The Effectiveness of Mandatory and Voluntary Water-Use Restrictions During Drought

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Introduction

The 2002 drought represented a major challenge for municipal water suppliers throughout the eastern United States. Many areas unaccustomed to temporary water shortages were forced to institute voluntary and mandatory water use restrictions on residential and commercial water users. In Virginia, the drought was so severe that Governor Mark Warner issued a first ever executive order that established bans on outdoor water use across most of the state.

While the 2002 drought was an unusual climatic event, the risk of temporary water shortages is likely to increase in the future even in the water-rich east. Historically, the prevalent method for dealing with water supply has been supply-side management. Under this system, municipalities essentially took water demand as given and secured sufficient water supplies to meet this demand, even under the most unfavorable circumstances. However, demographic trends and regulatory conditions increasingly limit the ability of local water suppliers to expand water sources at a sufficient rate to eliminate the risks of future water shortages. The mounting difficulties for municipalities in building new reservoirs, expanding reservoirs, or securing additional water withdrawal permits from rivers make future expansion of water supplies more difficult. Many of these challenges are due to environmental and legal constraints such as the Clean Water Act, Endangered Species Act (requirements for in-stream flows), NEPA and EIS requirements (Shabman and Cox 2004; Maddock and Hines 1995). The difficulty in expanding water supplies in conjunction with continued population growth will mean that the risks of short-term water shortages are likely to increase in the future.

Consequently, local water supply managers will be increasing forced to develop strategies and management plans to mitigate the effects of temporary water shortages. This planning process will require insight into expected changes in water demand due to imposition of various drought management programs. In the expansive water demand literature, only a limited number of studies have tried to estimate the reduction in water demand from drought management programs (Moncur 1987, Billings and Day 1989, Nieswiadomy 1992, Renwick and Archibald 1998, Wang et al 1999, Michelsen et al 1999, Renwick and Green 2000, Taylor et al 2004).

Studies estimating the effectiveness of drought management programs have also tended to focus on the southwest region of this country. It would be expected that the water use dynamics of this arid region would be quite unique and thus these estimates (even if otherwise transferable) would not necessarily be applicable in eastern states with different climatic and demographic conditions. For instance, in southwest cities the increase in summer usage compared to the winter months ranged from 60 – 320% with the typical increase between 100-200% (based on Michelsen et al 1999 data). In contrast, the typical increase in summer usage in the east is much lower.

Furthermore, most studies of drought management programs do not evaluate the intensity in which various drought management programs were implemented. The intensity of the drought management program is defined in this study as the information level used to promote the program and the enforcement effort used to ensure compliance. With the exception of Billings and Day (1989), previous studies make no distinction between the differences in program implementation intensity. Mandatory restrictions that levied fines for non-compliance were treated the same as ones that had no enforcement activities. Voluntary programs with a high-level of information dissemination were treated the same as programs with a cursory level of effort. The effectiveness in reducing water demand in either case might depend on the level of effort expended by the locality in the implementation of the program. The objectives of this study are to estimate the influence that information and enforcement levels with voluntary and mandatory water-use restriction programs have on residential water demand.

Drought Management Programs in Virginia

Monthly residential water use data was obtained for 21 local water suppliers across Virginia. They included water suppliers in both cities and to counties (suburban) areas. These 21 localities represented a broad range of experiences in dealing with the 2002 drought (see Table 1). Eighteen of the 21 localities were required to impose mandatory restrictions on outdoor water use under the Governor's executive order that became effective September 1, 2002. Furthermore, 7 of these localities imposed mandatory restrictions and 13 imposed voluntary restrictions at earlier stages of the drought in 2002.

Measuring differences in how voluntary and mandatory programs are implemented, however, has been a challenge in the water demand literature. Take for example, a study commissioned by the American Water Works Association Resources Foundation (Michelsen et al 1999). It seems reasonable to assume that a study supported by this organization would have an advantage in terms of cooperation from its member waterworks. However, the researchers still experienced significant problems in obtaining intensity-type data:

> "In order to identify and quantify the effectiveness of individual nonprice conservation programs, it is necessary to have accurate information about specific program activities, levels of effort, scope and coverage, and the exact periods of program duration corresponding with activities and levels of effort (p597)… Specific information about nonprice conservation program activities, levels of effort, scope and coverage and the exact duration of program activities was difficult to obtain from existing utility records. Nonprice program activities were often aggregated in reports without descriptions of individual program efforts (p597)… There was no consistent accounting across cities for the specific activities and level of effort of each program. One city may expend considerable effort and funds making a particular program work whereas another city may only make a token effort with a program. It should not be expected that the same percentage reduction in water use would result in both cases". (p601).

Thus a problem that these researchers encountered was the difficulty in making distinctions on the intensity levels of water-use restriction programs. These researchers intended to initially model the intensity of conservation programs and move beyond a binary approach to modeling conservation programs. However, due to problems in obtaining the desired data, Michelson et al. aggregated all programs (as well as all forms of each program) into a single variable.

The approach used in this study was to develop a qualitative ranking of voluntary and mandatory water-use restriction programs using information provided in a series of mail surveys and telephone interviews conducted between April and October of 2004. Surveys were generally sent out to program administrators or water conservation planners in the water supply branch of Public Works Departments. After initially contacting these individuals by phone, surveys were sent out by fax or email. The completed surveys were followed up with emails and interviews to clarify responses where needed.

The survey was divided into two sections. The first section solicited basic descriptive information about timing and coverage of drought management programs. The second section gathered information on the intensity (levels of information and enforcement) of voluntary and mandatory restriction programs.

The second section contained a combination of descriptive questions and a subjective self-assessment (see Table 3). The descriptive questions asked water managers to list information outlets used to disseminate information about mandatory/voluntary water restriction programs. For those areas where mandatory water-use restriction programs were implemented, program managers were also asked to list how frequently their programs issued warnings and citations to citizens who violated the restrictions. These descriptive questions were then followed up by a question that solicited the water managers' subjective overall ranking of their informational and enforcement efforts during the summer and fall of 2002. The water managers were asked to classify the overall informational and enforcement rating into three general categories: 1) minimal levels of informational and/or enforcement; 2) modest levels of information and/or enforcement; and 3) aggressive levels of information and/or enforcement (see Table 3).

The subjective ranking and descriptive responses for information and enforcement efforts were then used to develop a final classification scheme for each locality. The classification scheme is intended to broadly distinguish the differences in implementation of both voluntary and mandatory drought management programs across localities. The classification system provides an ordinal ranking based on low, medium and high levels of information for voluntary and mandatory programs and a similar high, medium, and low ranking for levels of enforcement for mandatory programs.

The ranking were initially based on the answers provided by the overall evaluations for information and enforcement efforts. To ensure consist comparisons across programs, however, these subjective program rankings were sometimes modified based on corroborating evidence gathered from descriptive questions and telephone interviews. Therefore, while a water quality manager might describe their enforcement efforts as "high" on the survey, the locality would only be assigned this ranking if objective information obtained from the survey and phone interviews verified the subjective ranking. While this approach does not provide quantitative measures of program implementation (number of fines, staff hours devoted to monitoring/policing, etc), such a ranking does provide broad delineations between programs with little or no enforcement/information from those programs with very aggressive implementation programs.

Table 2 provides the final rankings for each locality[1]. There was considerable variance in the level of information levels and enforcement across localities. For voluntary restrictions, the general information level was relatively high. Three localities had a low overall rating, five localities had a mid-level rating, and seven localities had a high rating. For mandatory restrictions imposed under the executive order, the information levels were somewhat similar. Only two localities had a low overall rating during this period, while seven had a mid-level rating, and eight had a high rating. For the mandatory restrictions imposed by the executive order, twelve localities had a low overall rating for enforcement, four had a mid-level rating, and only one had a high rating. Thus in general, information levels were considerably higher than enforcement levels.

Empirical Model

The ranking system developed above is incorporated into a monthly residential water demand model. The general model is described in equation 1. The specific variable definitions used are explained below.

(Eq. 1) Natural log Monthly Residential Water-Use$_{ij}$ *= f (voluntary restrictions, mandatory restrictions, price, income, average household size, month, rainfall during the growing season (deviation from historical average), temperature during the growing season (deviation from historical average), percent apartments]*

where i represents the 21 localities and j represents the monthly observation.

Total household water use is defined as the average monthly water-use (expressed in gallons per day) per residential account. Monthly water-use covers a minimum of 24 months for

[1] Individual program ranking can change over time depending on the unique implementation circumstances of the locality. For instance, enforcement might receive a higher ranking at the beginning of a program but enforcement activities might increase or decrease as the severity of the water shortage changes.

each locality (2002 data included for all localities). The longest monthly record of water use extends from 1991 to 2003. Thus the data represents an unbalanced panel of 1,286 observations.

To reflect the differences in mandatory and voluntary restriction intensities, a series of 12 dummy variables were defined that correspond to the ranking system developed above. Three dummy variables (VolInfo1, VolInfo2, VolInfo3) were included in the model that corresponded to low, medium, and high information levels. Given that mandatory restriction programs were distinguished based on ratings for information and enforcement efforts, a total of nine possible unique dummy variables were possible. However, one combination (low informational, high enforcement) contained no observations. Thus, a total of eight dummy variables were used in the model to identify intensities of mandatory water-use restrictions (MandInfo1Enf1, MandInfo1Enf2, MandInfo2Enf1 MandInfo2Enf2, MandInfo2Enf3, MandInfo3Enf1 MandInfo3Enf2, and MandInfo3Enf3).

Price was defined as the marginal price used by the average residential household. Furthermore, price was specified as three separate slope dummies for summer, spring/fall, and winter (MargPriceSummer, MargPriceSpringFall, MargPriceWinter) to reflect that households may respond differently to price across seasons. For instance, discretionary water-use is highest in the summer so price elasticities might be more elastic in the summer months compared to the winter months. Summer months are defined as June, July and August. Spring and fall months are defined as April, May, September, and October.

An additional variable, called the "difference variable" was used in conjunction with the marginal price specification to deal with what is typically considered in the literature as a minor income effect that would occur through the inclusion of fixed fees and/or previous block rates (e.g. a fixed fee of say $10 would effectively reduce the consumers disposable income available for purchasing water on other goods). This variable is constructed by subtracting the total usage at the marginal price from the actual bill. As with marginal price, this variable was specified with 3 slope dummy variables to account for differences in the three seasons (DiffVarSummer, DiffVarSpringFall, and DiffVarWinter).

Seasonal variation in water-use was modeled by a series of monthly dummy variables to capture the general cyclical trend (JanDum to NovDum). However, because water-use generally does not increase as rapidly in cities as in counties during the summer, an additional 12 monthly dummy variables were included to allow for structural differences between these two types of localities (JanDumCity to DecDumCity).

A number of rainfall and temperature variables are used to reflect deviations from seasonal water use patterns. The RAIN variables are defined as the difference between the observed monthly rainfall and the long-term monthly average (measured in inches) and are hypothesized to be negatively related to water use. The TEMP variables are defined as the difference between the average monthly maximum temperature and the historical average monthly high (measured in degrees Fahrenheit). Since changes in rainfall and temperature patterns are expected to only have an influence on residential water-use during the growing season (Summer and Spring/Fall), the rain and temperature variables are modeled in conjunction with slope dummies. Furthermore, since cities and suburban areas might experience different levels of outdoor water use during the summer months, rainfall and temperature are also distinguished by county (Cty modifier) or city (CITY modifier) location.

Rainfall is also expected to have a lagged effect to reflect the fact that drought situations are an accumulation of below average rainfall periods. Two lags of each of the four rainfall variables were defined to capture the longer term influence of rain on water-use behavior.

Income was defined as the median yearly income for owner-occupied households in each locality. Similarly to price, income was specified as 3 separate slope dummies for summer, spring/fall, and winter to reflect income level may have different effects across seasons (IncomeSummer, IncomeSpringFall, IncomeWinter). Household size (HouseholdSize) was defined as the median size for owner-occupied households in each locality. Water-use is expected to be an increasing function of household size.

Finally, four explanatory variables were included to account for the presence of apartment complexes in the water use data. Local water suppliers did not use a standard definition of residential to delineate between residential user accounts. Residential meant pure single-family residential data in some localities, while in others it included apartment data. The way in which this apartment data was incorporated into the residential data also varied. Residential data included only single-metered apartments in some localities (one meter per apartment), only group-metered apartments in others (one meter for a group of apartments), or a mix of the two. Yet how residential accounts are defined influences observed residential water use per account for obvious reasons. Thus estimates for the percentages of both single-meter and group-metered apartments (GroupMeterApt) were included in the final model[2]. The estimates for percentage of single-meter apartments in the residential data were specified with 3 slope dummy variables to account for differences in the three seasons[3] (SingleMeterAptSumr, SingleMeterAptSpringFall, and SingleMeterAptWinter).

Results

The model was originally estimated using OLS. Diagnostic tests revealed an autoregressive process in the error terms. Evidence existed for both a AR(1) and AR(12) process, which matched theoretical expectations as monthly panel data was used in the analysis. An AR(1) model was chosen to solely capture this autocorrelation as the AR(1) process was much stronger than the AR(12) process and was also more operationally feasible to implement using panel-level data. Another problem revealed by testing was evidence for possible heteroskedasticity across panels. Standard errors for parameter estimates were adjusted by using a Prais-Winsten regression with heteroskedastic panel corrected standard errors. The final model was estimated with these additions and reported in Table 4.

In general, the sign and magnitude on the voluntary and mandatory water-use restriction programs matched broad expectations. Voluntary water-use restrictions had only a minimal impact on residential water demand. The two lowest intensity levels for voluntary restrictions were slightly positive, but not statistically different from zero. Only the most aggressive voluntary restrictions seemed able to significantly reduce water use. Voluntary programs with a "high" information rating were estimated to reduce water-use by 7 percent.

Strong evidence was found that the intensity of mandatory water-use restriction programs can have a large impact on their effectiveness in achieving reductions in water-use. For mandatory restrictions, all parameter estimates were negative, and with the exception of one

[2] These variables were constructed by estimating the percentage of housing stock in apartments (constructed from the U.S. Census) and multiplying by the percentage of single metered apartments in the residential data (obtained from interviews with local water supply managers). For example, Newport News had 33.7% of its overall housing stock in apartments, and had 100% of these mixed into the residential data (80% group-metered and 20% single-metered). Thus the corresponding calculations would be:

Percentage of group-metered apartments in residential data = 33.7 x .80 = 27.0%
Percentage of single-metered apartments in residential data = 33.7 x .20 = 6.7%

[3] Seasonal dummy modifiers were not included with this variable due to limited observations.

parameter estimate, followed a pattern on increasing effectiveness with increases in information and enforcement levels. The results indicate that large difference in the parameter estimates for the mandatory program variables. Programs ranked as the most aggressive in terms of enforcement, MandInfo2Enf3 and MandInfo3Enf3, achieved estimated reductions in water use of 20% and 22% respectively. Conversely, estimates for the lowest information levels, while negative, were not statistically different from zero. Thus, mandatory water use restriction programs with only minimal information campaigns had a little influence on overall residential water use. Mandatory programs with aggressive informational campaign but perhaps without a credible or highly visible effort to actively enforce the restrictions (MandInfo3Enf1) still achieved water use reductions of 12%.

The parameter estimates for marginal price were all negative and significant. One expectation with these parameter estimates was that they would show the strongest response during the summer and the weakest response during the winter. This hypothesis was supported by the resulting estimates. An increase of $1 in the marginal price of water would be expected to decrease residential water-use by 4.8% in the summer, 4.3% during spring/fall, and 3.0% in the winter. These estimates translate into elasticities of -.26, -.23, and -.16 respectively. The signs of the difference and income variables all followed expectations.

All of the coefficients for the rainfall and temperature variables were of the correct sign. Ten out of the 16 climatic parameter estimates were significant at the .01 level or greater. Only 5 parameter estimates were not significantly different from zero at the .05 level, and were generally the second-lags of the rainfall variables.

The parameter estimate for household size was .20, which implies that an increase in average household size from 2.0 to 3.0 persons would result in an increase in water-use by 20%. It was expected that the response of this variable would be less than unitary in terms of the elasticity (i.e. a 1% increase in household size would lead to less than a 1% increase in water-use). This is because of efficiencies in water-use that occur with additional family members (such as for cooking, cleaning, washing dishes, etc.). In the above example, a unitary response would be a 50% increase in water-use, thus the expected increase of 20% seems reasonable.

All of the parameter estimates for the apartment variables had the expected signs and were significant at the .01 level. Moreover, the three single-meter apartment parameters had the anticipated relative ordering of magnitudes. It was expected that with single-meter apartment accounts, water-use would show the largest decreases during the summer months and the smallest decreases during the winter months. This is because apartment water-use is expected to remain fairly stable throughout the year as there are relatively few outdoor water-uses for this group. This hypothesis was supported by the parameter estimates. For a locality where 10% of its users were single-meter apartments, winter water-use would be expected to decrease by 4.4%, spring/fall usage would be expected to decrease by 5.9%, and summer usage would be expected to decrease by 7.4%. For a locality where 10% of its users were group-meter apartments, water-use per account would be expected to increase by 17%.

Conclusions

This study provides evidence that the intensity in which water-use restrictions are implemented has significant implications on program effectiveness. The results indicate that the mere imposition of water-use restrictions might not result in the desired behavioral change if not accompanied by strong enforcement and promotional efforts. The overall reductions in water-use ranged from 0-7% for voluntary restrictions and from 4-22% for mandatory restrictions. Thus the intensity in which these programs were carried out clearly had an impact on water use. The relative magnitude of these reductions fit a pattern of increasing effectiveness as information and enforcement levels increased. This increasing pattern lends some credence against the possibility that the results were site specific and that information and enforcement levels would not have such an effect in other localities and in other situations.

It is noteworthy to mention that majority of the observed instances of mandatory restrictions were in place mostly during the fall months when the potential to reduce outdoor water-use will generally be less than during the summer months. It would seem reasonable during the summer that estimates of the reductions in water demand could be higher than found here.

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Table 1: Water Use Restrictions in Virginia, 2002

Locality	Executive Order 33*	Self-imposed Voluntary Restrictions	Self-imposed Mandatory Restrictions
Albemarle County	X	1/1-8/31	8/22-8/31
Charlottesville City	X	1/1-8/31	8/22-8/31
Chesterfield County	X	4/1-8/15	8/15-8/31
Danville City	X	--	--
Hampton City	X	7/26-8/31	--
James City County	X	7/26-8/31	--
Newport News City	X	7/26-8/31	--
Poquoson City	X	7/26-8/31	--
Rapidan Service Authority	X	7/29-8/16	8/17-8/31
Spotsylvania County	X	2/26-3/26	3/26-8/31
Stafford County	X	5/1-8/22	8/22-8/31
York County	X	7/26-8/31	--
Augusta County	X	--	--
Bristol City	--	--	--
Manassas City	--	--	--
Prince William County	--	9/1-11/15	--
Suffolk City	X	6/1-8/31	--
Colonial Heights City	X	--	--
Richmond City	X	4/1-8/26	8/27-8/31
Harrisonburg City	X	--	--
Salem	X	6/1-8/31	--

*Effective September 1 to November 15, 2002. Required localities to adopt bans on outdoor water use.

Table 2: Rankings of Voluntary and Mandatory Program Implementation*

Locality	Information Efforts for Voluntary Water Programs	Information Efforts for Mandatory Restrictions	Enforcement Efforts for Mandatory Restrictions
Albemarle County	High	High	Medium
Charlottesville City	High	High	Medium
Chesterfield County	Low	Medium	High
Danville City	--	Low	Low
Hampton City	High	High	Low
James City County	High	High	Low
Newport News City	High	High	Low
Poquoson City	High	High	Low
Rapidan Service Authority	Medium	Medium	Medium
Spotsylvania County	Medium	High	Medium
Stafford County	Low	Medium	Low
York County	High	High	Low
Augusta County	--	Low	Low
Bristol City	--	--	--
Manassas City	--	--	--
Prince William County	Low	--	--
Suffolk City	Medium	Medium	Low
Colonial Heights City	Low	Medium	Low
Richmond City	Medium	Medium	Low
Harrisonburg City	--	Medium	Low
Salem	Medium	Medium	Low

*Blanks indicate that no program was implemented in this area.

Table 3: Selected Survey Questions for Enforcement and Information Activities

Selected Questions for Enforcement	Selected Questions for Information
How often were warnings issued? (Circle best answer)	Please check ways that information programs were disseminated
1 = few to no warnings (less than 10/month)	_____Included in water bill
2 = moderate number of warnings	_____Separate mailing
3 = high number of warnings (more than 100/month)	_____Local newspaper notices/articles
	_____Radio/TV coverage
How often were citations issued? (Circle best answer)	_____Other (please explain) _______________
1 = few to no citations (less than 5/month)	
2 = moderate number of citations	***Subjective Evaluation***
3 = high number of citations (more than 50/month)	Overall, how would you rate information? (Circle best answer)
	1 = little to no information; little to no news articles, etc.
Subjective Evaluation	2 = Moderate level of information and/or news articles, etc.
Overall, how would you rate enforcement? (Circle best answer)	3 = High level of information and/or news articles, etc.
1 = Technically required but little to no active enforcement	
2 = Moderate level of enforcement	
3 = High level of enforcement	

Table 4: Water Demand Model Results

Parameter	Coefficient	Std. Error	z	P>|z|
Intercept	4.56	0.09	50.50	0.00
VolInfo1	0.02	0.02	1.13	0.26
VolInfo2	0.02	0.02	0.85	0.40
VolInfo3	-0.07	0.02	-3.26	0.00
MandInfo1Enf1	-0.05	0.04	-1.02	0.31
MandInfo1Enf2	-0.04	0.04	-0.94	0.35
MandInfo2Enf1	-0.06	0.03	-2.11	0.04
MandInfo2Enf2	-0.09	0.02	-3.57	0.00
MandInfo2Enf3	-0.20	0.05	-3.97	0.00
MandInfo3Enf1	-0.12	0.03	-4.22	0.00
MandInfo3Enf2	-0.15	0.02	-6.64	0.00
MandInfo3Enf3	-0.22	0.04	-5.43	0.00
JanDum	-0.04	0.01	-4.75	0.00
FebDum	-0.07	0.01	-6.18	0.00
MarDum	-0.04	0.01	-3.45	0.00
AprDum	0.09	0.04	2.00	0.05
MayDum	0.23	0.04	5.15	0.00
JunDum	0.32	0.06	5.55	0.00
JulDum	0.33	0.06	5.64	0.00
AugDum	0.28	0.06	4.79	0.00
SepDum	0.23	0.04	5.24	0.00
OctDum	0.14	0.04	3.12	0.00
NovDum	0.02	0.01	2.08	0.04
JanDumCity	0.02	0.02	0.84	0.40
FebDumCity	0.01	0.02	0.72	0.47
MarDumCity	0.02	0.02	1.13	0.26
AprDumCity	0.00	0.02	0.08	0.94
MayDumCity	-0.07	0.02	-3.39	0.00
JunDumCity	-0.08	0.02	-3.89	0.00
JulDumCity	-0.08	0.02	-3.88	0.00
AugDumCity	-0.05	0.02	-2.43	0.02
SepDumCity	-0.07	0.02	-3.41	0.00
OctDumCity	-0.03	0.02	-1.63	0.10
NovDumCity	0.01	0.02	0.31	0.75
DecDumCity	0.01	0.02	0.73	0.46
RainCtySumr	-0.013	0.002	-5.66	0.00
RainCtySumrLag1	-0.014	0.003	-5.07	0.00
RainCtySumrLag2	-0.005	0.003	-1.94	0.05
RainCtySpringFall	-0.007	0.001	-4.65	0.00
RainCtySpringFallLag1	-0.006	0.001	-3.77	0.00
RainCtySpringFallLag2	-0.000	0.002	-0.07	0.95
RainCitySumr	-0.011	0.002	-4.76	0.00
RainCitySumrLag1	-0.007	0.002	-3.01	0.00
RainCitySumrLag2	-0.001	0.002	-0.39	0.70
RainCitySpringFall	-0.004	0.001	-3.21	0.00
RainCitySpringFallLag1	-0.001	0.001	-1.18	0.24
RainCitySpringFallLag2	-0.001	0.002	-0.23	0.82
TempCountySumr	0.007	0.002	3.39	0.00
TempCountySpringFall	0.004	0.001	3.32	0.00
TempCitySumr	0.002	0.002	1.07	0.29
TempCitySpringFall	0.003	0.001	2.51	0.01
SingleMeterAptSumr	-0.7347	0.122	-6.01	0.00
SingleMeterAptSpringFall	-0.5477	0.106	-5.16	0.00

SingleMeterAptWinter	-0.4391	0.112	-3.92	0.00
GroupMeterApt	1.6590	0.054	30.92	0.00
Income($1000)Summer	0.0044	0.001	4.64	0.00
Income($1000)SpringFall	0.0043	0.001	4.69	0.00
Income($1000)Winter	0.0038	0.001	4.08	0.00
HouseholdSize	0.1989	0.043	4.62	0.00
MargPriceSummer	-0.0478	0.005	-8.88	0.00
MargPriceSpringFall	-0.0426	0.004	-9.59	0.00
MargPriceWinter	-0.0301	0.004	-7.50	0.00
DiffVarSummer	-0.0050	0.001	-5.55	0.00
DiffVarSpringFall	-0.0062	0.001	-7.46	0.00
DiffVarWinter	-0.0052	0.001	-5.46	0.00
R^{2*}	.994			
Observations	1286			

*R^2 was 0.84 in the unrestricted model.