perception of water as a commodity and its effects on the other use factors. For each income level, respondents in Jerusalem and Haifa have higher scores on the scale of perception of water as a commodity than do respondents in Tel Aviv and Beer Sheva. The differences on the other two items are much

Table 8.

Per capita income	*Type of water rate*	*High (1, 2) on perception of water as a commodity*	*Low (1) on use of running water*	*"Definitely" or "fairly" limit use due to price*
0-249	Uniform[a]	36(145)	41(141)	37(153)
	Progressive[b]	25(206)	48(213)	43(220)
250-399	Uniform[a]	51(100)	31(101)	22(105)
	Progressive[b]	37(191)	31(196)	19(203)
400+	Uniform[a]	60(136)	24(139)	16(144)
	Progressive[b]	49(216)	34(213)	19(225)
	Table N:	994	1003	1050
	No answer:	163	154	107
	House metering:	469	469	469
	No data on meter:	266	266	266
	Total N:	**1892**	**1892**	**1892**

[a] Jerusalem, Haifa
[b] Tel Aviv, Beer Sheva

Per capita monthly gross family income, type of water rate, and: perception of water as a commodity; use of running water; limitation of water use due to price; among respondents in households having apartment metering only (Per cent in each group with high scores (1, 2) on scale of perception of water as a commodity; low scores (1) on use of running water; and "definite" or "fair" limitation of water use due to price; (N) for group).

smaller, less consistent, and in the opposite direction; that is, where such differences exist, they indicate that respondents in Tel Aviv and Beer Sheva are more concerned with actual water use than those in Jerusalem and Haifa. Thus, it seems as if both effects are operating at once, although differentially according to the specific item, and with unequal force: the higher price of water in Jerusalem and Haifa results in a greater perception of water as a commodity in those cities, but the progressive rate in Tel Aviv and Beer Sheva creates an incentive for respondents to limit their use (as measured by their self-reporting).

A third effect of the system of charges is on actual consumption rates, and on the actual price paid for water. The purpose of a progressive rate schedule is to penalize users of greater quantities of water, and thus serve as an inducement to lower use. An earlier study [20] in the Tel Aviv area of changes in water consumption as a result of the replacement of house metering by apartment metering revealed a substantial drop in total consumption for a period of 10

years, followed by a resumption of the annual consumption increase. This finding indicates that consumers are temporarily sensitive to changes which affect their water bills (the introduction of apartment metering generally leads to a rise in the amount of the bill), and temporarily adjust their behavior. We would similarly expect to find that the progressive water rate in Tel Aviv and Beer Sheva encourages consumers in those cities to use less water than those in Jerusalem and Haifa, which have a uniform rate.

Surprisingly, the opposite occurs, as Table 9 shows. When family size and per capita income are held constant, the total annual consumption of households in cities with a progressive water rate is consistently greater than the total annual consumption of households in cities having a uniform rate. Not only that, the mean price per cubic meter of water consumed is *greater* for households in Jerusalem and Haifa, which have a uniform rate, than for those in Tel Aviv and Beer Sheva, which have a progressive rate. Thus, the progressive rate, rather than leading to higher costs and lower consumption, results instead in greater consumption, and a lower price per unit. Clearly, the progressive rate as applied during the year to which our data refer did not achieve the intended effects.[8]

THE EFFECT OF ATTITUDES ON CONSUMPTION

Up to now, we have dealt with the distribution of attitudes toward water consumption among the respondents in the study, with the interrelationships among different attitudes, and with the effects of differences in charge systems on attitudes. In this final section we will consider whether attitudes toward domestic water consumption are related to the actual consumption of water by the respondents' households (only households with apartment metering were included in this analysis).

The mean per capita annual consumption was computed for four types of households: 1) small (1-3 persons), lower income (under IL300 per capita per month); 2) small, higher income (IL300 per capita per month or more); 3) large (4 or more persons), lower income; and 4) large, higher income. Each type was further divided in two sub-groups, according to whether the respondents were high or low on the scale of perception of water as a commodity; high or low on reported use of running water; and high or low on the reported limiting of water use due to price. The mean per capita annual consumption of each of the two sub-groups was compared, for each of the four types, and we expected that households in which respondents expressed greater sensitivity to price and

[8] A possible explanation for this finding lies in the structure of the progressive rate as applied in Tel Aviv and Beer Sheva. The price per cubic meter of the basic allocation is relatively low; the population of the region (in particular the Tel Aviv area) contains a relatively high proportion of small families; and the quantity of water provided in the basic allocation represents a substantial proportion of the needs of smaller families. Small families in the Tel Aviv and Beer Sheva regions are encouraged to over-consume by the rate structure, and this, combined with the fact that per capita consumption is inversely related to family size, results in a greater total annual consumption.

Table 9.

Family size	*Type of water rate*		*Per Capita Gross Monthly Family Income*	
			IL 0-299	*IL 300+*
1-3 persons	Uniform[a]	Total consumption	130 m^3	147 m^3
		price/m^3 (N)	IL .54 (48)	IL .51 (146)
	Progressive[b]	Total consumption	150 m^3	161 m^3
		price/m^3 (N)	IL .38 (89)	IL .41 (245)
4+ persons	Uniform[a]	Total consumption	181 m^3	188 m^3
		price/m^3 (N)	IL .56 (146)	IL .55 (64)
	Progressive[b]	Total consumption	208 m^3	245 m^3
		price/m^3 (N)	IL .41 (202)	IL .42 (109)

[a] Jerusalem; Haifa
[b] Tel Aviv; Beer Sheva

Table N:	1049
No answer:	108
House metering	469
No data on meter type:	266
Total N:	**1892**

Total annual family consumption and mean price paid cubic meter by family size, per capita monthly gross family income and type of water rate; for households with apartment metering only (consumption in cubic meters; price per cubic meter in IL; (N) for group).

quantity aspects of domestic consumption would have lower consumption rates. This expectation was not borne out: there were no significant differences in consumption between sub-groups in each of the four types on any of the three social-psychological variables examined. A further analysis was carried out, in which differences in system of charges (uniform or progressive) were controlled by examining separately the relationship between perception of water as a commodity and actual consumption for each of the four types in Jerusalem and Haifa, on the one hand, and Tel Aviv and Beer Sheva, on the other. Again, no sub-group differences were found. Thus, the data do not support the hypothesis

that attitudes toward aspects of domestic water use affect actual levels of consumption.

Discussion

We have shown that social-psychological factors in domestic water consumption are related to socioeconomic characteristics of respondents in Israel. We have also, and more important, been able to demonstrate that willingness to pay more for domestic water under various specified conditions is affected not only by ability to pay, but by the specific aspects of the situation, by other attitudes about water as a commodity, by attitudes about the situation, and by the actual situation in which consumers find themselves with respect to the cost of water. The clear relation between income and score on the scale of perception of water as a commodity strengthens the argument that different segments of the population have different approaches to problems of environmental quality, and the likelihood that measures to improve quality will be less easily accepted by poorer people for whom the marginal utility of an increment of improvement in quality may be less than that of the sum of money required of them to bring it about.

Equally important, we have shown that the degree to which the respondent's situation is seen by him as equitable has a clear effect on his willingness to pay more. Although our findings are necessarily restricted to the case of domestic water consumption in Israel, they are easily linked to more general questions of equity, and these issues are likely to arise with growing frequency as serious efforts are made to allocate the costs of preventing environmental deterioration among different sections of the population and the economy. We are thus led to consider the broader questions of social priorities and the mechanisms through which they are set, a topic far removed from that dealt with here.

While the present investigation did not succeed in demonstrating an independent effect of social-psychological factors on the amount of water consumed, over and above the effect of family size and per capita income, such effects may still occur under different circumstances. It may be that the two main variables related to domestic water consumption account for so much of the variation that the additional effects of socio-psychological factors are negligible. It should be remembered, however, that the present study was carried out during a period in which no special public concern was expressed about the amount of water available, nor were householders urged to reduce their consumption in order to save water. Moreover, the current price of domestic water in Israel is low enough so that it represents a relatively minor portion of family expenditures; were the price to rise sufficiently in the future in response to increased costs of production and distribution, a relation between actual consumption and reported use habits might well appear. Thus, the negative

findings do not necessarily provide evidence that respondent perceptions of shortages, and self-reports regarding water-saving efforts, would not be reflected in total family consumption, were there to be major changes in the country's water economy. The present research was unable to deal with attitudes toward water saving and perceptions of shortages, but it is not unreasonable to expect these to be more closely related to consumption than the more general orientations which were examined.

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