cited earlier. Items were selected from the PMMP to examine in a college student population some characteristics which the review of general credit literature had associated with credit use and debt. The Financial Value System consists of 3-item scales based on Price's (1969) research. Both of these instruments consisted of 5-point Likert scales. FLOC is a Financial Locus of Control scale developed by the author, but based on work of Lefcourt et al. (1979). It requires the respondent to rank the importance of internal attributions (knowledge, ability and effort) and external attributions (luck, economic and political conditions and other people) for success and failure in four economic tasks. Scores for the sub-scales are additive. The credit surveys were composed of multiple choice and open-ended questions.

FINDINGS

Sample characteristics

Sample characteristics are reported only for the 69 males and the 92 females in 1986-87 classes who responded to the first two instruments, because the major statistical analysis dealt with their responses. Eighty eight of them had also been given the Financial Value System instrument. Seventy four percent were between the ages of 21 and 30, and 24% were under 20 years of age. They represented a wide range of majors; approximately 39% were classified as enrolled in business, finance, management and consumer majors and the remaining 61% were from a wide variety of other majors. The most common living arrangement was sharing a house or apartment with peers (34%) followed by group housing (26%) living with parents (24%) running a household by themselves or with a spouse (9%). While only one student described debt level as "over my head," 23.6% felt uncomfortable with their debt; 47.2% had "not very much" or "very little" debt; 28.6% had no debt.

Credit Practices

The two credit surveys are descriptive of credit practices. Over half of the 1985-86 students had bank credit cards, about 1/3 had gas cards and about 1/3 had phone cards. The 1986-87 credit survey revealed that bank cards were still the most frequent. In 1985-86 forty three percent student loans, 15.8% had auto loans and 13.6% had other installment loans. The study conducted the following year indicated lower use of student loans (25.6%), possibly because of the tighter rules for student loans at that time; also, the number with auto loans had increased to 21%, possibly because of the very low interest rates being advertised by the car manufacturers. Eleven percent of the students in 1986-87 reported using overdraft accounts, which probably reflects the fact that 63% held debit cards.

Credit cards had been acquired and held by students in different ways: 53.2 in their own names, 13.5 as joint accounts while 13.5% used parents' cards. Six percent had established savings accounts as a condition for receiving a credit card and 3.6% secured cards as part of a package of services. Nearly 60% expressed preference for making payments of amounts between $10 and $20 with cash and about a third preferred check. Only 5 to 7% indicated credit card and less than 1% indicated preference for payment by debit card. For ordering tickets and catalog items 59% preferred check, 29% credit card, 4.5% cash and 4.5% money order. Slightly over half said they almost always paid off the entire balance before due date while about a third often paid the minimum balance. Over a third of the students owed less that $100 on all credit cards, another 25% owed between $100 and $300. At the other extreme were over 3% who owed $1000 or more.

Fifty percent reported that they had had credit refused at some time and 67% of these said that they knew why they had been refused. Less that 1% had ever asked to see their credit records.

Reasons for Using or Not Using Credit Cards

In response to open-ended questions asking those who used credit cards to give their reasons and those who did not to do likewise, 1986-87 students ranked as major reasons for using credit cards: convenience, easy to buy when don't have cash, and to establish a good credit rating. Reasons for not using credit ranked: too much temptation to spend, don't qualify, prefer using cash, no need to do so, and don't want to pay interest charges.

Outputs of Use of Credit

Since the control of money is a general goal of the money manager, the effect of use of credit was examined in the 1985-86 study, with mixed results. Over 39% felt that use of credit cards had greatly increased or somewhat increased control of their money and 24% felt that it had decreased their control, but about a third did not know or did not respond to this item. Eighty eight percent expressed satisfaction with use of credit cards. But 28% had experienced problems with credit cards. Of those who reported problems, only 42.8% said the problems had been resolved. This low rate of problem solving might be partially explained by the types of problems they listed. In rank order the problems were: can't control spending, credit errors, lost or stolen cards, credit limit too low, difficulty using parents' card,

Gender Comparisons

Mean scores for males and females on the items selected from the three general money management instruments are reported in Table 2. Differences were noted in only 8 of the 31 variables. Notably, males were more likely

TABLE 2. Items, Means, Standard Deviations, t-tests by Sex

ITEM	Male (N=69) $\bar{X}$	s.d.	Female (N=92) $\bar{X}$	s.d.	t-test
Regardless of your own income, which of the following best describes your economic condition? STATUS (1=affluent to 5=poor)	2.94	.79	2.92	.88	.13 (158)
My income covers my expenses. RES2	3.59	1.14	3.20	1.31	1.98 * (158)
I have adequate credit to meet my needs. RES3	4.09	.97	3.74	1.25	1.99 * (158)
Relevant to your present income, how deeply in debt are you? DEBT (1=over my head to 5=not at all)	3.38	1.09	3.58	1.21	-1.10 (159)
It is important to me right now to pinch pennies. PRI8	3.12	1.29	3.38	1.28	-1.28 (158)
It is important to me right now to juggle funds so that I can have cash available when big payments are due PRI7	3.62	1.09	3.73	1.12	-.63. (158)
Having personal control of my money is very important to me. PRI2	4.60	.69	4.51	.69	.83 (158)
I am "in control" of my spending and saving. CONTROL	3.75	1.10	3.33	1.21	2.25 * (157)
Self control is a problem for me. SC	2.44	1.13	2.45	1.14	- .02 (158)
I avoid the temptation to spend by carrying only the money I intend to spend. SC2	3.28	1.21	3.01	1.33	1.30 (159)
Carrying a credit card would cause me to spend money I might not otherwise spend. CC	2.86	1.44	2.97	1.4	- .48 (159)
I tend to buy things on impulse. IMPULS	3.04	1.14	3.11	1.3	- .32 (158)
I have a reputation as a big spender. SPENDER	2.71	1.05	2.45	1.24	1.43 (159)
I don't account to anyone concerning use of my money. ACCT	3.65	1.27	3.01	1.30	3.08 ** (159)
I anticipate that my financial situation will be better next year than it is now. FUTURE	4.10	1.02	3.86	1.05	1.47 (159)
Unexpected occurrences prevent me from reaching my goals in life. EVENT	3.12	.93	2.97	1.00	.96 (159)
I've run into financial problems: I need help. HELP	1.93	.91	2.30	1.26	-2.20 * (159)
Locus of Control					
Attribution to knowledge (8 items) KNOWLE (Lower scores are higher ranks)	22.28	8.80	23.34	8.62	.45 (159)
Attribution to luck (8 item scale) LUCK (Lower scores are higher ranks)	36.04	8.94	40.56	7.84	-3.36 *** (155)
Locus of Control (48 item scale) LOC (Higher scores more external)	99.48	21.82	100.34	23.03	-.24 (159)
Financial Value System	Male (n=38)		Female (n=50)		
Self-actualization SELFAT	3.87	.96	4.04	.83	- .89 (86)
Why worry about money? FAITHT	2.92	1.10	2.98	1.04	-.26 (86)
Status STATUST (3 items)	9.84	2.11	9.20	2.21	1.39 (87)
Self-indulgence INDULGT (3 items)	11.34	2.35	11.24	2.32	.20 (86)
Security SECURET) (3 items)	11.79	1.49	11.84	1.90	.14 (86)
Preparation					
My knowledge of facts needed to manage money PREP1 (1=poor to 5=very good)	3.37	.83	2.93	1.08	2.86 ** (157)
My ability to do the things and make the decisions necessary. PREP2 (1=poor to 5=very good)	3.71	.85	3.22	1.08	3.13 ** (158)
Putting enough effort into handling money. PREP3 (1=poor to 5=very good)	3.32	1.03	3.14	1.01	.85 (158)
Awareness of where to go to get answers to specific questions. PREP4 (1=poor to 5=very good)	2.72	1.03	2.43	1.25	1.53 (158)
Satisfaction					
I am satisfied with my economic condition. SATIS1	2.82	1.34	2.72	1.14	.54 (158)
I am satisfied with the way I handle my money. SATIS2	3.72	1.01	3.07	1.30	3.60 **** (158)

Terms in parentheses are degrees of freedom.
All items except those noted are scored: 1=not at all like me to 5=exactly like me.
*p<.05, two-tailed
**p<.01, two-tailed
***p<.001, two-tailed
****p<.0001, two-tailed

than females to perceive that they were "in control" of their spending and saving, that their income covered their expenses, that they had adequate credit to meet their needs and not to have to account to anyone concerning use of money. They were also likely to rank luck as a more important attribute than were the females. Females were more likely than males to indicate that they were having problems and needed help, but few indicated great need for help. Males rated their knowledge and their ability higher than did the females and expressed greater satisfaction with the way they handle their money. Both sexes had been more satisfied with how they handle their money than with their economic condition. Of particular interest is the fact that among the highest scoring items for both sexes were "I have adequate credit for my needs" and "having personal control of my money is important to me".

Freedom from debt

Pearson product moment correlations were used to examine the relationships of personal money management variables with three credit variables. Results are reported in Table 3. Freedom from debt was associated with feeling of being in control, satisfaction with economic condition and with personal handling of money. Freedom from debt was associated with two of the types of preparation: ability and effort. Freedom from debt was negatively correlated with low economic status, need to pinch pennies and juggle funds in order to meet large payments when due, recognizing self control as a problem, not being accountable to anyone, feelings that economic situation would be better next year and that events block goals. Freedom from debt was negatively associated with need for help and greater attribution to knowledge.

Having Adequate Credit

Having adequate credit to meet needs was associated with income covers expenses, placing a high priority on personal control of money, feeling of being in control and value of status. It was positively associated with all four measures of preparation, with the two satisfaction measures and with expectations that their economic situation would be better next year. Having adequate credit correlated negatively with lower economic status, self control a problem and recognition that carrying a credit card would encourage spending.

Credit Cards and Spending

"Carrying a credit card would cause me to spend more" was associated with lower economic status, need to pinch pennies, self control a problem, impulse buying, reputation as a big spender, feeling that events block goals, need for help, and value of self indulgence. Those who felt that carrying a credit card would cause more spending tended to show higher attribution to luck and to have more external

TABLE 3. Correlation of Items with Freedom from Debt, Adequacy of Credit, "Carrying a Credit Card would cause me to spend money I would not otherwise spend"

Code	Freedom from Debt	Adequacy of Credit	Credit Card Spending
STATUS	-.290 ****	-.212 **	.204 **
RES2	.065	.169 *	-.351 ****
RES3	-.023	-	-.162 *
DEBT	-	-.024	.102
PRI8	-.311 ****	.038	.217 **
PRI7	-.283 ****	.001	.122
PRI2	-.079	.214 **	-.118
CONTROL	.167 *	.222 **	-.259 ****
SC	-.200 **	-.155 *	.247 ***
SC2	.009	.017	-.015
SC3	-.10	-.162 *	-
IMPULS	-.12	-.068	.207 **
SPENDER	-.061	.008	.191 **
ACCT	-.187 **	.091	.116
FUTURE	-.167 *	.138 *	-.121
EVENT	-.142 *	-.104	.164 *
HELP	-.287 ****	-.122	.271 ****
Financial Value System			
SELFAT	.079	.154	-.009
FAITHT	-.023	-.078	-.097
STATUST	-.035	.214 *	-.03
INDULGT	.018	.026	.288 **
SECURET	.127	-.002	.000
Locus of Control			
KNOWL	-.144 *	-.104	.125
LUCK	-.025	-.053	.196 **
LOC	.071	.025	.186 **
Preparation			
PREP1	.010	.275 ****	-.242 ***
PREP2	.219 **	.166 *	-.334 ****
PREP3	.146 *	.191 **	-.159 *
PREP4	.036	.207 **	-.086
Satisfaction			
SATIS1	.284 ****	.146 *	-.146 *
SATIS2	.242 ***	.175 **	-.321 ****

The Value items, SELFAT to SECURET, were not administered to all students.
* p<.05, 1-tailed
** p<.01, 1-tailed
*** p<.001, 1-tailed
**** p<.001, 1-tailed

Total Locus of Control scores. Negative associations were found with: income covers expenses, adequate credit, feeling of being in control, levels of knowledge, ability and effort, and with both of the satisfaction measures.

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

College students are deeply involved in use of both credit cards and instalment loans, but many of them have been refused credit at some time. Most feel that they now have adequate credit to meet their needs and very few are currently deeply in debt. A large percentage of students carry student loans and/or auto loans, so must be prepared to deal with the payments when they get out of school.

There is a tendency for males to show higher confidence in their knowledge and ability to manage money and also to be more satisfied with their handling of money than females. This may reflect the earlier home socialization and job experience of males and the fear of math on the part of some females. Financial education should form a part of the education of more females.

The findings that freedom from debt was not related to resource adequacy, locus of control and the value of security may have resulted from the fact that current debt and student loans were not distinguished. Four types of preparation for financial management were considered because of their different implications for self-help. Ability and effort were related to all 3 measures. While ability is a more stable individual caracteristic, an individual can vary the amount of effort applied to a task. This research found that students associated only levels of ability and effort with debt level, while they also associated knowledge with the other two variables. Awareness of where to go for answers to specific questions appeared relevant only to getting and maintaining adequate credit. The research supported earlier findings that those who claimed less knowledge were apparently more cautious about debt.

The value of self-indulgence and external LOC orientation were related to the tendency to spend more when carrying a credit card. The value of status was related to having adequate credit. The value of security did not prove to be related to freedom from debt.

College finance classes offer an opportunity not only to teach factual economic information, but to help students become aware of their attitudes and habits of spending and saving, along with the potential consequences. For students who are having money problems, as well as for those who want to improve their management, an analysis of whether they have accepted the idea that they just don't have ability in this area or the idea that their problems grow out of lack of knowledge or effort could be a valuable aid in designing appropriate intervention methods.

This study found that students in finance classes express a strong desire to be in control of their money and most feel they are in control. They recognize a need to control impulsive behavior. Some avoid temptation to spend by not carrying money or credit cards. Positive responses by students to the item, "Carrying a credit card would cause me to spend money I might not otherwise spend" were negatively related to most of the variables describing control attitudes and behavior and positively related to the value of self-indulgence, attribution of behavior to luck and to more external locus of control. It was not related to debt level, possibly because the measurement of freedom from debt did not distinguish between current debt and student loans.

In Personal Finance classes students are introduced to personal financial records and budgetting. It is useful to show and explain the effect of different ways of recording credit transactions (Garman, Eckert and Forgue 1985, p.71-72 for example). This research would also indicate that there may be need for greater emphasis on credit rating and reporting practices and on where this type of information may be obtained. Also, their plans for re-paying student loans should also be considered.

While earlier research has generally focused on credit behavior of established households, this research has recognized the college level consumers of financial education as a group worthy of more attention. The subjects of this research may not represent the general population of college students but do represent those who are availing themselves of the opportunity to improve their knowledge of handling money.

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CONSUMER DEBT: MEASURING THE ABILITY TO REPAY

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Are consumers over extended? Some using total dollars outstanding or comparing debt to income say consumers are over burdened. Others citing debt to asset ratios find consumers have a reasonable amount of debt. This paper analyzes each of the popular measures and then suggests that the ratio of monthly debt service payments to a net income figure is the best approach.

> "There is no consumer debt problem" (Silvia, 87a:34).
>
> "'The consumer is definitely not in a position to continue to borrow like he is'" (Morris, 87:39).

Which observer of consumer indebtedness is correct? The answer largely depends on how consumer debt is measured. Total debt measured in dollars is one measure. Some type of ratio measure is also popular. The ratios normally compare total debt outstanding to consumer financial assets or personal disposable income or debt service payments to disposable income. We discuss each of the approaches at both the macro economic and micro economic levels in the following sections. Our conclusion is that at both levels of analysis debt to income ratios are preferred over other types of debt usage measures.

MACRO ANALYSIS OF DEBT SERVICE CAPACITY

Total Debt Measured in Dollars

There is no question that total consumer debt has grown. Between 1980 and 1985, household debt grew to $2.4 trillion, a 64 percent rise (Wilson, et al., 1986). But this growth needs to be compared to the growth in the ability to pay. Just as inflation will have had an impact on the growth in dollar debt, it will also have had an impact on financial assets and income, both being possible mechanisms for repaying debt. Demographic changes have also had an impact on outstanding debt. Baby boomers have moved into their mid-20s to early 40s, and the 25- to 44-year old group is the heaviest borrower of all age groups (Sternlieb and Hughes, 1987).

Also, all consumer debt is not considered credit by consumers. Based on the Survey of Consumer Finances, nearly two-thirds of all families have some type of credit card. However, nearly 50 percent of these families used the credit card as a transaction device, meaning they paid off the entire account balance each billing period (Canner and Cyrnak, 1985). Thus, even though all credit card charges are treated as debt in government reports, many families see it as a short-term replacement for cash and pay off the debt immediately.

In summary, dollar debt outstanding grew because of inflation and the growth of the group most likely to borrow. This growth must be measured in relation to ability to pay.

Debt to Financial Assets

Financial assets can be used to pay off debt obligations. Also, total debt is carried on a consumer's balance sheet as a liability (it is not completely repaid in one year), and thus, it should be compared to the consumer's assets (Silvia, 1987a, 1987b).

In the 1980s financial assets have grown faster than household debt (72 versus 64 percent growth). Also, with a macro analysis the same people who hold the assets also hold the debt, namely both assets and debt are concentrated in the upper income strata (Wilson et al., 1986).[2] Since 1982, the ratio of assets to debt has increased from about 2 to 1 to 2.3 to 1. However, it still is below the 1971 level of about 3.2 to 1 (Silvia, 1987a). While the ratio of assets to debt has been improving, the composition of financial assets has been changing.

More and more of a household's assets are represented by claims to relatively illiquid pension funds. In the first five years of the 1980s, pension assets as a percent of total financial assets increased from 19 to 22 percent. The rising stock market also led to a large jump in household assets. However, the more accessible and liquid deposits at financial institutions actually declined by a little over one percent, 36 to 34.6 percent (Wilson et al., 1986). It should also be noted that although debt and assets are concentrated in the higher income strata, this does not mean that the same high user of debt household has a corresponding high level of financial assets. Heavy borrowers may

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[2]In 1983, thirty two percent of the households in the lowest income quintile were in debt. This is in contrast to the highest quintile where 72 percent were in debt. The amount of debt held by these two quintiles is also informative. The lowest quintile held a total of 5 percent of the total debt in the survey while the highest held nearly 46 percent (Luckett and August, 1985).

not be heavy owners of financial assets.

Financial assets, especially pension funds and investments in growth-oriented equities, do not produce current income to meet debt service payments. Certainly some pension assets could be "cashed in," most frequently with a substantial penalty. Equities could also be sold, hopefully not in a declining or low price market. But it is likely, before they retire, most consumers do not view pension assets as a source of funds for repaying debt obligations. Thus, while it is true that total debt is a balance sheet item, it is likely that most borrowers' source of funds for repaying this debt is coming from current (at the time of payment) disposable income and not from the sale of financial assets.

Debt and Debt Service to Personal Income

The ratio of total household debt to disposable personal income rose from .58 in 1975 to .74 at the end of 1985. Generally most of the change in the ratio was due to mortgage obligations. The mortgage ratio went from .40 to .50, while the ratio of installment debt rose from .15 to .19 (Paquette, 1986).[3] However, this ratio also gives a distorted image of the consumer's ability to repay. Consumers do not repay all of their outstanding debt each year. They repay part of it. What is most important is the ability of the borrower to make the yearly debt service payments, repayment of each month's interest and principal (Luckett and August, 1985). When looked at from this perspective the consumer obligations are not as burdensome.

The ratio of debt service to disposable personal income grew by 8 percent between 1975 and the beginning of 1986, while total debt to income grew by 22 percent. Why was there such a large difference in growth rates? There are two parts to the answer: increases in loan extensions and lengthening of maturities.

As new loans are issued, in the short-run, debt will increase faster than debt service payments. As old loans are paid back the principal amount outstanding declines while the monthly payment remains the same for the life of the loan. As new loans are taken out, the total debt contracted is added to a smaller base than debt service payments. In Paquette's (1986) analysis, for a new loan, after the first six months debt outstanding increased 33 percent while debt service increased 17 percent.

The lengthening of loan maturities will also in the early period of the loan lead to lower debt service requirements but increase total debt outstanding. If the interest rate stays the same, a 48-month loan replacing a 36-month obligation will lead to lower but more monthly payments. Also, with the longer payback the principal is repaid at a slower rate leading to debt being outstanding for a longer time and thus a slower repayment of "old" loans. Again using Paquette's (1986) analysis, if maturities would have stayed the same instead of lengthening in the 1975 to 1986 period, the installment debt ratio, total debt to disposable income (there was little change in the length of mortgages) would have only increased by eight percent versus the actual 24 percent. Again, the difference is due to a slower repayment of principal with longer maturities. The debt service payment ratio (debt repayments to disposable income), on the other hand, would have increased by three percent instead of <u>falling</u> by four percent.

There is at least one situation where the debt service ratio will increase faster than the debt ratio. If interest rates rise, either nominal or real, debt service payments will rise faster than total debt. The fundamental reason is that more of the monthly payment represents interest and less a repayment of principal. Thus, the large rise in the payment is due to paying back more interest than paying back principal.

MICRO ANALYSIS OF DEBT SERVICE CAPACITY

The discussion to this point has examined consumer debt load from a macro prospective. As has been pointed out there is a good possibility that an analysis of subsets of the larger group may ultimately result in a quite different scenario than the one painted. For example, within the upper income group those with high debt may not be those with high assets. If there is debate on the proper measurement of consumer debt at the macro level, the situation at the micro level is perhaps worse. One problem is the lack of uniformity in the analysis of a family's financial situation.

Debt to Financial Assets

A number of authors have proposed balance sheet ratios to measure the consumer debt load. The Exhibit gives the relevant consumer debt ratios and identifies authors recommending the use of each. Both Griffith (1985) and Gitman (1984) developed liquidity ratios (Exhibit, A. 1-5). The ratios contrast liquid assets to some measure of debt. Measures of debt include total debt, current debt, non-mortgage debt, and short term debt plus 12 months payment on other debt. Others (Barngrover <u>et al</u>., 1981, Bailard <u>et al</u>., 1986, Griffith, 1985) have proposed comparing debt to net worth or total assets (Exhibit, A. 7-10). Some modifications to this ratio include deleting securities from the asset component (Barngrover <u>et al</u>., 1981), while others suggest deleting both the home mortgage from the

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[3]Household debt is made up of mortgage and consumer debt. Mortgage debt uses housing as collateral for a loan. Consumer debt is divided into installment obligations (the borrower can repay in two or more payments) and noninstallment debt. Here the total debt must be repaid in one payment. Travel and entertainment cards are a good example of this type of consumer borrowing (Pearce, 1985).

liability number and the value of the home from the asset base (Bailard et al., 1986).

EXHIBIT. Relevant Consumer Debt Ratios

A. Balance Sheet Ratios:

1. Liquid Assets/Total Current Debt (Gitman, 1984)
2. Liquid Assets/Short Term Debt + 12 Months Payment on Other Debt (Griffith, 1985)
3. Liquid Assets/Non-mortgage Debt (Griffith, 1985)
4. Liquid Assets/Total Debt (Griffith, 1985)
5. Liquid and Other Financial Assets/Short Term Debt + 12 Months Payment on Other Debt (Griffith, 1985)
6. Liquid Assets and Other Financial Assets/Total Debt (Griffith, 1985)
7. Total Debt/Net Worth (Griffith, 1985, Apilado and Morehart, 1980)
8. Assets - Securities/Liabilities (Barngrover et al., 1981)
9. Non-Mortgage Debt/Net Worth - Market Value of House (Bailard et al., 1986)
10. Non-Mortgage Debt/Net Worth (Griffith, 1985)

B. Debt/Income Ratios:

1. Total Household Debt/Total Yearly Disposable Personal Income (Apilado and Morehart, 1980)

C. Repayment/Income Ratios:

1. Monthly Debt Payments - Mortgage Payments/Monthly Disposable Income (Apilado and Morehart, 1980, Bailard et al., 1986)
   where: Disposable income = Gross income less taxes
2. Monthly Debt Payments/Take-home Pay (Amling and Droms, 1982)
3. Monthly Debt Payments - Home Mortgage Payments/Monthly Spendable Income (Lang and Gillespie, 1981)
   where: Spendable income = gross income less wage or salary deductions
4. Monthly Debt Payments/Discretionary Income
   where: Monthly debt payments = all contractual payments on debt obligations including home mortgage payments. Excluded are payments made on revolving accounts that are repaid within the free period.
   Discretionary income = disposable income minus all fixed and variable expenses necessary for household maintenance, excluding contractual debt payments.

The basic problem with balance sheet ratios is twofold. First, total debt is normally used and not the amount of debt that needs to be repaid within one year. The other shortcoming is that consumers rarely plan on liquidating assets, especially non-financial assets, to pay off debt. Of course the liquidity ratios do overcome some of these problems. However, the cash and near-cash stock of the family is needed to pay more than just maturing debt obligations.

In actuality consumers plan on making debt payments out of income flows. Thus, the capacity to handle debt should be based on monthly or yearly debt repayments compared to the amount of income available to make these payments. The relevant ratios will contain some debt number as the numerator and some income number as the denominator.

Debt and Debt Service to Personal Income

Total Debt to Income. It is necessary to adjust the time frame for flows of income to the time frame for flows of debt service. Thus, it is inappropriate to look at total debt to yearly income in assessing consumer debt capacity (Apilado and Morehart, 1980), because the individual does not repay total debt within one year (Exhibit, B. 1).

Monthly Debt Payment to Disposable Personal Income. The most frequently cited funds flow ratio for measuring consumer capacity to carry debt is the debt payment to disposable income ratio (Exhibit, C. 1) recommended by Bailard et al. (1986). Disposable income is defined by these authors as income after payment of taxes and social security. This is the standard economic definition of disposable income.

One problem with using this ratio is that it assumes that the individual has control over all income funds other than tax payments. While this may be true in the long-run, it is frequently not true in the short-run. A consumer may be able to adjust contributions to charity, drop insurance coverage, or change contributions to retirement plans. However, employers may restrict such changes to certain time periods, greatly reducing the control by the individual. Thus, the use of total disposable income in evaluating debt repayment ability, has some of the same inherent problems as the use of assets. While in the long-run the individual may eliminate these payments and free funds for debt payment, in the short-run the funds are not available.

Debt Service to Take-Home Pay. One might change the above formula by adjusting the disposable income figure. Van Arsdale (1982) subdivides

deductions into mandatory, voluntary and conditional. She then reduces disposable income by the amount of mandatory and conditional expenses when calculating a debt proration formula.

An example of mandatory expenses might be payroll deductions, over which the consumer has no control. Payments for insurance, which are mandatory if the individual is to participate in group coverage, are an example of this type of deduction. Amling and Droms (1982) make these adjustments to income in the comparison of monthly installment payments as a percent of take-home pay (Exhibit, C. 2).

Total Monthly Debt Payment to Total Monthly Discretionary Income. Generally, for the initial analysis, the income figure to be used as the denominator for the debt repayment ratio should be disposable income minus all fixed and variable expenses excluding contractual debt payments. Lang and Gillespie (1981) suggest comparing total regular monthly debt payment to monthly spendable income (Exhibit, C. 3). One problem with their ratio is the exclusion of mortgage debt payments from total regular monthly debt payments.

We propose that the numerator in the formula should be total monthly debt payments including mortgage payments (Exhibit, C. 4). Monthly debt payments would include all payments that include a finance charge. Excluded would be payments on credit cards used for convenience where all charges are repaid during the interest-free period. Thus mortgage payments, installment payments, revolving credit card payments, as well as other non-revolving credit payments not fully repaid within the month would be included.

Mortgage payments are included because they are fixed debt repayment charges that must be paid just as car loans or other installment payments must be met. Mortgage payments have been excluded by some because they were treated as a monthly living expense that was probably building equity at a faster rate than the property was depreciating. The high rates of interest paid on mortgages in the past 10 years however, and markets with declining real estate values, have resulted in many families seeing little equity growth in their property. Mortgage payments that exceed 30 to 40 percent of take-home pay significantly affect the safe limit of other credit that can be assumed by the individual. Thus it is this total debt payment that is crucial. If the mortgage is held out separately then the percentage of other debt that may be safely carried should be adjusted downward. While some authors indicate that many special circumstances may affect the individual's debt capacity none include mortgage payments in the calculation of a debt to income ratio. Another reason given for excluding mortgage payments from total payments is to make it possible to compare non-mortgage credit users with mortgage holders (Lang and Gillespie, 1981). This seems unrealistic when one is attempting to establish an individual's debt capacity ratio.

The denominator in this formula is discretionary income. This is disposable, take-home income, minus all fixed and variable expenses necessary for household maintenance, excluding contractual debt repayments. People must spend money on food, utilities, transportation and other normal living expenses. Using discretionary income takes into account these expenditures.

The resulting ratio becomes monthly debt including mortgage payments divided by monthly discretionary income as defined in this paper (Exhibit, C. 4). The resulting number is the starting point for analysis. The analysis may be used to determine the consumer's capacity for assuming more debt or for determining that the current debt load is excessive.

This ratio will give a picture of debt repayment ability without modifying lifestyle or living and expenditure patterns. If this ratio appears to provide inadequate coverage of current debt payments, then an analysis of possible places for adjustment is required. Either income needs to be enlarged (earn more) and/or expenditures reduced (spend less). Adjustments to debt are also possible. In the short-run, seeking extended debt repayment terms is a possibility. In the long-run, a reduction in taking on new debt is a strategy (Van Arsdale, 1982, Lang and Gillespie, 1981).

Monthly vs. Annual Income. Another important consideration is whether to use a monthly income or annual income figure in calculating consumer credit capacity. Where income is stable, monthly income figures should be used. Where income is erratic, it is probably advisable to make the analysis on an annual rather than monthly basis. In the latter case it is generally more difficult to develop a safe debt limit. The uncertainty of income flows makes the prediction of funds available for monthly debt payment difficult at best. Nevertheless, it is just as vital to evaluate the economic condition of the individual, or family, with erratic income as it is to evaluate the condition of those with regular income receipts.[4]

It is possible, of course, that some of the consumer's debt will be established with longer than monthly terms. This may be particularly true for farm families. However, most revolving and installment debt is created on a monthly installment payment basis.

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[4]The whole issue of variability of income needs to be addressed. For any number of reasons income may be erratic or even cease. Erratic income may be due to seasonal labor, the receiving of bonuses, expense reimbursements, or incentive pay. Income may cease due to temporary unemployment, retirement, or illness. The issue then becomes how will the debts be repaid. At this point an asset analysis may be necessary. Namely the "cashing in" of assets or borrowing from "friendly" lenders such as relatives and friends may be required.

SUMMARY AND CONCLUSIONS

Contrasting debt service to income appears to be the best comparison in measuring the consumer's ability to handle debt. This is the case in both the macro as well as micro analyses of indebtedness. Consumers take on debt with the expectation they will repay it out of current income. Rarely do they plan on selling assets to make the repayments. Even if they did plan on selling assets it is likely they would not be able to obtain book, balance sheet, value if they were forced into a distressed sale. This would be especially true for non-financial assets.
When using the debt to income ratios both the debt and income figures need to be modified. First, the numerator is monthly debt service and not total debt owed. Consumers do not pay back all their debt in one month or year. Thus, only that amount of debt due during the period should be considered. Second, gross income needs to be adjusted. Disposable income after taxes should be computed. Next, income after mandatory expenses should be obtained. Finally, the consumer's living expenses must also be subtracted from the denominator. The resulting ratio is total monthly (or analysis period) debt service payments including mortgage to monthly discretionary income.

Consumers may or may not be taking on too much debt depending on how the analysis is undertaken. We have suggested that comparing debt service to income is the preferred method of performing this analysis. Total dollar debt is meaningless unless compared to the ability to repay. Debt to some asset number is also not optimum since few consumers plan on selling assets to repay their debt. Also consumers do not re-pay all their debts at one time. Thus the ratios of choice contain monthly debt repayment as a numerator and monthly discretionary income as a denominator. We further suggest that income be adjusted downward to reflect a consumer's required living expenses.

This analysis is only the beginning. Other researchers need to develop numeric guidelines as to when the consumer is approaching "more month than money." Numerous authors have presented guidelines, but it appears few of these guidelines are based on an empirical analysis of the ability to repay. Rather they are convenient and historical heuristics. Prather and Hanna (1987) have begun the work of developing numeric guidelines for assessing the financial strength and well-being of families. They developed norms for 16 balance sheet ratios using data from the 1983 Survey of Consumer Finances. This work needs to be expanded to include income and expense data.

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CONSUMER CREDIT--DISCUSSION

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All 3 papers focus on consumer use of credit - determinants of consumer credit rationing, college student use of credit, and alternative specifications of consumer debt as an indicator of ability to repay.

CREDIT RATIONING AS A CONSTRAINT ON THE FINANCIAL FUTURE OF FAMILY

This paper begins with an excellent conceptual approach. "If rationed status could be predicted using household debt characteristics, households could manage their finances in the present in order to better assured of obtaining credit they might desire in the future." The author selects variables which with but exception, "total credit line", can be controlled by the household. If empirical estimation can identify those measures which are important to lenders, the value to consumer educators and counselors would be significant.

Unfortunately, as is often the case with models with real-world value, the estimation results, as the author notes, are disappointing. Perhaps, a logistic regression model merging all data with rationed - non-rationed as the dependent variable would improve the findings. This would allow the author to identify the effect of family status on the probability of rationing and perhaps allow the author to draw conclusions related to credit discrimination.

COLLEGE STUDENTS USE OF CREDIT

This paper addresses some important issues related to college students and their views about credit usage. As a researcher with often limited funding, I applaud the use of subjects who can be found in your own classroom backyard. However, I also believe that the use of college students as subjects must be done with care to prevent serious sample selection bias. This research contains two potential sources of trouble on this score: first, the respondents selected were members of a personal finance class and thus may not be representative of the campus at large, much less all college students. Second, although the survey was administered before the credit unit, certainly students had been exposed to some principals of good money management earlier in the semester. This, too, makes them different from other students. This problem could be circumvented in future projects by using an experimental design - perhaps give the same survey before and after the credit unit, or give the class some treatment such as a film on the perils of overextension. The possibilities are endless and the results more generalizable.

Although knowledge of credit finance and legislation is discussed in the literature review, it is not tested in the survey. Rather students were asked to assess their knowledge of these aspects of credit. It has been my experience, as a teacher of personal finance, that students actually know far less about credit than they think they do.

The data analysis was limited to frequencies, t-tests and correlations. More analysis should have been done. One possible model would be a regression to identify factors leading to the probability of using credit or the level of debt currently outstanding - both student loan and other. As it stands, one doesn't come away feeling they have learned very much about college students' use of credit.

CONSUMER DEBT: MEASURING THE ABILITY TO REPAY

This paper represents an impressive attempt to deal with a most difficult problem - how should consumer debt be measured. The authors make some very interesting points about existing formulations and derive a measure of their own which is logical and maybe useful for empirical work.

In evaluating existing measures, the authors consider the ratio of debt to financial assets. Current indebtedness is unlikely to be repaid from long-term assets such as pension funds so perhaps, they conclude, a balance sheet approach is not appropriate. Yet, in extreme hardship, families with such assets are certainly in a better position than those with no long-term funds to tap.

Next, debt to income measurements are considered but the debate over whether to use monthly or total indebtness continues. The authors present a nice discussion of the impact on lengthening maturities on this measure. The authors state "There is at least one situation where the debt-service ratio will fall faster than the debt ratio. If interest rates rise, debt service payments will rise." That is true only for loans, like credit cards or variable rate loans, that have an interest rate which can fluctuate. Rates on fixed interest instruments will remain unaffected. Further, if rates rise too high, consumers may stop incurring new debt and repay existing debt, causing both debt service payments and total debt service to fall. Rising interest rates may trigger consumers' fears regarding recession and unemployment and they may attempt to preserve what they already have rather than increasing risk of financial failure by taking on additional debt.

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Finally, measurements of indebtedness related to income seem to be based upon an implicit assumption that this income stream will go on forever, or at least until the debt is repaid. If our concern is for overextension of credit, this should be noted and addressed. Perhaps, for example, it is emergency cash reserves or rich and generous relatives that make the difference.

DETERMINANTS OF ENERGY CONSERVATION ACTIVITIES

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This study uses a sample of 37,687 single family homeowners from the 1980 Annual Housing Survey to determine which variables influence the presence and addition of insulation. Age of the head, household income, presence of a child under 6, age of the house, regional location, presence of storm doors or windows, an attic or ceiling fan, and type of heat contribute significantly to distinguishing between housing units with and without insulation as well as between households who did or did not add insulation. Using these variables as discriminators, 74.2% of the households with insulation and 61.2% of the households who added insulation are correctly classified.

INTRODUCTION

Residential structures account for about 20 percent of the energy consumption in the United States. Opportunities exist to reduce energy consumption in housing without disrupting societal functions (Dillman 1977). Addition of insulation, use of energy saving appliances and clock thermostats as well as caulking and weatherstripping can enhance energy efficiency. Newly constructed dwellings can make use of passive and active solar design as well as earth sheltering more easily than adding these items to existing structures.

Much has been written about the need to improve energy conservation (Dillman 1981, Laquatra 1986, Hanna 1978). However, few studies using a national sample were located that focused on adoption of energy conservation measures (Williams 1979, Tremblay 1984, Niemeyer 1986). A major DOE effort focused on factors that influence energy consumption (Latta 1983).

This paper examines the factors which influence the use and addition of thermal insulation in owner occupied single family residences. A review of the literature suggested family, housing and energy related characteristics that would be relevant as discriminators.

PREVIOUS RESEARCH

Although Gladhart (1984) reported that family characteristics have little relation to conservation, other research, as indicated below suggests that household characteristics may be useful as discriminators. Household characteristics reviewed here include: income, education, age of family members, family size and length of occupancy.

Researchers (Cunningham and Lopreato 1977, Newman and Day 1975) seemed to agree that income is a strong predictor of energy consumption and energy conservation. Dillman et al. (1983) found that lower income households adjusted to higher energy prices by purchasing less of other items or making temporary adjustments, such as changing the temperature of the room. On the other hand, higher income households invested in more permanent conservation activities. Thus, the housing of lower income families is less energy efficient (Eichner and Morris 1984, Trienda & Aboramph 1981).

Thompson (1983) reported that "There is a large difference in average energy consumption and expenditures among households with different incomes. The highest income households use about 70% more energy than the lowest income group . . ." Their houses are about twice the size of the lowest income group and they have more appliances. However, for 3 years (1978, 1979, and 1980) higher income households lowered their energy consumption more than lower income households. Although lower income families tend to use less energy than higher income families, Newman and Day (1975) found that they spend a greater percentage of their income on energy.

Previous studies suggest that education is negatively related to conservation behavior (Heberlein and Warriner 1980) but positively related to consumption (Cramer et al. 1983).

Tyler et al., (1982) found that the homes of the elderly were energy efficient while Eichner and Morris (1984) found no relationship between age of the household head and energy conservation features. Johnson - Carroll, Brandt & Merfeld (1987) reported that the older the respondent the less likely was there to be a propensity for conservation alterations. At the other end of the age scale, Douthitt (1986) found that the presence of preschool children increase energy consumption.

Although Latta (1981) reported that the larger the household the greater the use of energy, Eichner and Morris (1984) found no relationship between size of household and energy conservation features. Johnson - Carroll et al., (1987) found that the larger the household size, the more energy-saving features were added to the house.

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The number of years the current household head had lived in the house was thought to be an influence on current conservation behavior. Gladhart (1984) reported that families work at conservation year after year and as a group get more efficient and effective in conserving.

The literature suggests that size of the housing unit and type of heat may influence energy conservation. Size of the housing unit has been related to energy consumption by Morrison et. al., (1978) and energy conservation by Johnson-Carroll et al., (1987).

A study of natural gas (NG) and liquid petroleum gas (LPG) users provides an indication of how households respond to price increases and the role that type of heating fuel could play in energy conservation (Ogus 1980). When the price of LP gas doubled and (NG) changed little, LPG households adopted and maintained energy conservation activities such as closing off a room and turning down the thermostat more. Furthermore, they were more likely to make permanent changes such as attic and wall insulation, adding storm windows and doors, caulking, and weatherstripping. Ogus (1980) concluded that a substantial economic incentive is required to create a significant and sustained energy conservation response. Latta (1981) also reported that households that use LPG tend to use less energy than households with the same characteristics that use natural gas. Thus, type of heating fuel may contribute to different energy conservation behavior.

DATA AND MODEL SPECIFICATION

The data for this paper were taken from the 1980 Annual Housing Survey tapes. The data were collected from mid - August 1980 through December 1980 by the Bureau of the Census for the Department of Housing and Urban Development. A survey instrument was used by interviewers to collect the data. Energy data were not collected on manufactured (mobile) homes.

Only homeowners were selected for study since tenants are not likely to undertake insulation energy conservation activities in which the majority of the benefits would accrue to the landlord. Therefore, the sample studied consists of 37,687 single family homeowners.

Discriminant analysis is used to determine which household, housing or energy related characteristics influence:

(1) the presence of insulation in a house and
(2) the addition of insulation to the attic, walls or floor in the 12 months prior to the survey.

Both of these variables are measured as either 0, no insulation or none added, or 1 insulation or insulation added.

Discriminant analysis is a statistical technique which maybe used to classify cases into a particular group based on the information carried by the discriminating variables (Klecka 1980). The discriminant function can be expressed as follows:

$$C = b_0 + b_1 x_1 + b_2 x_2 + \ldots b_k x_k$$

where C = the discriminant score

$x_1, x_2, \ldots, x_k$ represent the value of the predictor variables

$b_1, b_2, \ldots, b_k$ are the weights associated with each of the respective predictor variables

For the discriminant analysis, the sample was split randomly. One group, the developmental sample, containing 95% of the households was used to obtain the discriminators that were significant (Klecka 1980). The results from this analysis were then validated on the other 5% of the sample to see how well they performed as discriminators.

The analysis was thus performed in three stages. First a stepwise procedure was used with all the variables discussed below as discriminators. This produces an optimal set of discriminating variables (Klecka 1980). A variable had to be statistically significant at the .05 level to both enter and remain in the model. With a smaller sample size, a more moderate level of significance would have been chosen since the overall probability of rejecting at least one true null hypothesis is much larger than 5%. Second from the stepwise model, a smaller list of discriminators was then entered into a discriminant anaylsis model using the developmental sample. The results from this were then tested on the validation sample.

The following section describes the household, housing and energy related characteristics selected for use as discriminators and how the variables are measured.

Discriminators

Race and sex of the head were used as controlling variables. They are entered in the model as 0,1. Income is the sum of wage and salary income, public assistance and all other money income received for the 12 months prior to the survey. The discriminant analysis coefficient for income is reported in $100 units rather than $1.

Although better educated household heads have higher earnings and can thus afford larger houses and energy consuming appliances, it is hypothesized, despite Heberlein & Warriner, (1980), that better educated heads will undertake energy conservation activities.

Five levels of education were examined: (1) less than high school education, (2) a high school graduate, (3) some college, (4) a college graduate, and (5) post college or graduate work. These were entered in the stepwise discriminant analysis as 0, 1 with the group of high school graduates used as the omitted variable.

In this research, household size is measured as the number of persons living in the house.

Three measures related to age of family members are included in the present study: age of the head of the household and presence of a person 65 years of age or older. In addition, the presence of a child under 6 was included on the basis that a household with young children would consume more energy and thus have a higher demand for conservation. Age of the head is measured in years whereas the other two variables are individually specified as 0, 1 with 1 being presence of a person over 65 or under 6.

Three housing characteristics were examined: age of the house, measured in years; house size, measured by number of rooms; and value of the house which is the respondent's estimate of how much the property (house and lot) would sell for if it were for sale. It was thought that older houses would be less energy efficient than newer houses. It is expected that higher valued homes would use more energy; whether their owners would then opt for more energy conservation measures is unknown. Further square feet would obviously be more precise as a measure of house size but was not available on the data tape.

Types of heat considered here are: electricity, oil, gas, wood and LP gas. Since gas was the fuel used in the largest number of households, it was omitted as a discriminator. The other variables were entered as 0, 1 in the model with 1 being presence of that type of fuel. Natural gas has generally cost less than electricity, oil or LP gas so that households using these types of fuel may have a greater incentive to be energy conserving.

Households with other energy saving features were thought to be more likely to have insulation and less likely to add more insulation. Several energy saving features were considered: (1) whether a household had a ceiling or attic fan (2) whether a household used a window or portable fan rather than air conditioning; and (3) presence of storm doors and windows; and (4) presence of awnings.

Region of the country in which the house is located was used as a proxy for climatic conditions. Region was coded as 0 not in a given region or 1 in the region. The Northeast, Northcentral and Western regions were included in the discriminant analysis while the South was omitted. Obviously a more specific variable such as heating and cooling degree days would give precise rather than general results obtained by using region but such data were unavailable for this sample.

RESULTS

Sample Description

The 37,687 homeowners in this study had a mean income of $21,481 (Table 1). Most were married (76.1%). About 1/3 had less than a high school education, 1/3 had a high school education, and the other 1/3 had at least some college. Most of the heads were male (80.9%) and white (91.8%). Age was fairly evenly distributed among the categories from 30 to 69 years with only 8.9% of the heads under 30 and 14.6% over 70. A person 65 years or older was present in 25.2% of the households and a child under 6 in 15.8%.

TABLE 1. Household Characteristics

Characteristic	N	%
Presence of child < 6	5967	15.8
Presence of a person 65+	9503	25.2
Age of head		
< 29 years	3365	8.9
30-39 years	8222	21.8
40-49 years	7041	18.7
50-59 years	7251	19.3
60-69 years	6316	16.8
70-79 years	4024	10.7
80+ years	1468	3.9
Race of head		
Black & other	3090	8.2
White	34597	91.8
Education of head		
< 8 years	6526	17.3
9-11 years	5039	13.4
High school graduate	12939	34.3
Some college	5787	15.4
College graduate	3818	10.1
Post graduate	3578	9.5
Sex of head		
Female	7187	19.1
Male	30500	80.9
Marital status of head		
Married	28695	76.1
Widowed	4850	12.9
Divorced	2102	5.6
Separated	607	1.6
Never married	1433	3.8
Length of occupancy		
< 1 year	1722	4.6
1-5 years	12646	33.6
6-10 years	6093	16.2
11-20 years	8500	22.5
over 20 years	8726	23.2
	Mean	S.D.
Household Income (N=37687)	$21481	13649
Household Size	3.04	1.6

The housing units had an average of 6 rooms (Standard Deviation 1.6). Twenty-two percent of the housing units were 10 years old or less, 20.2% were 11 to 19 years old, another 28.4% were 20 to 40 years old and the remaining 28.6% of the units were over 40 years old (Table 2). House value was fairly evenly distributed among the categories. Natural gas heat was the dominant fuel for 51.9% of the units, followed by oil for 19.4% and electricity for 17.4%.

Storm doors and windows were the most frequent energy saving feature present for the housing units studied. Slightly over half of all households had storm doors and windows on every door or window in the house. In addition 11.2% had storm windows on some of the windows while 13.3% had storm doors on some of the doors. In declining order of importance, 7.6% of the sample used a window or portable fan (detached fan), 6.4% a ceiling fan or attic fan (attached fan), 5.7% awnings and 2.8% a dehumidifier to save energy.

TABLE 2. Housing and Energy Characteristics

Characteristic	N	%
Age of house		
< 1 year	327	0.9
1-5 years	4614	12.2
6-10 years	3663	9.7
11-19 years	7606	20.2
20-40 years	10701	28.4
over 40 years	10766	28.6
Type of heat		
Electric	6570	17.4
Gas	19556	51.9
LP gas	2664	7.1
Oil	7311	19.4
Wood	1023	2.7
Value of house		
< 25,000	4299	13.5
25-34,999	4134	12.9
35-44,999	5038	15.9
50-54,999	4524	14.3
55-64,999	3455	10.8
65-74,999	2866	9.0
75-89,999	2878	9.1
90-99,999	1123	3.5
100,000+	3426	10.9
Region		
Northeast	7450	19.8
Northcentral	10906	28.9
South	13438	35.7
West	5898	15.6
Energy Saving Items		
Storm doors & windows		
All	19074	52.6
Some	8968	24.7
Window or portable fan	2871	7.6
Ceiling or attic fan	2395	6.4
Awnings	592	5.7
Dehumidifier	1053	2.8

The Southern region contained 35.7% of the units followed by the Northcentral region with 29.8% and by the Northeast with 19.8% and West with 15.6%.

Conservation Activities

In the 37,687 households studied, 30,605 (81.2%) reported having some insulation, 4661 (12.4) reported having no insulation while the remaining 2421 (6.4%) did not know whether they had insulation in their houses.

In the 12 months prior to the survey, 20.6% of the sample added insulation in the following areas: 3.1% floor, 5.6% walls, 7.6% attic, and 4.7% water heater. (Addition of the individual percents slightly exceed 20.6 since households could have added insulation in more than one area). Other energy saving improvements added included storm windows (4.7%), storm doors (5.0%) and weatherstripping (19.1%).

Discriminant Analysis

SAS computer programs were used for the discriminant analyses. All the discriminators listed above were used in the preliminary stages of the data analysis. Based on these results, the variables entered into the stepwise discriminant analyses were reduced to:

(a) age of head
(b) presence of a child under 6
(c) household income
(d) household size
(e) length of occupancy
(f) age of the house
(g) value of the house
(h) region
(i) presence of storm doors or windows
(j) presence of a ceiling or attic fan
(k) presence of awnings
(l) type of heating fuel

Of key importance is how well the variables selected as discriminators predict behavior of households. Results are reported for the developmental sample from which the variables were chosen as well as the validation sample on which they were tested.

Presence of insulation. In the developmental sample, the discriminating variables correctly classified 75.9% of the households without insulation and 74.2% of those with insulation (Table 3). In the validation sample, 56.5% of the households without insulation were correctly classified whereas 76.1% of those with insulation were correctly classified. This suggests the variables are somewhat less successful in classifying household without insulation. Since this is a key group to target for energy conservation education and sales, more work is needed to improve the prediction ability of the model. For some households data on insulation were missing, these were classified as indicated in Table 3.

Addition of insulation. In the developmental sample, the discriminating variables correctly classified 61.1% of the sample who did not add insulation and 61.2% who added insulation (Table 4). In the validation sample, 60.6% were correctly classified as not adding insulation and 62.1% as adding insulation.

In addition to knowing how well the discriminant function differentiates between members of the groups studied, of importance is the contribution of the individual predictor variables to that success.

Coefficients for the variables used in the discriminant models with the developmental sample are given in Tables 5 and 6. The coefficient represents the amount of change in a household's position on that function if its score on the corresponding variable changed by one unit except for income where the change is reported on $100 units rather than one. To determine where any individual household would be classified, their raw score on each predictor variable X is taken and multiplied by its associated classification function coefficient. These products are summed and added to the constant. No interpretation of the coefficient is presented here since there is a different function for each group (Klecka).

It is important to remember that all the variables entered into the discrimant analysis are significant at the .05 level by design. Variables which were found to discriminate between housing units with insulation and those without in decreasing order of importance are: presence of storm doors or windows, age of the house, house value, location in the Northcentral region, household income, electric heat, oil heat, age of head, presence of an attached fan, location in the Western region, wood heat, and presence of a child under 6.

Variables which were found to discriminate between those households which added insulation and those who didn't in decreasing order of importance are: age of the head, presence of storm doors or windows, length of occupancy, age of the house, presence of an attached fan (ceiling or attic), wood heat, location in Northeast region, household income, presence of a child under 6 in the household, LP gas heat, location in the Western region, followed by location in the Northcentral region and oil heat.

CONCLUSIONS AND IMPLICATIONS

The present study was based on 1980 data. However, in 1986 The General Accounting Office reported that 86% of single family homes could be considered less than fully insulated. Thus, two, ways in which the results of the present study can be useful are in identifying households who are likely to add insulation and households who need to be educated on the benefits of insulation.

Williams and Braun (1979) indicated success with education efforts directed toward limited resource households. While Johnson-Carroll, Brandt and Olson (1987) note that educational programs aimed at encouraging energy conservation through belief in the energy problem are not recommended. The relationship between other conservation items and the addition of insulation suggests that information on the value of insulation at the time of purchase of items such as storm doors and windows would encourage greater conservation activity. Energy conservation packages are also suggested.

Policy-makers can segment programs to assist those most likely to undertake insulation conservation action and conversely to educate those least likely to undertake insulation activities on the benefits of such activities. Advertisement of education programs, as well as demonstrations, at the point of sale needs to be increased. Further, utilities could provide an evaluation of energy efficiency at the time housing units are sold as a base of comparison for prospective buyers of existing units as well as new units.

Caution should be used in applying the results of this study in that the data were collected in 1980 and as with much research could be refined and improved, especially in measurement of the variables. However, the study can provide a meaningful base for program planning, educational efforts and sales targeting.

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TABLE 3-Predicted and Actual Presence of Insulation

Actual	Predicted					
	Had Insulation		No Insulation		Totals	
	N	%	N	%	N	%
Developmental Sample						
Had insulation	18993	74.23	6593	25.77	25586	100.0
No insulation	880	24.10	2772	75.90	3652	100.0
Missing	555	57.51	410	42.49	965	100.0
Totals	20283	67.16	9920	32.84	30203	100.0
Validation Sample						
Had insulation	999	76.14	313	23.86	1312	100.0
No insulation	80	43.48	104	56.52	184	100.0
Missing	18	40.91	26	59.09	44	100.0
Totals	1097	71.23	443	28.77	1540	100.0

TABLE 4-Predicted and Actual Addition of Insulation

Actual	Predicted: Added Insulation N	%	Did Not Add Insulation N	%	Totals N	%
Developmental Sample						
Added insulation	2248	61.20	1425	38.80	3673	100.0
Did not add insulation	10313	38.87	16217	61.13	26530	100.0
Totals	12561	41.59	17642	58.41	30203	100.0
Validation Sample						
Added insulation	123	62.12	75	37.88	198	100.0
Did not add insulation	528	39.34	814	60.66	1342	100.0
Totals	651	42.27	889	57.73	1540	100.0

TABLE 5-Discriminant Analysis Coefficients for Presence of Insulation (N = 29238)

Variable	Coefficient: Insulation	No Insulation
Constant	-15.271	-14.511
Age of house	0.212	0.256
Northeast	- 0.499	- 0.488
Northcentral	0.718	0.074
West	0.246	0.499
Age of head	0.991	1.020
Household income	0.001	0.001
A child under 6	5.477	5.608
Length of occupancy	- 0.061	- 0.056
Value of house	0.665	0.588
Storm doors & windows	3.480	1.959
Attached fan	0.395	0.044
Electric heat	4.468	4.005
Oil heat	0.937	0.613
LP gas heat	4.856	5.441
Wood heat	5.954	6.288

TABLE 6-Discriminant Analysis Coefficients for Addition of Insulation (N = 31743)

Variable	Coefficient: Insulation Added	No Insulation Added
Constant	-18.727	-18.305
Age of house	0.245	0.227
Value of house	0.652	0.655
Northeast	- 0.429	- 0.806
Northcentral	0.654	0.451
West	0.694	0.504
Age of head	1.166	- 1.222
Household income	0.007	0.007
A child under 6	4.081	3.888
Length of occupancy	- 0.089	- 0.061
Storm doors & windows	3.514	3.216
Attached fan	1.034	0.567
Oil heat	0.953	0.772
LP gas	5.017	4.800
Wood heat	6.253	5.495
Electric	4.566	4.549
Household size	1.983	1.965
Awnings	- 0.426	- 0.517

CHARACTERISTICS OF CONSUMERS WHO SAVE AND DISSAVE ENERGY AFTER INSTALLING ENERGY-CONSERVING DEVICES

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Abstract

The purpose of this paper was to describe the energy savings and dissavings households accrued after installing energy-conserving devices and to identify determinants of saving and dissaving. The data are a longitudinal component of the Residential Energy Consumption Survey, U.S. Department of Energy. The results indicate that a substantial portion of consumers who installed energy-conserving devices consumed more energy in the year following installation than in the year prior to installation. The likelihood of saving increased with installation of a wood-burning stove, higher previous energy consumption, and an increase in average price. The likelihood of dissaving increased with house size, installation of caulking, household size and increases in household size and single-parent households.

Consumers' energy conservation has been assessed primarily by describing and analyzing the determinants of the installation of energy-conserving structural devices (Fujii and Mak, 1984; Labay and Kinnear, 1981; Smiley, 1979). The actual savings from energy-conserving actions have rarely been described or analyzed. Instead we assume that these actions result in savings. Evidence indicates that actual savings may not accrue after taking energy conserving actions. Gladhart (1984) explored the determinants of energy savings and discovered that when other factors were accounted for, the installation of various energy-conserving devices did not significantly influence energy savings. Other researchers have also found that the savings obtained by installation of energy-conserving devices often fall short of expected savings (Douthitt, 1986; Beyea, Dutt and Woteki, 1978). There are numerous reasons for short-falls including improper installation, construction flaws, and lifestyle changes such as changes in household size. Another reason, only recently suggested, is compensation -- the idea that some consumers modify their behavior post installation of energy-conserving devices and consequently reduce savings or use more than they used prior to installation (Beck, 1984).

The purposes of this paper are to examine consumers' energy consumption post installation of energy-conserving devices and to determine why some consumers achieve net savings after installing energy-conserving devices and others do not. The objectives of this study are 1) to describe the savings and dissavings in Btus per degree day among installers of energy- conserving devices and 2) to identify the characteristics which distinguish savers from dissavers. Longitudinal data from the U.S. Department of Energy's Residential Energy Conservation Survey, are employed in the analysis.

The Model and Review of Literature

Various researchers have projected that about 50 percent of residential energy consumption could be saved with conservation and solar energy (Rosenfeld, Cleary and Harris, 1980). Sinden (1978) was able to achieve a 67 percent saving in the Twin Rivers townhouse he retrofitted. Others have reported that consumers in their studies have achieved between 5 and 45 percent savings with the most typical achievement being 5 to 15 percent (Gladhart, 1984). Gladhart also found approximately 15 percent of sample members to have increased energy consumption in particular years but only 8 percent had dissavings over the entire period measured. The savings and dissavings reported by Gladhart (1984) are, however, not discussed in relation to conservation efforts undertaken.

To determine why some consumers save energy after investing in energy-conserving equipment and others dissave, the initial supposition of this paper is that it is largely a function of consumer behavior. A scenario is offered in which consumers have conserved behaviorally prior to retrofitting and then modified or dropped these behaviors after installing the conservation substitute. This is a plausible scenario because most conservation by U.S. consumers has been acheived by behavioral means (Friedan and Baker, 1983). In addition, consumers value lifestyle amenities and incorporate them in decisions to conserve energy (Feldman, 1986).

If the primary reason for whether consumers save or dissave subsequent to retrofitting their homes is behavioral, we posit that the behavior change occurring after installation of energy-conserving devices would be a function of the determinants of other energy-conserving efforts. Energy conservation is associated with characteristics of both consumers and their dwellings. These characteristics influence the benefits, costs and constraints of conserving.

Benefits and Costs of Conserving

Benefits to conserving are a function of the price of energy and changes in price. Price has been strong and consistent in determining consumption of energy but less so in affecting

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conservation. Gladhart (1984) found a strong effect on conservation, Fujii and Mak (1984), an inconsistent one and Smiley (1979), none at all.

The benefits of conserving are also influenced by personal characteristics of consumers. Household size has sometimes been positively related to conservation (Fujii and Mak, 1984; Gladhart, 1984). Age reduces conservation efforts (Smiley, 1979; Hirst et al., 1981) or has no effect (Gladhart, 1984).

Personal characteristics may influence the costs of conserving. For example time costs limit the amount of behavioral conservation consumers will undertake.

Constraints to Conserving

Qualities of the dwelling impose constraints on conservation efforts. Conservation has been positively linked with house age (Hirst, Goeltz and Carney, 1981; Smiley, 1979) and a measure of house size, number of rooms heated (Fujii and Mak, 1984). Previous additions of insulation predict further additions of insulation (Smiley, 1979) but additions of insulation do not necessarily reduce consumption (Gladhart, 1984). Sinden (1978) found window insulation to reduce energy consumption.

Another constraint, income, is an important (Gladhart, 1984) and consistent indicator of actual conservation (Hirst, et al., 1981; Friedan and Baker, 1983). It has been more consistent than price in predicting conservation (Fujii and Mak, 1984; Smiley, 1979).

Gladhart (1984) found previous years' consumption to be nearly as important as price and more important than income in determining level of conservation. Hirst et al. (1981) identified a positive relationship between prior consumption and conservation. Prior consumption measures several things including amount of discretionary consumption, structural inadequacies and ability and willingness to pay for energy.

METHODS

Data

The data used in this analysis are from the Residential Energy Consumption Surveys (RECS) collected by the U.S. Department of Energy. About 96 percent of the data were collected with interviews and 4 percent with mail questionnaires (U.S. Department of Energy, 1983). The energy consumption data span two one-year periods, April, 1980 to March, 1981 and April, 1982 to March, 1983. Where inconsistencies existed between answers to the same question over the period, the households were contacted by telephone for supplemental information (U.S. Department of Energy, 1985).

Sample

The 1980/81 RECS sample is a random sample of households in the contiguous United States. Of the households interviewed in 1980, about 2300 were resurveyed in 1982 (U.S. Department of Energy, 1983, p. 10). Of these, 1603 lived in the same housing unit in both time periods and thus, were employed in this analysis. Renters were subsequently omitted, leaving 1207. Of these homeowners, 548 had installed some type of energy-conserving device between March 1981 and April 1982 (the year between the available energy consumption data) and are employed in this analysis.

Analysis

To address the first objective, energy use and savings over time were described with means and comparisons were made with t-tests. The second objective was met with a logit analysis. The dependent variable, defined in Table 1, equals one for those who saved at least one Btu/DD and zero for those who consumed at least one Btu/DD more in 1983 than in 1981 (dissaved). To investigate the effects of type of energy-conserving device on energy savings and dissavings the model was specified in two ways. The first model included the variables, number of major and lowcost energy-conserving devices installed, while the second model contained three specific energy-conserving devices.[1] The models were alike otherwise. Multicollinearity was explored with simple correlations and multiple regressions of the independent variables on each other. Income, age of the house and employment status of household adults were found to be so highly correlated with several of the remaining independent variables that they were eliminated from subsequent logit analyses.

Variables

Variables and the direction of expected relationships are defined in Table 1. The energy consumption and expenditure data were obtained from the respondents' energy suppliers, including utility companies and retailers of propane gas, among others. Imputations were made when the data were not available or when there were gaps in the data. The average price variable was computed by dividing the total annual expenditure on energy by the Btus consumed during the same year. This was the only price variable available on the data set.

The energy-conserving devices were limited to those added between March 1981 and March 1982 and were coded dichotomously as indicated in Table 1. We employed the typology of Stern, Black and Elworth (1983) to categorize the energy-conserving devices as major efficiency improvements and low-cost efficiency improvements. Major efficiency improvements included adding attic, wall, or basement insulation, storm doors, windows, a clock thermostat, heatpump or wood-burning stove; fixing the furnace by adding or replacing the head burner, automatic flue door, or spark ignition; and replacing the furnace, water heater, or air conditioner. Low-cost improvements included adding duct, pipe

or water heater insulation, shutters or plastic sheets to windows, caulking, or weatherstripping.

Table 1

Variable definitions and data sources

Symbol	Definition	Expected sign
Dependent:		
SAVE	Dummy variable =1 for Btus per degree day consumed in 1980/81 minus Btus per degree day consumed in 1982/83 greater than or equal to 1 and =0 for the difference in Btus per degree day less than or equal to -1[a]	
Independent:		
Average price per Btu	Total expenditure for energy in 1980/81 divided by total number of Btus of energy consumed in 1980/81[a]	+
Change in average price/Btu	Average price/Btu in 1983 minus price/Btu in 1981	+
Household size	Number of household members in 1981	+
Change in hsld size	Household size in 1983 minus household size in 1981	-
Age	Age of household head	-
Single parent of hsld	Dummy variable = 1 for single-parent households in 1981	-
House size	Size of house in square feet in 1981	-
Change in house size	House size in 1983 minus house size in 1981	-
Major devices	Number of major energy-saving device installed[b]	+
Low cost devices	Number of low cost energy-saving devices installed[b]	+
Storm doors	Dummy variable = 1 for storm doors added to sliding glass doors[b]	+
Wood-burning stove	Dummy variable = 1 for installation of wood-burning stove[b]	+
Caulking	Dummy variable = 1 for caulking added[b]	+
1980-81 Btus	Total number of Btus per degree day consumed 1980/81[a]	+
Income change household	Household income in 1983 minus income in 1981	-
Education	Level of education of household head	+

[a]Utility bills from April of the beginning year through March of the following year.

[b]Devices were installed between March 1981 and April 1982.

FINDINGS AND DISCUSSION

Descriptive Statistics

As Table 2 shows, the average sample member had installed 2.58 energy-conserving devices but installation ranged from a low of 1 to a high of 10. On average they had installed 1.09 major devices and 1.49 low-cost devices. The mean energy usage in 1981 was 20.31 Btus per degree day (Btu/DD) and in 1983, 19.56, for the sample as a whole. The 4 percent decrease in energy consumed was statistically significant ($p \leq .01$).

Table 2

Descriptions of energy-conservation efforts and energy saved

	Mean (Standard Deviation)
Number of major devices installed	1.09 (1.07)
Number of low-cost devices installed	1.49 (1.22)
Btus per degree day in 1981	20.31 (9.52)
Btus per degree day in 1983	19.56 (9.74)
Mean savings in Btus per degree day	.75 (5.97)

Energy savings and dissavings were defined in two different ways, as shown in Table 3. In the first case savings and dissavings were defined as positive and negative values, respectively, on the change in Btus/DD over the period. In the second case, savings and dissavings were defined as positive and negative changes, respectively, greater than or equal to one. Using the first definition, Table 3 shows that 55 percent of the sample saved energy over the period. Savings ranged from .02 to 26.12 Btus per degree day. The median savings were 2.67 Btus per degree day, or 13 percent of their 1980/81 usage. On the other hand 45 percent of the sample, all of whom also had added some sort of energy-saving device, increased their energy use between 1980/81 and 1982/83. In other words -- they dissaved. The dissavings ranged from 56.24 to .01 Btus/DD. The median dissavings was 1.91 Btus/DD amounting to a 9 percent increase.

The second, and more rigorous definition of savings (those who saved at least 1 Btu/DD), shows that 40.1 percent of the sample of installers obtained net savings over the period (Table 3). The median savings for this group was 3.81 Btus/DD. According to this definition approximately 30 percent of sample members had no

Table 3

Energy savings and dissavings of installers of energy-conserving devices

	Percent of sample	Median change in Btus/DD
Definition 1: Saved (dissaved) than (less than) zero		Btus/DD greater
Savers	55	2.67
Dissavers	45	-1.91
Definition 2: Saved (dissaved) or equal to than 1 and -1		Btus/DD greater
Savers	40	3.81
Dissavers	30	-3.18
No change	30	0.00

net change in their energy usage after installing energy-saving items. Finally 30.5 percent dissaved, a median dissaving of 3.18 Btus/DD.

Using either definition the percentage of dissavers in this sample is substantial. The more rigorous definition indicates that 60 percent of the households in the sample had either not changed or had increased their energy use after trying to conserve by improving the thermal integrity of their dwellings.

Logit Results

The results of the logit analysis used to explore why some households saved and others dissaved are reported in Table 4. The two models in Table 4 correspond to the two specifications of the model which vary by the indicants of energy-conserving efforts made. Because the coefficients of the variables common to both models are similar the first model is used for interpretation. The likelihood ratios of each model indicate both equations are statistically significant at the .0001 level.

Benefits and Costs

Average price in 1980-81 did not affect whether consumers saved after installing conservation equipment and the coefficient on change in price was significant in Model 1 but not in Model 2. The inconsistency is probably due to collinearity with one or more of the insulation variables. The likelihood of saving rose with price increases; price increases of an additional .1 of a cent per Btu increased the probability of saving by almost 19 percent compared with the average household.

Household size and growth in size increased the likelihood of dissaving. Households with one extra member were .05 percent less likely to save than the average household. Households which had grown by one member were .14 percent more likely to have dissaved over the period compared with the average household. Growing households would be expected to increase their use but the same would not be expected for larger households. This is because the benefits to saving energy rise with household size. Installation of energy-saving equipment has been positively associated with household size (Fujii and Mak, 1984). While larger households may be more likely than smaller households to install insulating devices, findings from this study argue that they are less likely to achieve

Table 4

Results of Logit Analysis ofSavers and Dissavers[a]

Independent Variables	Model 1 Column 1 Coefficient[b] (A.S.E.[c])	Model 1 Column 2 ME[d]	Model 2 Column 3 Coefficient[b] (A.S.E.[c])	Model 2 Column 4 ME[d]
Benefits				
Avg price/Btu	15.06		19.42	
	(36.94)		(37.87)	
Change in price/Btu	75.52**	18.88	52.43	
	(36.33)		(36.04)	
Household size	-.20**	-.048	-.22**	
	(.10)		(.10)	
Change in household size	-.55****	-.14	-.55***	
	(.16)		(.17)	
Age	-.006		-.005	
	(.01)		(.010)	
Costs				
Single parent hsld	-.48**	-.24	-.46**	
	(.23)		(.23)	
Constraints				
House size	-.0002*	-.00004	-.0002	
	(.0001)		(.0001)	
Change in house size	-.0001		-.0001	
	(.0002)		(.0002)	
Installation of:				
Major devices	.09			
	(.11)			
Low cost devices	-.04			
	(.09)			
Storm doors			.38	
			(.28)	
Wood-bng stove			.68***	.34
			(.23)	
Caulking			-.25**	-.13
			(.12)	
1980-81 Btus	.09****	.0223	.09****	
	(.02)		(.02)	
Income change	-.00001		-.000008	
	(.00001)		(.00001)	
Education	-.02		-.02	
	(.04)		(.04)	
Intercept	.92		.13	
	(1.04)		(1.09)	
Likelihood Ratio Statistic	468.61****		451.04****	
N	388		388	

[a]The dependent variable is SAVE, coded 1 for those who saved energy and -1 for those who dissaved energy after installing at least one energy-conserving device, using the second definition in Table 3.

[b]Statistically significant at *p≤.10, **p≤.05, ***p≤.01, ****p≤.001.

[c]Asymptotic standard error

[d]Marginal effects were calculated with the following formula:

$$\frac{\delta P_i}{\delta X_i} = \left[\frac{e^{\bar{X}}}{(1 + e^{\bar{X}})^2}\right] \beta_i$$

For the interval level variables X as been computed with mean values and for the categorical variables X has been computed with modal values (Harushek and Jackson, 1977).

savings than smaller households.

The probability of saving declined with age, as expected. Older households have shorter time horizons than younger households and may be more likely to increase thermostat settings to increase comfort after improving the thermal quality of their dwellings.

Finally households of single parents were more likely to be dissavers than other households. Specifically they were .24 percent more likely to have increased their energy consumption after installing energy-conserving devices than their counterparts. The high time costs of single parents would encourage them to drop time-consuming behavioral energy-saving methods after installing substitutes for them. In addition they might have relied increasingly on energy, especially electricity, to substitute for their own time in household production tasks.

Constraints

The likelihood of dissaving increased with house size but the effect was small. Households with an extra 1000 square feet of space were .04 percent less likely to have saved energy than the average household. Change in house size did not affect the process (see Model 1, Column 1, Table 4). Few respondents enlarged their houses (or reduced their size) over the period thus the latter finding may reflect low variation in the variable, change in house size, than its unimportance to saving energy.

The number of either major or low-cost conserving devices did not significantly influence whether the household saved or dissaved post installation. However, the signs of the coefficients imply that the more major energy-conserving devices installed the more likely saving will occur and the more low-cost items installed the more likely dissaving. As the coefficients in Model 2 indicate, savers were more likely to have installed wood-burning stoves but were equally as likely as dissavers to have installed storm doors on sliding glass doors. Dissavers were more likely to have caulked than to have added energy-conserving devices. Adding a wood-burning stove increased the probability of saving by .34 percent while caulking raised the probability of dissaving by .25 percent compared with the average household.

Energy consumed in the baseline period, 1980/81 strongly increased the likelihood of saving. Consumption of an extra Btu/DD in 1980/81 increased the probability of saving energy by more than 2 percent. Energy consumed in the baseline period suggests the level of discretionary consumption as well as the relative thermal efficiency of the dwelling. Those who had previously made few conserving improvements would have had higher previous consumption and thus an incentive to save. Dissavers may have felt that their relatively lower consumption warranted relaxation, especially if the lower consumption had been achieved with lifestyle cutbacks which the households wanted to regain.

Although the univariate statistics indicated the changes in income to be substantial they did not influence consumers to save or dissave energy over the period. Furthermore the likelihood of saving was not influenced by the education of the household head.

CONCLUSIONS AND IMPLICATIONS

This analysis showed that a high proportion of consumers who had installed energy-conserving devices consequently dissaved or used the same amount of energy before and after the investment. Thus installation of energy-conserving structural devices alone does not necessarily save energy. The model used in this study identifies the characteristics that differentiate between consumers who saved and those who dissaved after retrofitting provided a partial explanation of the process. Because of the longitudinal nature of the data base the impacts of changes in the house, household and economic environment could be measured. Change in average price and household size were predictably important. Average price, however, did not increase the probability of saving energy which is congruent with those of Fujii and Mak (1984) and Smiley (1979). The equivocal effect of the price variable is particularly salient because U.S. energy policy relies on price primarily, if not exclusively, for stimulating conservation among consumers.

These results imply that other factors are as important as attempts to improve thermal integrity in determining energy conservation. If future studies indicate that these results point to widespread malfunctioning and improperly installed conserving products then they indicate that consumers have problems with manufacturers and retailers that need to be addressed. The results may also indicate that do-it-yourself installers need better information than they now obtain.

Furthermore the additional, albeit indirect, evidence of behavioral changes occurring after installing energy-conserving devices imply that observing the conservation process only up to the point of retrofit fails to capture a comprehensive view of the process. The RECS data are longitudinal and incorporated information about the structural, economic and demographic characteristics of consumers, their dwellings and economic systems and the structural modifications consumers make to conserve. As broad as these data are it will be necessary in the future to collect longitudinal data that also inquires about consumers' behavioral conservation methods including those which are used following energy-conserving structural improvements. Knowledge of the entire conservation process will promote the dissemination of information to consumers which will help them ensure net benefits to conservation and savings of energy for the society as a whole.