The Effect of Debt on Household Welfare

By

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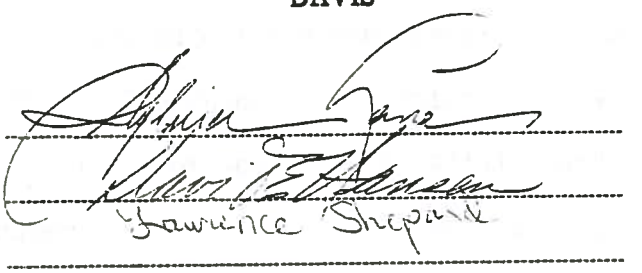

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The Effect of Debt on Household Welfare

Abstract

Does the use of consumer credit by the average American household increase or decrease its utility as measured by a household member's perceived change in financial well being? This question arose when a dichotomy was observed between the fact that the use of consumer credit increased dramatically since World War II and the fact that much of the traditional literature and education on consumer credit recommended its avoidance.

Traditional literature and education in the area of consumer credit emphasized the virtues of paying cash and warned consumers that an inevitable decrease in their financial well being would ensue if they made a practice of using credit. However, statistics show aggregate consumer installment debt increased thirty-five hundred percent since 1946 and installment debt rose to sixteen percent of personal disposable income by 1975. In addition, economic investment theory, as developed by Fisher ahd Hirshleifer, suggests that consumers may increase their market opportunities and also their utility through judicious selection of debts and assets.

This study was designed to determine whether the holding of both debts and assets and a change in their ratio tends to decrease financial well being as perceived by one member of the household.

Reporting their perceived changes in financial well being involved a choice problem for the respondent being interviewed. Binary logit models were used to analyze this choice problem and to determine the

effect of changes in debt-asset ratios and other financial and demographic characteristics on perceived changes in financial well being. Logit analysis provided maximum likelihood estimates of the log of the probability of feeling better (or worse) off as opposed to the probability of not feeling better (or worse) off. The results from these models were compared to those from models for which alternative estimating techniques were used, namely, transformed ordinary least squares and multinomial logit analysis. The set of panel data collected by the Survey Research Center of the Institute for Social Research at the University of Michigan provided a national sample of 1426 family units for analysis in this study.

Changes in debt-asset ratios were generally not found to be significant variables in influencing family units' perceptions concerning changes in their financial well being. However, there were a few notable exceptions. A decrease in the ratio of installment debt to liquid assets increased the probability of family units feeling worse off. Two other exceptions were changes in investment debt ratios. For those who earned more than $10,000 a year and those who lived in urban areas, an increase in the ratio of investment debt to liquid assets increased the probability of their feeling worse off and for those family units whose head was between age thirty-five and forty-five an increase in the ratio of investment debt to nonliquid assets increased the probability of their feeling worse off. The probability that urban dwellers would feel worse off decreased as the ratio of investment debt to nonliquid assets increased. Noninstallment debt ratios were not significant in any of the models.

The majority of American family units appear to adjust levels and types of debts and assets in order to maximize their utility in the face of an intertemporal budget constraint as investment theory suggests they would. Consumer credit may be viewed as one of several money management tools available to the family unit which it uses to manipulate debts and assets in a manner consistent with economic theory.

Variables which had a significant impact on the probability of feeling better (worse) off were conditions affecting the earnings potential of the family unit, its major expenditures and those demographic states which change in predictable or controllable patterns. Demographic states not likely to change in any given year, except for rurality in the case of two subsamples, were insignificant in all models.

Stratifying the sample and applying the Chi Square test for similarity revealed family units perceived changes in financial well being similarly regardless of income level. Rural and urban dwellers also perceived their changes in financial well being similarly. Those who were married perceived changes in financial well being differently from those who were single and each age group had its own unique view concerning changes in financial welfare.

The effect of debt on household welfare was estimated using maximum likelihood estimators from logit analysis. Similar conclusions on this effect were reached using ordinary least squares coefficients transformed by a constant to obtain discriminate estimates. This similarity verifies the results and strengthens the credibility of logit analysis but it does not imply that discriminate analysis or ordinary least squares are viable estimating techniques for this study. Due to its theoretical superiority and statistical viability, logit analysis remains the preferred method of analysis.

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CHAPTER I

INTRODUCTION

Household Economics and Consumer Credit: The Problem Defined

"Economics has been defined as "...the study of that part of the total social system which is organized through exchange and which deals with exchangeables" (Boulding, 1969). The household[1/] is a subset of the total social system. The widespread acceptance and availability of consumer credit has made it possible for the household to exchange a stream of future payments for a stream of future services (consumption) or, in the case of nondurables, for current consumption. Consumer credit provides a means of reallocating lifetime earnings and wealth in such a way as to maximize the intertemporal utility function of the household.

Economics encompasses the technique of maximizing objective functions subject to resource constraints for the purpose of finding the optimal course of action. By using credit households capitalize their potential wealth, rearranging financial constraints over time for the purpose of bringing their level of consumption more closely in line

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1/ The United States Department of Commerce, Bureau of the Census defines "household" as all persons who occupy a housing unit and "family" as a group of two or more persons related by blood, marriage, or adoption and residing together. The data for this study were collected for "family units". At times, the terms household and family unit may be used interchangeably in this study. This assumes that the utility function of individual members of a household can be aggregated into a household utility function.

with their desired intertemporal standard of living. Determining and using the optimum amount of credit enables households to maximize long run or intertemporal utility.

The primary question which this study addresses is whether or not the average American households' use of consumer credit serves to increase or decrease utility as measured by a household member's perceived change in financial well being.[2/] This question presents itself when one observes the dichotomy between the philosophy advocated in much of the traditional literature on consumer credit or the concepts used in educational materials for the subject area, which encourage avoidance of credit use, and the fact that households' use of consumer credit has steadily and dramatically increased since the end of World War II.

Traditionally, consumer credit educational material based upon ideas expounded in historical literature cited in Chapter III, warned the consumer that an inevitable decrease in his/her financial well being would ensue if he/she indulged in the use of consumer credit. Authors such as Hardy (1938), Eubanks (1938) and Mors (1944) considered the use of consumer credit as tantamount to poor money management and those who used it as being badly in need of education in thrift, self-denial, and sound finance. They avered the use of consumer credit would lead to less personal freedom, a deterioration of family life and family health and certainly to a decrease in the lifetime level of living. A recent study by Waddel (1970) reinforces the last point of

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2/ Perceived changes in financial well being or welfare are assumed to be indicators of changes in utility. Perceived financial well being is not a measure of net worth but is a measure of how "well-off" the responding family member discerns he/she is.

view by illustrating how finance charges can erode one's lifetime purchasing power. Extensive studies which focus on those users of consumer credit who are known to have experienced a decline in financial well being, namely persons who are in bankruptcy or who have had their wages garnished, provide further documentation of the potential problems for households in debt.[3/]

Despite potential problems which may ensue because of the use of consumer credit, aggregate consumer installment debt has increased thirty-five hundred percent since 1946 and more than fifty percent since 1970, while the number of households increased only eight percent since 1970. (Business Week, 10/12/74) The percentage of disposable income committed to installment debt grew from six and two-thirds percent in 1950 to fifteen percent in 1965 and sixteen percent in 1975. (U.S. Board of Governors, Federal Reserve System, "Federal Reserve Bulletin", 1955-1975) These statistics do not include the increases in credit card use or noninstallment debt.[4/] Thus, the following questions emerge. Does the use of consumer credit by the average American family increase their perceived financial well being (revealed utility)? If it does not, why is the demand for consumer credit continuing to increase? Under what financial and demographic circumstances is perceived financial well being likely to increase or decrease as a result of the use of credit?

[3/] For these studies see: Caplovitz (1974), Dolphin (1965), Herrmann (1965), Huber (1967), Lane (1968, 1969, 1971), Stanley and Girth (1971), and Vago (1968).

[4/] See Appendix A for graphic trends in consumer credit since 1945.

These questions have not heretofore been addressed in formal empirical studies. Bymers (1967) examined the financial vulnerability of various households in debt. Ryan (1968) classified debtors as being in "deep trouble" or "some trouble" in order to identify the financial and demographic characteristics of households in each classification. Hendricks, Youmans, and Keller (1973) built an index of "revealed utility" and correlated it with installment debt, but no one has yet examined the question of whether or not using consumer credit has any effect on the typical consumers' perceived financial well being, and if it does, the likely direction of that effect. More recent consumer credit literature, as well as economic investment theory, implies that consumer credit is an integral part of personal financial management. It allows family members to allocate lifetime resources over time. The use of credit may also be interpreted as one method of coping with future uncertainty through a self imposed financial discipline. The payoff for this discipline is earlier access to consumption and investment.[5/] The question is whether or not the self imposed discipline of consumer debt increases or decreases perceived financial well being. This study addresses that question directly. The main hypotheses which are tested are:

Hypothesis 1. Changes in debt-asset ratios and other selected financial and demographic characteristics have a significant impact on perceived financial well being as reported by one member of a family unit.

Hypothesis 2. Increases in debt-asset ratios will decrease the probability of feeling better off and increase the probability of feeling worse off.

5/ Household investment is discussed in the next chapter and is defined as any financial activity which potentially increases the household's intertemporal budget constraint.

Hypothesis 3. Changes in financial well being are perceived similarly by members of family units belonging to different categories of demographic groups.

Plan of Investigation

The basic economic question being studied is identified in this first chapter. In Chapter II there is a discussion of a dilemma which exists in economic literature regarding the classification of expenditures financed by credit. They are alternately classified as consumption, savings, or investment depending on the author and the commodity purchased. When studying individual households, such expenditures will be classified differently by different households, as they should be, since each family unit has its own motivations for purchasing any given commodity and financing it in a manner best suited to its individual budget. A discussion of the Fisher-Hirshleifer investment model with suggested adaptations for household economic decisions and the theoretical development of intertemporal utility maximization is also presented in Chapter II together with a review of empirical applications of intertemporal utility theory.

The literature concerning consumer credit reviewed in Chapter III includes a discussion of some of the studies which document macroeconomic effects of rapidly expanding consumer credit. These studies focus primarily on the aggregate burden of debt, the need for regulations, or the effects on monetary policy and how changes in consumer credit interface with business cycles and economic stability and growth. The volume of literature and empirical analysis which exists documenting macroeconomic effects of consumer credit compared to the volume

documenting microeconomic effects is testimony to the need for more research in the area of consumer credit as used and viewed by individual households. Chapter III also includes a discussion of microeconomic studies, some of which examine the role of credit in influencing commodity demand and some of which examine the relationship between consumer credit and household welfare. These latter studies are the ones most closely related to this study. Since this study utilizes a specific indicator of utility, various definitions of household welfare and utility are presented at the end of Chapter III.

One possible indicator of utility is the perceived change in financial well being on the part of a household member. Reporting his/her perception involves making a qualitative choice. The qualitative choice utility model designed for this study and techniques for estimating qualitative choice models are discussed in Chapter IV -- specifically, ordinary least squares, discriminate analysis, and logit analysis are compared. The emphasis in Chapter IV is on logit analysis, the technique used in this study to estimate the effect of debt on household welfare.

The data set used in this study, the inherent problems with cross-sectional data, and ordinary least squares screening models used to determine the most appropriate variables to use in the logit models are discussed in Chapter V. Findings from the screening models and the logit models are presented in tabular and narrative form. Logit models were used to estimate (1) the conditional probability of feeling better off and (2) the conditional probability of feeling worse off. Since the latter model explained a greater portion of the conditional probability, it was used to test whether different categories of

demographic groups perceive changes in financial well being similarly. Chapter V includes a comparison of empirical results obtained using maximum likelihood estimates from logit models with the results obtained using discriminate coefficients calculated by multiplying ordinary least squares estimates by a constant.

Analysis of the findings regarding the effects of changes in debt ratios on perceived household welfare is presented in Chapter VI. Other financial and demographic variables included in the logit models were analyzed with respect to their effect on perceived household welfare and this analysis is also presented in Chapter VI.

The results of this study led to some policy recommendations with respect to consumer credit education and general governmental policy. Since the continued utilization and extension of consumer credit is intimately related to both the private sector and governmental policies, many questions arose which are tangentially related to the results of this study. Some of these issues, which range from indexing of prices and wages to electronic transfer systems, are addressed in the section which focuses on further research. Some theoretical and methodological suggestions for future studies are also made in this section. These recommendations and a summary comprise Chapter VII.

CHAPTER II

MICROECONOMIC THEORY OF CONSUMER CREDIT

Expenditures Financed by Credit: Consumption, Saving, or Investment?

Incorporating consumer credit into neoclassical economic theory of consumption has not yet been satisfactorily accomplished. One of the reasons is that economists do not agree on how to classify expenditures financed by credit. Consumption and expenditures are treated as the same activity in the neoclassical economic theory of consumption behavior. The idea of durable goods which are acquired today and consumed and paid for over time is not considered, nor is the more recent and growing phenomena of consuming a commodity today and paying for it over time, made possible through the use of credit cards for durable and nondurable goods. When credit financing is introduced into the model, consumption must be redefined and separated from expenditure. One alternative is to define consumption as the actual using up of the commodity (sometimes measured by the depreciation rate) and define expenditure as the act of paying for the commodity. Another alternative is to define consumption as the total sum of goods and services acquired or negotiated for in a given time period regardless of whether they are paid for in that time period or later. Sporlander (1974) attempts to separate consumption and expenditure by breaking commodity demand analysis into two steps. First, the consumer decides on which price to pay for the commodity; the cash price or the credit

price. Then he/she decides on the quantity to buy. Once the quantity is established, traditional demand analysis may be used as long as the price variable reflects the price associated with the method of payment and not the simple market price.

If consumption is defined as the using up of the commodity, then one may argue that if the length of time over which the payments take place is designed to coincide with the depreciation rate and the life expectancy of the commodity, consumption and expenditure coincide and neoclassical economic models apply. The problem with this concept is that some commodities depreciate immediately and more durable commodities depreciate at a rate which extends their life beyond the last installment payment. It is this derivation of future consumption services from a commodity that has led to the classification of expenditures on durable commodities as either investment or saving.[6/]

Seligman suggests that the residue of the commodity not consumed at the end of the accounting period is a form of capital and represents savings, implying that the expenditures for durables are an investment (Seligman, 1927). Mors, in the classic tradition, counters Seligman by stating that capital in the form of a commodity is not available or adaptable for the purpose of augmenting future income for its owner or

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6/ In both Friedman's permanent income hypothesis (Friedman, 1957) and Modigliani's life cycle hypothesis (Modigliani, 1957) durable goods are counted as expenditure only to the extent that they are depreciated in a particular period. All consumption is equal to purchases. Chow believes that the classification of durables as consumption or investment is a "statistical question", but he separates the less durable from the more durable and classifies the former as consumption. (Chow, 1967)

to make purchasing power available to him/her at some future date.[7/] Therefore, the purchase is not a saving or an investment (Mors, 1944, pp. 45-47). Mors believes that using credit to buy durable goods is a distinctly different type of investment than productive investment because investing in durable goods permits optimal spending, over time, of a given income and productive investment permits an increase in money income, over time. This is based on his belief that the firm's ability to raise capital is infinite while the income of the household is finite in both time and amount.

It may be argued that the purchase of most durable goods is indeed an investment for the household in that it enables one to earn an income more efficiently (such as owning an automobile) or it yields returns to the household in excess of the money cost of the durable by saving the higher price of alternative commercial services (such as owning sewing machines, washer and dryer, kitchen appliances). Morgan (1958) includes automobiles, household durables and additions and repairs to homes as part of investment. There have been a few attempts to estimate the "yield" from investment in household durable goods. The results usually depend on the intensity of use; the "yields" being higher as the intensity increases (Poapst, 1964; Stone and Rowe, 1960; Dunkelberg and Stephenson, 1976). This contradicts theories of "optimal rate of use" and indicates the need for more research in this area.

7/ This represents the traditional approach to the purchase of assets which is to consider them an investment only if they will actually produce future income, or at least contribute to the earning power of the firm (household). Consequently, household durable goods have been omitted from the list of legitimate investments (except in the case of the Federal Reserve Board) leaving only education, business ownership, and various securities and financial investments as household assets assumed capable of yielding a return to the owner.

A macroeconomic reason for classifying installment credit payments for durable goods as investment is that household ownership of durable goods has, in part, replaced business ownership of durable goods which have always been classified as investment both by the firm and in national accounting. For example, instead of riding on a public railroad car consumers purchase their own automobiles, thereby investing in a commodity which replaces business ownership of a durable good designed to provide the same service as the automobile. Juster's study (1966) of household capital formation is based on the premise that households are now a more important determinant of the growth and cyclical variation in the nation's total fixed capital investment than are business enterprises. The main capital assets which households acquire are durable goods, housing, and human skills and the main method of financing the acquisition of these assets is with consumer credit. Therefore, it is argued, credit payments for capital assets may be classified as investment.

Expenditures on durable goods have also been classified as savings, most notably by Milton Friedman in his presentation of the permanent income hypothesis (Friedman, 1957). Others who classify such expenditures as savings include Goldsmith (1955); Seligman (1927, pp. 237-274); Hardy (1938, p. 147); Fisher (1930); Herendeen (1974); and Houthakker and Taylor (1970). Katona classifies credit expenditures as savings on the basis of survey data from which he concludes that most people perceive the saving of money as a positive act which is the result of substantial pressures directed toward achieving highly valued goals of life (Katona, 1960, pp. 101-102). The acquisition of money and wealth resembles the acquisition of goods of

long lasting value and in order to discipline themselves to save, many introduce constraints on their budgets through installment credit because they find that repaying debt is easier than adding to liquid savings accounts. Strotz calls this the "strategy of precommitment" which enables consumers to cope with uncertain future tastes and events (Strotz, 1956, p. 173).

Installment credit payments have frequently been classified as savings, irrespective of whether the underlying commodity purchased was a durable or nondurable good, since the payments represent a reversed (and forced) saving activity. When installment credit is used, the date at which consumption takes place is earlier than it would otherwise have been, giving the household the benefit of using the commodity sooner. Periodic payments, which include a finance charge for this commodity, are made (saved) to the seller rather than being deposited in an account where interest may be earned. If the household's rate of time preference is such that the utility received from the earlier consumption of the commodity is greater than the opportunity costs represented by both the interest foregone and the finance charges paid plus any other costs of transferring funds between periods, then it is rational for the household to choose the strategy of precommitment and invest in current consumption.[8/]

Fisher (1930) and Hirshleifer (1970) provide theories of investment which are helpful in examining households' rational use of

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8/ For purposes of clarifying exactly what is meant here, decisions made in time period one about what and how much of the services of durable goods to consume, in the most general sense, are considered investment decisions. Expenditures in future time periods for debt incurred earlier are considered savings.

credit. These theories are compatible with the concept of credit expenditures being considered as either investment or saving. Consumption is then defined as all goods and services actually acquired in a given time period regardless of when payment is made. The Hirshleifer idea that firms (households) face both production (investment) and market opportunities will be adapted in keeping with the belief that households can enhance their future financial status through several resource reallocation projects including investing in both durable and nondurable commodities, keeping liquid assets in interest bearing accounts, and making various other financial investments.

Intertemporal Utility Maximization

If the household has only market opportunities, that is, all it can do is transfer funds between time periods, then the only decision it must make is how to transfer available funds. This is illustrated in a two time period model in Figure 2.1. This is the first of a series of graphic models illustrating how consumer credit may be incorporated into investment analysis.

Typical assumptions underlying these models include:

1. Perfect information which implies no uncertainty.
2. A fixed stream of income for each individual or household.
3. Perfectly competitive conditions in the market which implies free entry to the market.
4. Both market and investment (production) opportunities are available to every household.

Symbols and terms used are:

y_t = funds available in time period t. This will include income, endowments of wealth which can be converted

Figure 2.1

Market Opportunities Only
Unlimited Transferability of Funds at interest rate = i.

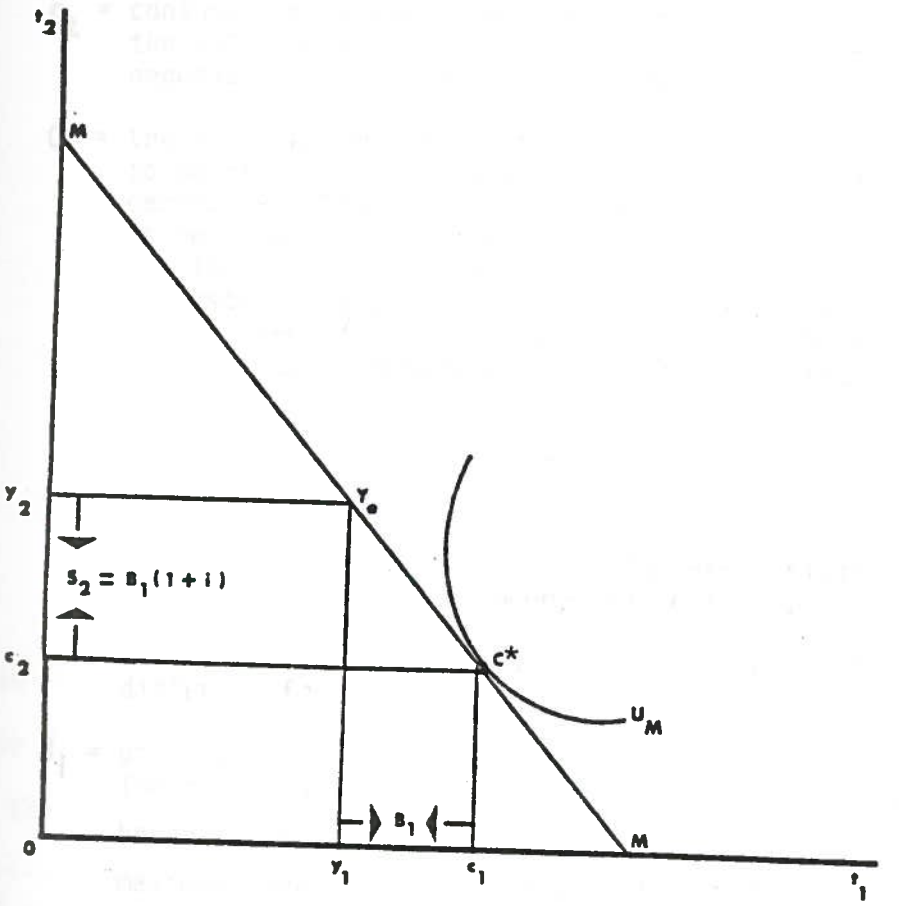

Figure 2.1 shows that a particular household with endowment vector Y_e and with the consumption possibilities set limited by the market opportunities line MM, and with unrestricted borrowing and lending at the same interest rate i, chose to borrow $B_1 = (c_1 - y_1)$ in t_1 and to repay $S_2 = B_1(1+i)$ in t_2 and to accept c_2 as the maximum value of consumption available in t_2. The household has simply transferred S_2 funds from t_2 into t_1 to effectuate their preference for earlier consumption. Note: at C*, $\delta=1$.

to cash, and liquid assets.[9/] This assumes that liquid assets have the same role in providing consumption opportunities as does current income. No subjective rate of return is imputed to liquid assets due to their contribution to psychological security.[10/]

Y_e = the endowment vector of cash funds available over the two time periods. This does not include available credit.

c_t = consumption in each time period which is equal to the value of all commodities actually acquired or negotiated for in that time period.

C* = the equilibrium consumption vector. It is important to point out that in a two period analysis, credit cannot be extended in t_2; it can only be repaid. This is because in a two period model, the second period is the last period, and using the assumption of no bequests [as does Tobin (1967) and Yarri (1964 and 1965)] precludes borrowing or lending in the second period. c_2 is determined solely by the allocation decisions in t_1.

$$\sum_{t=1}^{T} c_t = \sum_{t=1}^{T} y_t$$

i = the market rate of interest. (In later graphs, the interest rate at which money can be lent.)

r = the rate of interest paid on borrowed funds if it is different from i.

U_i = utility level represented by the indifference curve. The position and slope of U_i is determined by the household's rate of time preference (δ). U_M is the maximum level of utility available given δ.

$$\delta_{12} = -dc_2/dc_1 - 1$$

MM = the market opportunities frontier or the budget line. All points along this line are of equal present value. The slope of this line is determined by the relevant

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9/ It has been found that all cash money available, not just income, comprises the funds which families allocate to consumption over time (Bymers and Rollins, 1967).

10/ For an analysis which does assume a subjective rate of return to liquid assets, see Juster and Shay (1964, p. 88).

rate of interest. The slope = $-(1+i)$;

$c_1 + c_2(1+i)^{-1} = MM$.

PP = the production opportunities curve which according to Hirshleifer is the curve that defines the ability of the household to physically transform present consumption claims into future ones and vice versa. Herein this definition is expanded to include any project which will increase the household's future financial well being.[11/] This allows the inclusion of liquid assets in the endowment vector and allows saving and the holding of liquid assets to be considered as "production projects" associated with some internal rate of return.[12/] The PP curve is redefined as the Investment Opportunities Curve for this study. The payment stream of one investment project is considered independent of the adoption of the other projects and the projects are infinitesimal in scale. This produces the smooth curve. PP slopes towards the northwest and is concave indicating that there are diminishing returns to scale as investment out of current resources (or equivalently the sacrifice of current consumption) increases. The slope of PP is equal to the rate or resource transformation or $dy_2/dy_1 - 1$. The symbol for this internal rate of return will be ρ.

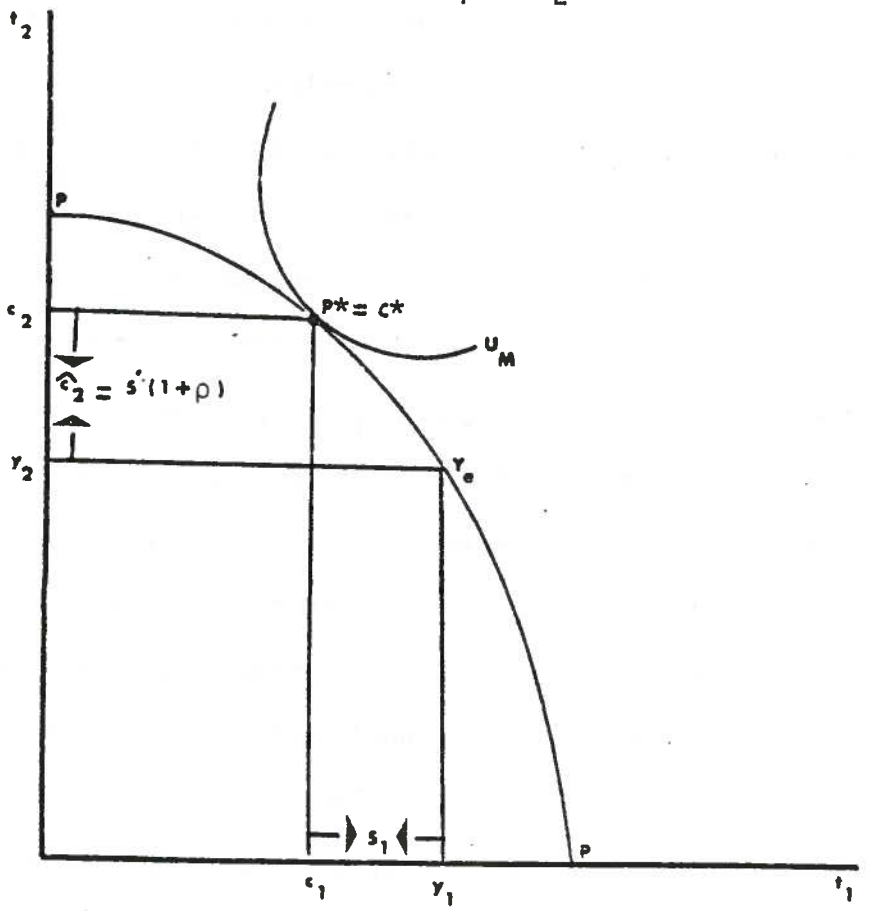
The allocation of financial resources over time is more complicated than Figure 2.1 suggests, even in a two period model. The household also faces investment opportunities. Figure 2.2 illustrates the concept of the investment opportunities curve, PP.

11/ Financial status is enhanced by: 1. Providing increased "leisure" time which has enabled more household members, especially women, to engage in wage earning activities. 2. Saving future expenditures on consumption of commercial services. 3. Providing the wherewithall to perform a wage earning occupation. This includes education as well as adequate transportation. This principle could be extended without loss of generality to credit payments by households for items such as hair cuts, vacations and other commodities which enhance ones working ability or earning potential.

12/ Hirschleifer would classify any shifting of cash over time as strictly a "market" transaction, not as a "productive" or "investment" opportunity. (Hirshleifer, 1970, p. 37).

Figure 2.2

Investment Opportunities Only
Unlimited Conversion of c_1 to c_2.



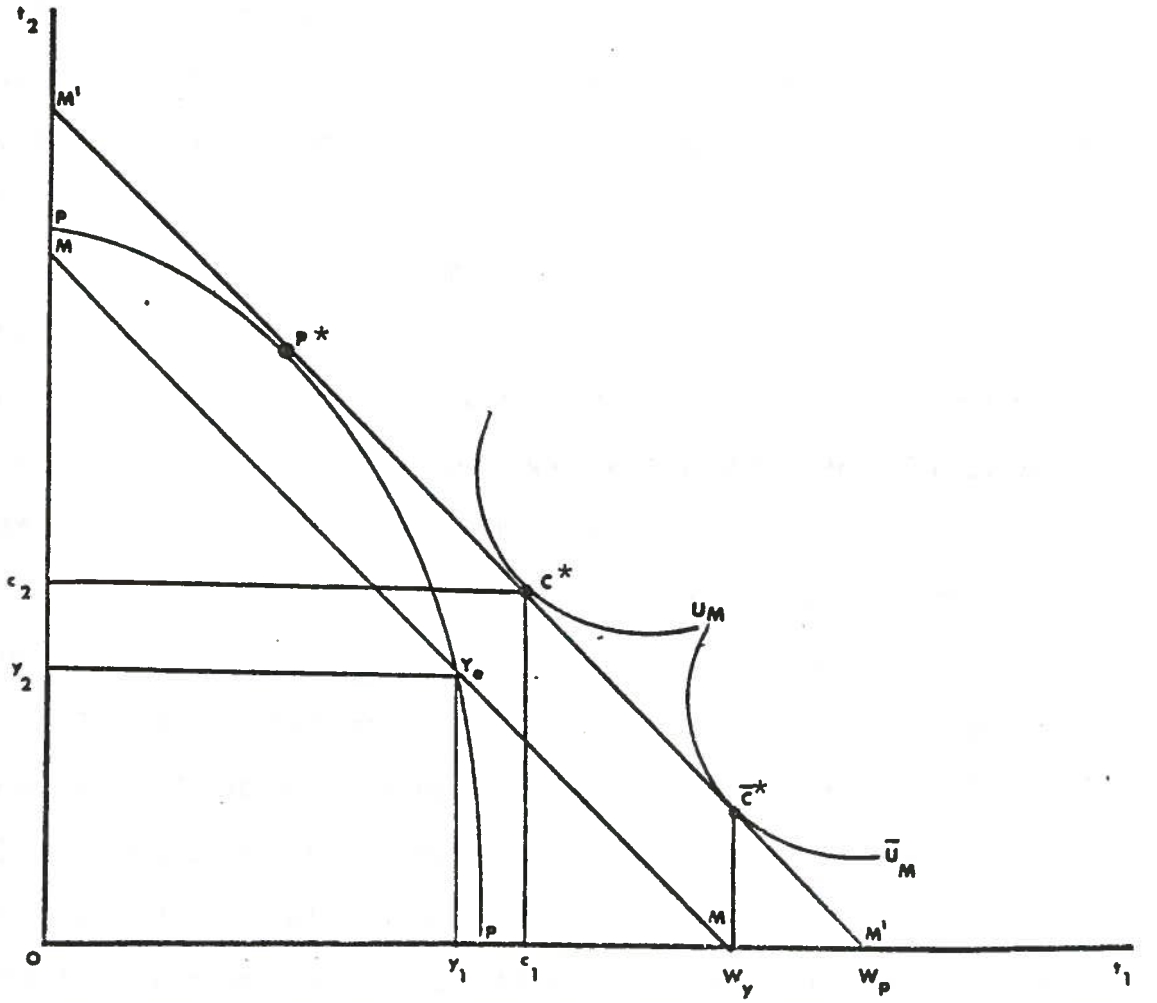
The household maximizes its utility at P*=C*, giving up $S_1 = (y_1-c_1)$ in t_1 and obtaining $\hat{c}_2=S_1(1+\rho)$ more than y_2 in t_2. Note that at P* $\rho=\delta$: The rate of resource transformation equals the rate of time preference.

In Figure 2.3 both market and investment opportunities affect decisions. The presence of investment opportunities pushes the present value budget line out and enables the household to reach a higher level of utility at C*. The total consumption possibilities set has been expanded from MM to M'M'. This model assumes perfect and complete markets and it assumes that the investment decision will be governed by the objective market criterion represented by attained wealth without regard for the rate of time preference which enters into the consumption decision. Essentially, this is a statement of the Separation Theorem, which defines the two step decision procedure used to maximize utility in this model. First the household equates ρ to i at P* and then it equates δ to i at C*. (Hirshleifer, 1970, p. 63)

Referring to Figure 2.3, if c_1 is greater than y_1 the household borrows in t_1, but this does not preclude simultaneous investment along PP. In fact, if certainty is assumed, there is no reason to restrict the household to investing out of current available cash funds equal to y_1. The household can borrow to finance the investment projects as well as borrow for current consumption on the strength of the prospective future consumption yield from the investment. In this case, referring again to Figure 2.3, consider W_y as endowed wealth since the household can increase its current funds by borrowing along $Y_e W_y$ to W_y if it chooses. If investment takes place until ρ = i at P*, M'M' defines the total consumption possibilities set and is the highest present value budget line. This makes W_p the highest present value of wealth. Term W_p attainable wealth. If the household did borrow the full extent of W_y in t_1 and invested along PP, $\overline{C}$* would be its chosen consumption vector. Note that a C* and $\overline{C}$*, $\rho = i = \delta$.

Figure 2.3

Investment and Market Opportunities
Unlimited Transactions at Interest Rate i.



The two steps of the decision procedure for the household in this model are: 1. Begin from Y_e and move up along PP as long as $\rho > i$; $\rho = i$ at P*.

2. From P* the second step is to move along M'M' until $i = \delta$ to establish the location of the consumption vector, C*. The shape of the indifference curve is the primary determinant of the location of C*.

To bring this model closer to the realities faced by households when they make investment and consumption decisions, two additional refinements are presented. One is to account for imperfect capital markets where the market rate of interest (i), differs from and is lower than the rate of interest (r) on borrowings. The second refinement is to impose a limit on the amount of credit the household can obtain in t_1. As Figures 2.4 and 2.5 will show, each of these changes, in turn, contract the total consumption possibilities set a bit further.

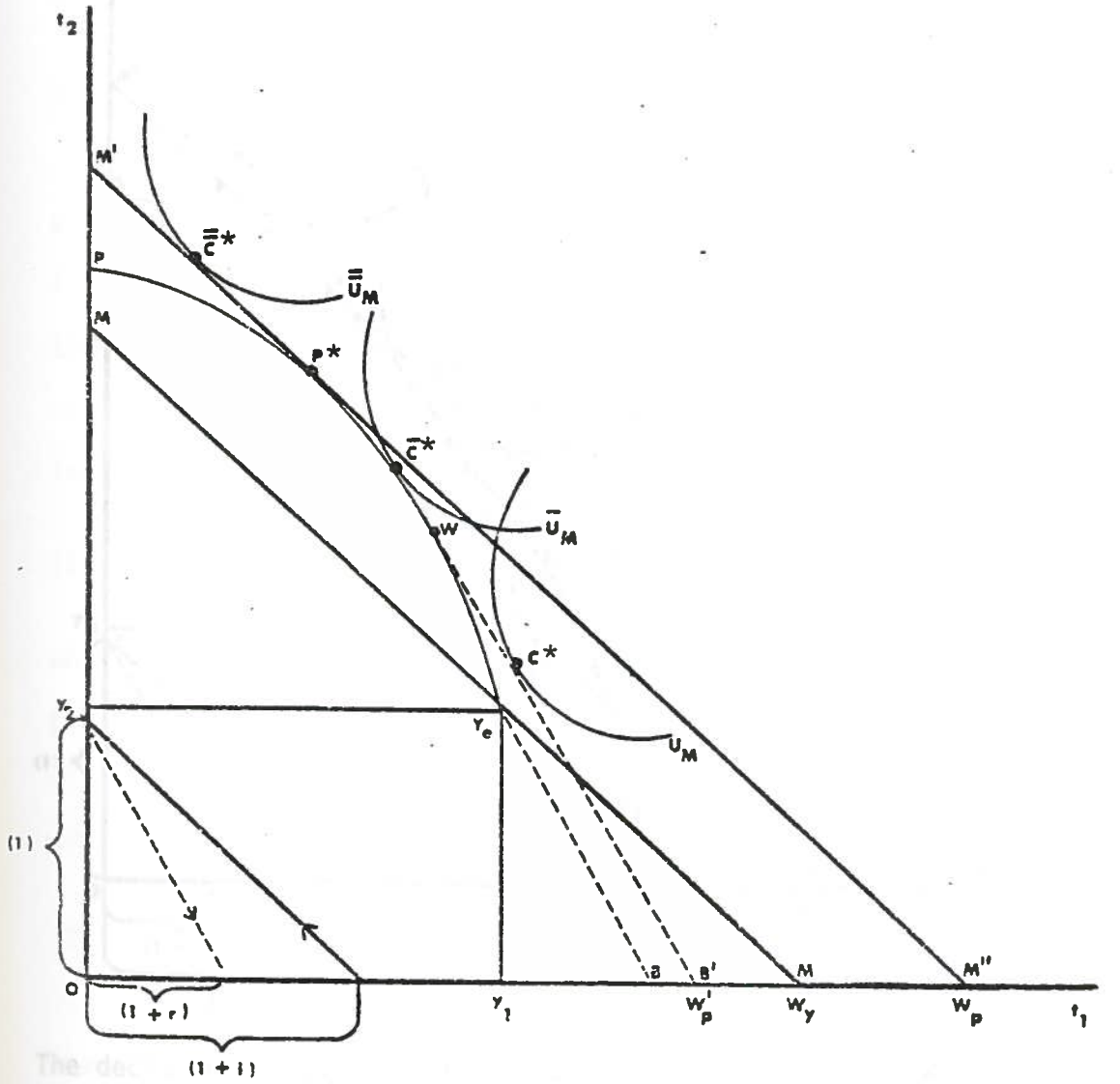
Figure 2.4 follows Figure 2.3 except for the omission of the bottom portion of the PP curve. Investment opportunities effectively exist between Y_e and P. The different rates of interest for lending and borrowing are shown in the lower left hand corner. The slope of MM and M'M" is still -(1+i). The slope of Y_eB is -(1+r). It is along Y_eB which borrowing can take place. The decision process still involves the two step procedure detailed under Figure 2.4.

The last refinement of the two period analysis of household resource allocation involves imposing a limit on the available credit. In Figure 2.5 this is accomplished by the vertical line az, where Oa is the limit of credit. The distance Y_eB' = xz and distance y_1a' = Oa. The total consumption possibilities set is outlined by an envelope curve connecting the points of maximum credit available along a series of possible borrowing lines all parallel to Y_eB'. The total consumption possibilities set is further collapsed to a'B'TWP*M' and attainable wealth is now at a' which is less than B' in Figure 2.4.

The last five figures have shown that the household's total consumption possibilities set contracts as capital markets become less

Figure 2.4

Investment and Market Opportunities
Lending Rate = i < Borrowing Rate = r
Unlimited Transactions

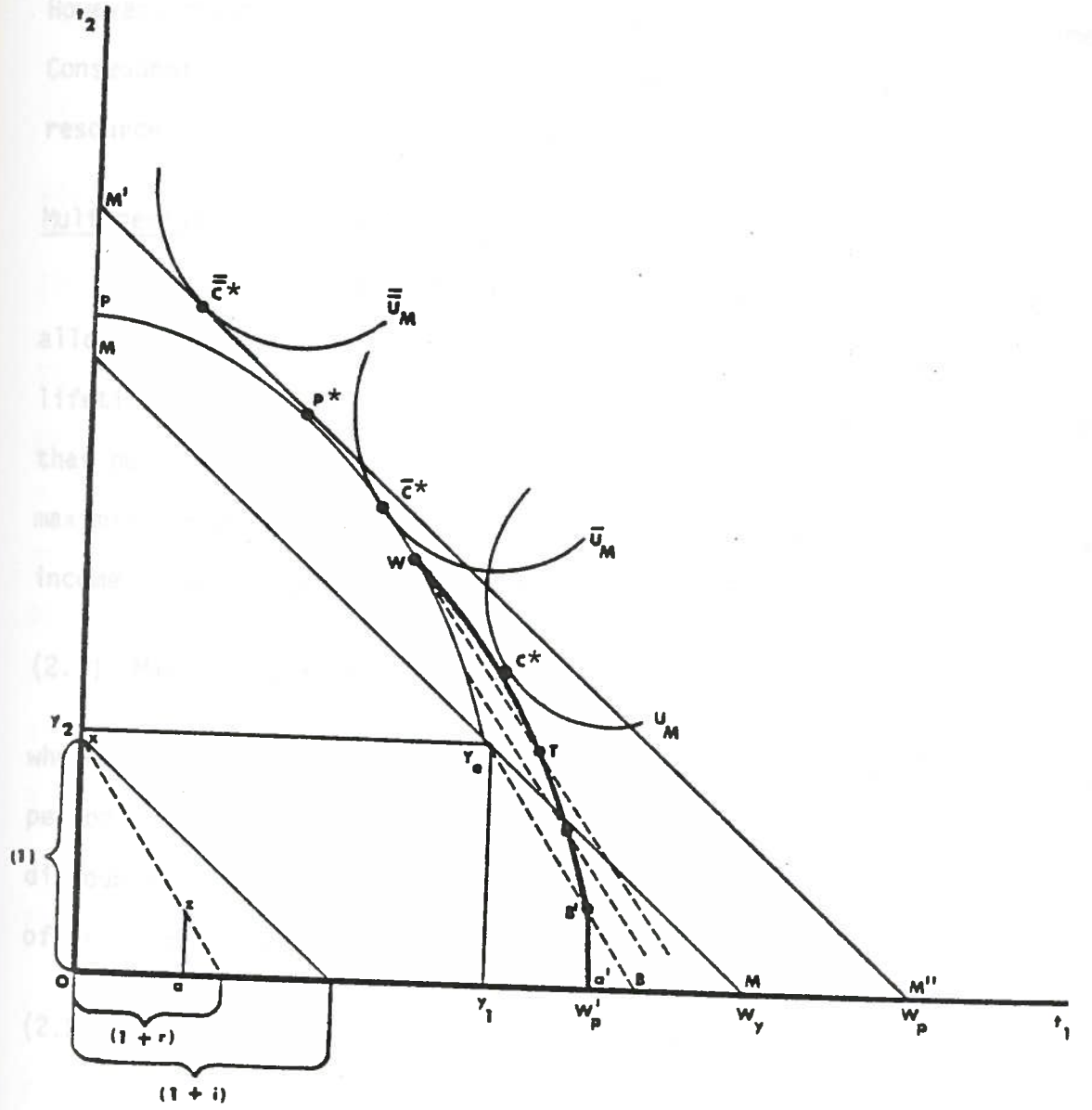


The two step process illustrated involves moving up Y_eP until $\rho=r$ at W. Then borrow along WB' (which is parallel to Y_eB) until $r=\delta$ at C*. Or, the household can continue up along Y_eP to P* where $\rho=i$ and then lend along M'P* until $\delta=i$ at $\bar{C}^*$. δ always equals ρ but whether these two rates are equated to i or r depends on the shape of the indifference curves. The total consumption possibilities set is now B'WP*M'<M'M". The total attainable wealth is now at B' at $W'_p<W_p$ at M".

The household could choose to neither borrow or lend. Then $\bar{C}^*$ would be somewhere between P* and W. In this case they are simply transferring resources from one period to another.

Figure 2.5

Investment and Market Opportunities
Lending rate = i < Borrowing rate = r
Limited Credit Available = 0a.



The decision process here is to move up $Y_e P$ until $r=\rho$ at W, then borrow along WT until $\delta=r$. Or, from W, continue up along $Y_e P$ until $\rho=i$ at P* and then lend along P*M' wherever $i=\delta$, such as at $\bar{\bar{C}}^*$. As on the other figures, the location of C* will depend on the shape of the indifference curve which reflects the rate of time preference for consumption.

perfect and as credit is limited to a finite amount below endowed wealth. This is the reality facing households in the American society. However, households exist and plan for more than two periods at a time. Consequently, a multiperiod model is more helpful in allocating resources over the lifetime of the family unit.

Multiperiod Resource Allocation to Maximize Utility

One economic allocation problem facing the household is how to allocate available resources in each time period so as to maximize lifetime utility. Since Tintner (1938) specified an economic model for that purpose, the standard presentation of the problem has been to maximize intertemporal utility subject to the present value of lifetime income. The procedure is as follows:

(2.1) Maximize utility = $U = u(q_{11}\ldots q_{n1}, q_{12}\ldots q_{n2}, \ldots\ldots q_{nT})$

where q_{it} is the quantity of the i^{th} good consumed in the t^{th} marketing period. Utility is maximized subject to the constraint that the discounted value of lifetime expenditures equal the discounted value of lifetime income.

$$(2.2) \qquad \sum_{t=1}^{T} (y_t - \sum_{i=1}^{n} p_{it}q_{it})(1 + \varepsilon_{1t})^{-1} = 0$$

where i = interest rate, and $(1 + \varepsilon_{1t})^{-1} = [(1 + i_1)(1 + i_2)\ldots (1+i_{t-1})]^{-1}$. This is the discount rate applicable to time period t. y_t = income in time t and

$$(2.3) \qquad c_t = \sum_{i=1}^{n} p_{it}q_{it},$$

the total commodities obtained in time t. (y_t could include wages,

interest and dividend income, endowed wealth, assets and the limit of credit available in t.) In order to maximize the value of the utility function a Lagrangian is used. Therefore:

(2.4) Maximize: $L = u(q_{11}.....q_{nT}) + \lambda[\sum_{t=1}^{T}(y_t - c_t)(1 + \varepsilon_{it})^{-1}]$

First order conditions with respect to q_{it} and λ show that

(2.5) $$-\partial q_{it}/\partial q_{kT} = p_{kT}(1+\varepsilon_{1T})^{-1}/p_{it}(1+\varepsilon_{it})^{-1}$$

The consumer equates the marginal rates of substitution between each pair of commodities in every pair of time periods to the ratio of their discounted prices. This corresponds to step one in the decision process outlined in the two period models discussed previously. It is the physical shift of consumption claims between periods. The second step, here, as in the two period model analysis, involves the selection of the optimal commodity combinations corresponding to the planned expenditures on each date. After solving the $nT + T + 1$ equations from the above maximization problem to eliminate the q_{it}s, utility is expressed as a function of the consumption expenditures.

(2.6) $$U = V(c_1.....c_T)$$

This utility function is more commonly used since it determines the consumer's rate of time preference (δ) which, in equilibrium, will equal the appropriate discount rate $(1+\varepsilon_{1t})^{-1}$, or ε. (See 2.9 & 2.10 below)

(2.7) $$\delta_{12} = -\partial c_2/\partial c_1 - 1$$

where δ_{12} is the rate of time preference for consumption in time period one rather than in time period two.

$$(2.8) \quad \text{Maximize: } L' = V(c_1 \ldots\ldots c_T) + \lambda'\left(\sum_{t=1}^{T} (y_t - c_t)(1 + \varepsilon_{1t})^{-1}\right)$$

First order conditions with respect to c_t and λ' show:

$$(2.9) \qquad -\partial c_3/\partial c_2 = (1+\varepsilon_{12})^{-1}/(1+\varepsilon_{13})^{-1} = 1+\varepsilon_{23}$$

$$(2.10) \qquad \text{Therefore from (2.7) } \delta_{23} = \varepsilon_{23}$$

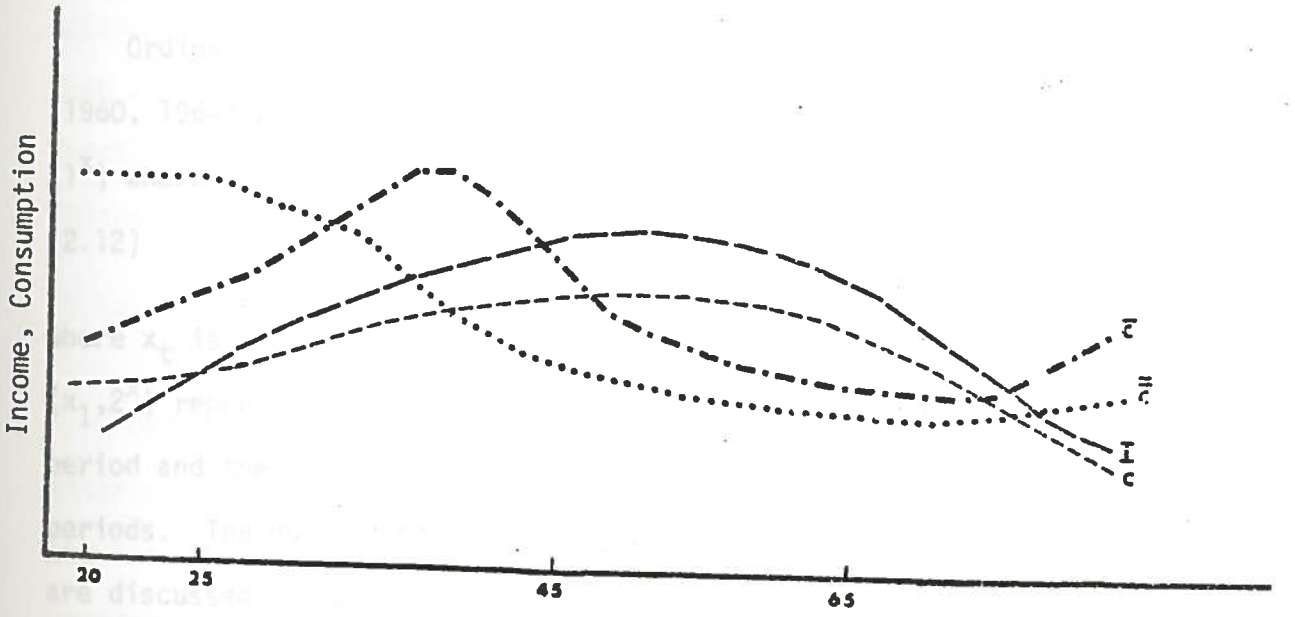
(This is the point C* on the two period models, Figures 2.3, 2.4 and 2.5) Second order conditions show that the principle minors of the bordered Hessian matrix alternate in sign, indicating a maximum has been found and that the utility function is strictly quasiconcave. This results in convex indifference curves which implies

$$(2.11) \qquad -d^2c_2/dc_1^2 < 0 \qquad \text{(Henderson \& Quandt, 1971)}$$

Optimum intertemporal resource allocation over the lifetime of an individual or a family unit is also examined in the life cycle models of the consumption function. (Modigliani & Ando, 1957; Modigliani & Brumberg, 1969; Tobin & Dolde, 1971; and Thurow, 1969) Lifetime optimization models show a smoothing out of expenditures which are above or below resource levels at any given time. Thurow (1969) tests a life cycle consumption function which incorporates the use of credit. Graphically, his results substantiate the traditional findings and presentations; that is, consumption is above income (meaning total cash resources) in the early years and below income in later years. Figure 2.6 shows this pattern. It clearly documents a low rate of time preference (see equation 2.7) which encourages individuals to use credit to obtain commodities during their younger years.

This phenomenon is also documented in numerous studies which show the distribution of credit is correlated with age or life cycle stage. Younger families or individuals use credit more extensively than middle and older aged persons. This is illustrated in Figure 2.6. Those who are under age twenty-five and in some cases under forty-five, tend to spend more than their income with the aid of credit. Those who are between the ages forty-five and sixty-five or older tend to save or repay debts. Consumption being greater than income in the older ages is a phenomenon of dissaving rather than the using of credit. (For illustrations of this life cycle behavior pattern see Katona, Survey

Figure 2.6
Lifetime Consumption Patterns



I = typical pattern of lifetime income
C = typical pattern of lifetime consumption
$\bar{\bar{C}}$ and $\bar{C}$ = alternative patterns of preferred consumption found by Thurow.

of Consumer Finances, 1968-1970; Enthovan, 1957; U.S. Board of Governors, Federal Reserve System, Federal Reserve Bank of San Francisco, 1973).

Empirical Adaptations of Intertemporal Utility Theory

Graphic and mathematical explanations of intertemporal utility maximization theories have appeared in the literature cited. Some attempts have also been made to adapt or modify the theory to make it suitable for empirical analysis. The concepts involved in the adaptations which are discussed are cardinal verses ordinal utility functions, separable or independent utility functions additive over time, certainty versus uncertainty, finite versus infinite planning horizons, and wealth constraints.

Ordinal intertemporal utility functions are explored by Koopmans (1960, 1964) who terms the ordering of a sequence of bundles a "program", (1^X) where

$$1^X = (x_1, x_2, \ldots\ldots x_t) = (x_1, 2^X) \tag{2.12}$$

where x_t is a vector of n commodities in time t. $x_t = (x_{t1}, x_{t2} \ldots\ldots x_{tn})$. $(x_1, 2^X)$ represents the vector of commodities consumed in the first time period and the program for ordering consumption in all subsequent time periods. The postulates or assumptions underlying this utility model are discussed in Koopmans (1960, 1964) and Phlips (1974). In brief they are: 1. Existence and continuity. 2. Sensitivity. 3. Limited noncomplementarity or independence. 4. Stationarity and 5. Monotonicity.[13/]

[13/] A brief explanation of the postulates follows. 1. Existence and continuity means there exists a continuous utility function $U(1^X)$ which is defined for all $1^X = (x_1, x_2 \ldots x_n)$ such that for all t, x_t

(continued)

This theoretical model has not proved useful in empirical work as yet.

In the cardinal utility function used in most applied research in this area, total utility is the discounted sum of the utilities maximized in each time period and where the rate of time preference (δ) is assumed constant

$$U = \sum_{t=1}^{T} 1/(1+\delta)^{T} u_t(c_t) \tag{2.13}$$

A cardinal utility function also implies the restriction of additivity which (usually) further implies independence or separable utility functions for each time period. This means the marginal rate of substitution between consumption in any two time periods is independent of consumption in a third. One refinement of the cardinal utility approach is to assume continuous rather than discrete time periods. Then an integral sign replaces the summation sign and the utility function is redefined as a utility functional. Yarri (1964, 1965) and Phlips (1974) used such a functional of the form

$$U = \int_{0}^{\infty} e^{-\delta t} u_t(c(t))dt \tag{2.14}$$

Defining the conditions under which the consumer maximizes his/her intertemporal utility function (functional) has caused more controversy and has been the source of more variation in empirical studies than the

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13/ continued
is a point on a bounded convex set in n commodity space.
2. Sensitivity means that a change in one consumption vector will lead to a change in utility. 3. Limited noncomplementarity or independence refers to separability between time periods.
4. Stationarity means that preferences remain the same over time.
5. Monotonicity has the standard interpretation. An ordinal utility function can be replaced by another utility function which is a monotonic transformation of the original one.

measurement of utility itself. The original Fisher type models assumed certainty. This includes the certainty of death as well as the usual perfect information assumptions. Empiricists then made further assumptions avering all monetary resources must be used up by the date of death. This "no bequest" assumption was used by Tobin (1967) and Yarri (1964, 1965). It also meant that, even if there was a bequest, no debts could be left. Consequently the equation

$$\sum_{t=1}^{T} c_t \leq \sum_{t=1}^{T} y_t + e \tag{2.15}$$

was used where e is endowments and y_t is income in time t; c_t is consumption in time t. This assumption has been widely adopted.

Certainty of death and no bequests implies a finite planning horizon, therefore, t = (1.....T). In the case of uncertainty, t = (1.....T = α). With a planning horizon which extends beyond one's death, bequests can be granted to future generations. The assumption of bequests was adapted by Kendrick and Bowles (1970). Their adaptation is particularly appealing when combined with Yarri's loss function introduced to cope with random horizons (Yarri, 1965). For this approach, maximize

$$U = \int_0^T e^{-T} u_t(c(t))d_t + \theta[S(t)] \tag{2.16}$$

subject to no constraint where θ is a nondecreasing concave real function. S(t) is the bequest in Yarri's model where it is assumed there is an increase in utility if S(t) is positive and a loss of utility if S(t) is negative.

Another method of coping with random horizons suggested by Yarri (1965) is to maximize the expected value of utility. He applied a

chance constrained program to cases with and without insurance. Maximized expected utility implies that S(t) must be replaced by the probability that $S(t) \geq 0 \geq \lambda$ (a fixed number) and T is replaced by the probability that the consumer will live until time = T. Tobin, in his life cycle savings model, maximized the present value of accumulated net worth up to age T times the probability that age T will be reached (Tobin, 1967). Hirshleifer also incorporated risk and uncertainty into preferences for investment over time (Hirshleifer, 1970).

Several well known functions have been developed to incorporate the concepts of risk and uncertainty, namely the von Neuman-Morgenstern utility function, a certainty equivalent model which assumes risk aversion; the Friedman and Savage utility function, which is not everywhere concave; and the Markowitz utility function which maps utility against the change in wealth and incorporates both risk and risk aversion (Naylor and Vernon, 1969, pp. 309-314). The relative nature of the Markowitz utility function makes it an attractive theory applicable to the study of household welfare as a function of changes in wealth due to the use of consumer credit.

Exactly what is included in the budget constraint also varies from study to study. In some cases it is the present value of the earnings stream $[\sum_{t=1}^{T} y_t/(1+i)^t]$. Green adopts Farrell's "normal income" as the wealth constraint. Normal income assumes y_t is constant over time and that wealth is equal to the present value of that income stream (Green, 1971, p. 190). In other cases the wealth constraint is the initial endowment of financial wealth plus the present value of the income stream. This is used by Modigliani and Brumberg in their lifetime

utility analysis (Modigliani and Brumberg, 1969). Yarri (1965) uses $S(t) = \int_0^T \{\exp. \int_{T'}^{t} i(x)dx\} \{Y_{T'} - C_{T'}\}dt$ which translates into the accumulation up to time t of the excess of the stream of earnings over the stream of consumption expenditures, compounded continuously by the prevailing interest rate.

In some empirical studies the utility function is not the function that is maximized. Herendeen (1974) shows that the household may want to maximize the present value of its income stream, but suggests that it is more realistic for it to maximize the rate of growth of consumption over time. Green (1971, p. 201) also suggests finding an optimal rate of consumption growth. Others suggest using optimal control theory to define an optimal path on which the relative rate of change of the implicit value of wealth is equal to the difference between the rate of time preference and the rate of interest associated with financial wealth. (Phlips, 1974; Glycopantis, 1972; Samuelson, 1971) This innovative technique defines utility as a function of consumption plans (decision variables) and the state of the system (state variables). The consumer maximizes the current flow of utility from all sources, present and anticipated.

Even though much progress has been made in specifying utility functions in such a manner that they may be estimated empirically, very few have been tested with numerical data. The utility function used in this study accounts for changes in utility from one time period to the next and it is estimated with numerical data collected from family units across the United States. Before defining this utility function in Chapter IV, a review of the literature in the field of consumer

credit is presented. This review demonstrates the dearth of studies which incorporate debt as a specific variable when studying household behavior.

CHAPTER III

LITERATURE ON CONSUMER CREDIT AND HOUSEHOLD WELFARE

Six different categories have been identified as useful for the purpose of reviewing the literature in the field of consumer credit. Studies have been categorized according to the major focus of the essay or study involved. The categories are: 1) The effect of consumer credit on national economic growth, business cycles and monetary policy. The majority of studies on consumer credit fall into this category. 2) The structure and functioning of the credit industry. Most of this literature will not be reviewed in this dissertation because it is only tangentially related to the study proposed. 3) Partly because of a large number of well documented cases where debt has become a burden on households and partly because of traditional beliefs regarding usury, credit transactions are highly regulated. Thus, the third category is government regulation of the credit industry. 4) Consumer credit as a social or economic phenomenon. 5) The role of consumer credit in household financial management, or the role of credit in the demand for durable goods, and 6) Studies which focus on household welfare and its relationship to household debt.

Consumer Credit and the National Economy

In 1957 the Board of Governors of the Federal Reserve System compiled a major credit study devoted to examining aggregate demand and

supply of installment credit and the extent to which it affects and is affected by economic stability and growth, monetary policy, and direct government regulation. The focus for most of this study was the extent to which government can or should try to regulate the market for installment credit (U.S. Board of Governors, Federal Reserve System, Six Volumes, 1957).

The National Bureau of Economic Research has published numerous studies dealing with specific topics related to installment credit. Many of them are referred to in other parts of this paper. They have also published a series of books titled Studies in Income and Wealth which deal with various related topics. Volume fourteen has at least two chapters which deal with aggregate household debt. The main concern is with the structure of financial claims throughout the economy such as total consumer debt outstanding, the percentage of income saved, and the ratio of net interest to national income (Brill, 1951, pp. 75-121; Klein, 1951, pp. 195-227).

Hardy (1938) presents a composite statement of all the traditional beliefs about the reasons for using credit and its effects upon the finances and social status of the user. He also examines two effects of credit on the economy: 1) The long run effect on the rate of capital formation. 2) The short run effect on the business cycle.

Runcie (1969) provides a description of the effect of installment credit on the Australian economy and includes a chapter on the place of installment credit in macroeconomic theory.

Hoffman (1974) finds that the substitution effect between money and real assets is the mechanism through which monetary policy affects the market for consumer durable goods rather than monetary policy working

through the change in interest rates which result from changes in the money supply.

As pointed out in the introduction to this study the rapid increase in consumer credit has caused concern over the effects it will have on national economic health and on aggregate demand. Enthovan (1957) argues that the increased use of installment debt is so highly correlated with the life cycle that a new group of borrowers will move in to replenish the stock of debtors as long as the population grows and therefore one need not be concerned by the aggregate burden of debt on consumption.

Many of the studies which show that consumers are not overextended in their use of credit do so by comparing aggregate liquid assets to aggregate debt outstanding and invariably they find that either among income groups or in total, consumers have more assets than liabilities and therefore they could retire the debt at anytime if they so desired. This type of analysis is theoretically useful for monetary policy makers and those interested in the overall financial health of the nation, but it is extremely misleading, since it in no way accounts for the income distribution and the fact that the net asset holders and debtors are often not the same people, and there is no reason to believe a transfer of funds will take place in the direction of the debtors. McCracken (1965) recognizes this but he also points out that the statistics understate assets since they include only financial assets and not the value of goods acquired by the increased liabilities. Therefore, the real net worth of consumers is greater than shown; "Consumers are adding substantially more to their assets each year than to their liabilities". (McCracken, 1965, p. 107) He also argues that those who

owe debts, also have assets, and that "on balance, the total operation of consumer credit has clearly augmented consumer purchasing power and has been an instrument for pushing levels of living above what would otherwise have been possible. In that very meaningful sense, there has been no net 'burden' at all." (McCracken, 1965, p. 109).

Other studies comparing aggregate debts and assets include Smythe (1968) and the National Commission on Consumer Finance Study of 1972. Smythe tried to determine how long "categories of families" could live on their assets if they became unemployed. She found that they could live from nine weeks to two years and were, therefore, not overindebted. The National Commission on Consumer Finance Study (1972, p. 18) looks at the aggregate household balance sheet and concludes that the ratio of debt to net worth of Americans is negligible. They also examined households by income category and found that higher income households were more likely to make accelerated payments. Those with greater than twenty percent of their income committed to payments were about equally likely to repay faster or become delinquent, suggesting that high debt-income ratios may be as much of an indicator of greater ability to incur and carry debt as a measure of excessive financial burden. The National Conference on Consumer Finance (1974) also presents a series of empirical studies designed to analyze various markets for consumer credit.

In 1956 the National Consumer Credit Conference held a workshop under the direction of the Bureau of Business Research at the University of Michigan (National Consumer Credit Conference, 1956). Their focus was on a general understanding of the role of credit in the economy and in households with special emphasis on the aggregate results of the use

of credit by American families. Nine years later the American Home Economics Association held a similar workshop on "Consumer Credit in Family Financial Management" (American Home Economics Association, 1967). Home economics educators had long been involved in teaching the traditional principles of money management and the goal of this workshop was to determine those types of education which would best help consumers to manage credit and other financial resources in order to enhance the attainment of individual goals and to contribute in a positive way to the overall economy.

Another approach focused on studying the aggregate effect of consumers' spending habits on the consumption function. Consumption function analysis based upon Keynes' absolute income hypotheses (Keynes, 1936) and Modigliani's and Duesenberry's relative income hypotheses (Modigliani, 1949; Duesenberry, 1949) has been used for individual households and for aggregate entities. Consumption function analysis can be developed from a utility maximization viewpoint and thus can be useful in studying the burden of debt upon households over time. This suggests using some form of the life cycle theory which has been tested extensively (Modigliani, 1957, 1969), but rarely using debt as an explanatory variable. In fact, none of the consumption function studies reviewed by Ferber (1953) incorporated a direct measure of debt. Ferber suggests, however, that potential borrowing is an appropriate variable in the budget constraint (Ferber, 1953, p. 62).

Studies in support of the life cycle theory which account for debt include Thurow (1969) Tobin (1957) and Klein and Lansing (1955). Klein and Lansing found a positive correlation between the ratio of the purchase of durables to income and the ratio of debt to income at the

beginning of the year and Tobin (1957) found a negative correlation between the ratio of debt to income at the beginning of the year and the change in debt incurred during the year. Klein (1951) added debt to an aggregate savings function and found that it was insignificant compared to current income, percentage change in income, liquid assets and age in explaining the savings to income ratio. Furthermore, it barely changed the estimated coefficient of determination in his analysis. Lansing and Morgan (1955) used survey data to explore the life cycle patterns of spending and borrowing; their findings generally support the life-cycle theory.

Structure and Functioning of the Credit Industry

Hundreds of books, pamphlets, and articles exist containing a discussion of the consumer credit industry, not to mention studies conducted specifically for the benefit of the industry. Most of these sources will not be referred to in this study because they do not deal with the effects of credit on household welfare, nor do they fall into any of the other five areas of concern designated herein (p. 33). It is relevant, however, to look at the credit rationing strategies used by the credit industry because they have a direct bearing upon availability or usefulness of credit and the burden of debt on individual households.[14/]

14/ For purposes of this study, the consumer credit industry is defined as those firms which lend money or extend credit directly to consumers. The consumer agrees to repay the loans or the amount of the commitment in a single payment or in regular installments over a period of time shorter than that for repayment of a typical home mortgage loan. (Short term credit is usually extended for less than five years.) One form of noninstallment, single payment loan is charge accounts which may be paid in full within thirty days, interest free. Noninstallment credit is the less common type of credit in the consumer credit field, but it will be included in the empirical section of this study.

Firms in the credit industry include banks, savings and loan associations, finance companies, personal property brokers, credit unions, retail stores, credit card companies and pawnbrokers. All of these (except banks in some places) are regulated by state laws with respect to the maximum interest rate they may charge and consequently their profit maximizing behavior is generally reflected in an adjustment of the amount of money lent and eliminating the highest risk borrowers or types of loans from their market. Freimer and Gordon (1965, p. 397) define such credit rationing as the practice of setting (or accepting) the interest rate and then loaning to the consumer all he wants at that rate, limited by his ability to repay.[15/] Most banks do not face legal price ceilings, yet their customary interest rates serve as one of the most effective rationing devices in the industry.[16/] Hoffman (1974) provides an interesting study of credit rationing under various circumstances: rationing by the use of loan maturity, rationing due to tight credit conditions in the economy, rationing under various conditions of demand, and rationing by profitability. One interesting observation is that in spite of credit risk reporting agencies and "scientific" scorecards which enable the lenders to determine the relative risk of lending to various consumers, very little intrafirm price discrimination or interfirm price competition takes place. Reasons for this are discussed in Freimer and Gordon (1965).

Retail stores use credit as a competitive device to expand sales and are, therefore, disinclined to ration customers seeking credit.

15/ Parentheses added.

16/ For a theoretical discussion of banks' rationing behavior see Freimer and Gordon (1965) and Jaffee and Modigliani (1969).

especially credit through charge accounts. Time-price differential is generally used to compensate for the costs of extending credit. This means the price of the merchandise is simply increased when credit services are offered.[17/] Dunkelberg provides us with two studies, one using a California sample (Dunkelberg and Smiley, 1975) and one using a New York sample (Dunkelberg and Shay, 1974) in which he examines the characteristics of retail credit users and their net contributions to the revenues of the store. In both of the papers, he shows that lower income credit card users are subsidized by higher income credit card users effecting a small redistribution of wealth among those consumers participating in the credit card market. McAlister and DeSpain (1976) examine the yields provided to the retailer under various methods of calculating interest charges. They found no inequity against poor and uneducated credit card customers in terms of yield on charge accounts but they did not look at the finance charges paid as a portion of the income of the customer.

The National Commission on Consumer Finance (1972) undertook a comprehensive study of the functioning and structure of the finance industry and made ample suggestions for industry reform. Much attention was given to the efficiency of the credit industry in dealing fairly with customers and fully informing borrowers of the consequences of incurring new debt. Recommendations for revisions in credit regulations reflect their concern for the protection of consumers from exploitation by creditors. They conclude that a more competitive market for consumer

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17/ For an economic analysis of this practice see Johnson (1969). For a study of the profitability of department store revolving credit see Dunkelberg, Smiley and Shay (1974).

credit would bring optimum benefits to consumers and foster long run economic growth. This report remains one of the best sources of information about credit industry practices and problems.[18/]

Government Regulations of the Credit Industry

Government regulation affects virtually every phase of the consumer credit industry, from the availability of loanable funds to contract terms. The copious regulations have two major goals: 1) To ensure economic stability and growth. Examples of activities under this objective are loan insurance and a constant watch on cyclical trends in order to adjust monetary policy accordingly.[19/] 2) To protect borrowers in a market where the lenders' costs are relatively low compared to that of the consumer. This protection has two sub-goals: a) To ensure credit is supplied to consumers who demand it (which is, of course, tied to economic growth and stability). b) To prevent exploitation of the consumer by the lender through usury and/or unconscionable contract terms or sales and collection practices.

Credit industry firms are subject to more price regulations than any other type of firm except regulated monopolies. However, the consumer credit industry's market structure is that of monopolistic competition (Commission of Money and Credit, 1963). It may also be

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18/ Consumer Credit 1975 published by the Practicing Law Institute is also a good current source on credit law and practices.

19/ For a discussion of these regulations and their relative advantages see U.S. Board of Governors, Federal Reserve System, 1957, Part II, Volume II; Part II, Volume I, pp. 169-294, Katona p. 450, Lansing et al. p. 487, Tobin, p. 521; Part III; Institute for Contemporary Studies, 1975.

described as an oligopoly (Hoffman, 1974) with firms subject to various price ceilings depending primarily upon the amount of risk taken by each type of firm. The price ceilings which are supposed to protect borrowers from excessive debt burdens and compensate them for having unequal power provoke a strange mixture of effects (National Commission on Consumer Finance, 1972, pp. 95-108). The most obvious is that credit is rationed among the risky borrowers since the price is not the equilibrium price.[20/] The ceiling price also tends to protect the lender from price competition and gives him a legal rationale for charging the ceiling rate regardless of the credit worthiness of an individual borrower.[21/]

To protect borrowers from unconscionable lending and collection practices, laws exist at both the federal and state levels regarding the format and content of credit contracts. The legality of specific contract clauses is governed primarily by state laws.[22/]

One of the more recent types of contract regulation has been a mandate for disclosure of all relevant facts including the annual

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20/ Legal prices both above and below the market equilibrium price will result in less credit being used. (National Commission on Consumer Finance, 1972, pp. 110-111).

21/ For a discussion of price ceilings and their effects on availability of credit or competition between lenders see National Commission on Consumer Finance, 1972, pp. 109-138, 243-244; Avio, 1973; Dauten, 1973; Mors, 1968; Commission on Money and Credit, 1963, pp. 319-327; Chapman and Shay, 1967, pp. 139-160. For a discussion of costs and ceiling prices see National Commission of Consumer Finance, 1972, pp. 102, 139-149, 220-230; Chapman and Shay, 1967; Smith, 1964; Greer and Shay, 1974.

22/ For a thorough discussion of the clauses see National Commission on Consumer Finance, 1972, Chapter 3 and for an outline of which clauses are legal in which states see National Consumer Finance Association, 1974.

percentage rate of interest and all finance charges being levied.[23] The rationale behind these laws is that disclosure lowers the consumer's information (transaction) costs. If the consumer is not aware of the terms of the contract and the finance charge he/she is unable to make an economic decision and his/her ignorance can lead to unexpected and burdensome economic and psychic costs. But if he/she is fully informed and willing to pay the finance charges as part of the price of obtaining goods and services sooner, it is difficult to argue, on economic grounds, that the consumer should save first and buy later. Sigel (1957) points out that a decrease in future liquid savings or in the purchase of other goods is not an expression of the burden of debt if it represents part of the choice the consumer is making, unless he/she miscalculates his/her future preferences in which case a real economic burden arises because resources have been misallocated.

There have been six major laws passed at the Federal level since World War II which regulate either the price of credit or credit contract terms. Prior to these, most of the regulations were at the state level and most of those were the result of forty-four states adopting the Model Consumer Finance Act of 1948 promulgated by the Russel Sage Foundation. The six recent laws are:

1. The Consumer Credit Protection Act of 1968. This is known as the truth-in-lending law and contains Regulation Z. It is primarily a disclosure law, but reforms in garnishment were also included. The next three laws listed are amendments to this act.
   a. Amendments to the truth-in-lending act, 1975. Two changes brought about by this law are the required full disclosure

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23/ For an empirical evaluation of the success of this disclosure law see Brant and Day, 1974 and National Commission on Consumer Finance, 1972, Chapter 10.

of closing costs before a down payment is committed and the imposition of contingent liability upon the holder-in-due course in the event that any section of the truth-in-lending act is violated.

b. Fair Credit Billing Act, 1975. This act adds chapter four to the truth-in-lending act. This law copies some of the provisions of California's Beverly-Song Act which makes the credit card company and the seller jointly liable for faulty merchandise under specific conditions. It also allows stores to offer discounts to cash customers and mandates rapid attention to computer billing errors.

c. Equal Credit Opportunity Act, 1975. This act amends the Consumer Protection Act of 1968 by adding Title VIII. Its most notable reform is making it illegal to use sex or marital status as discriminatory factors when granting credit.

2. Uniform Consumer Credit Code, 1968. This was supposed to act to replace the Model Consumer Finance Act of 1948 and smooth out an uneven structure of interest rate ceilings among the different states. As of 1974, only seven states had adopted the Uniform Consumer Credit Code.

3. Fair Credit Reporting Act, 1971. This is to protect consumers from inaccurate and unfair credit selling and credit card practices and against inaccurate and outdated information being distributed by credit reporting agencies.24/

Consumer Credit as a Social or Economic Phenomenon

Seligman (1927) wrote a book based upon a quantitative analysis of credit extended by retailers to households. It represents one of the first major works to explore the phenomenon of consumer credit and is often quoted in subsequent writings as an authoritative source of information and theory applying to credit.

Eubanks (1938) presents the historical beliefs that the use of consumer credit is poor money management at best and both irresponsible

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24/ Credit reporting agencies are a subset of the lending industry which will not be discussed in this paper, even though their existence serves to further imbalance transaction costs in favor of the lender and their practices often impose undue burdens upon borrowers in terms of credit availability and personal reputation.

and immoral, at worst. He talks about credit as being charity, limiting freedom, causing a deterioration of health and family life and decreasing the household's standard of living.

Hardy sees consumer credit as an "adjustment agency to mitigate some of the disadvantages resulting from a change in the social order... a change from rural individualism to the subjection of urbanization which costs more money" (Hardy, 1938, p. 115).

Mors (1944) provides a review of the theories (and philosophies) of consumer credit prior to 1944. He is critical of those who claim that household investment and business investment are analogous in that they both lead to capital formation. He would not agree with Juster (1966) who analyzes capital formation by the household. Juster argues that installment credit is a cheaper way to finance purchases than using cash, since the use of cash implies a decline in liquid assets, whose subjective rate of return is viewed as very high in as much as they are held as security against emergencies. The rate of time preference and the cost of equity financing are the real marginal costs of borrowing to the consumer and since consumers consistently choose to decrease down payments and lengthen the term of the loan, Juster assumes that using debt financing must be cheaper, otherwise consumers would not choose to do it. As long as the installment payments are greater than the sum of the interest and depreciation, equity is built up in the products financed on the installment plan, which adds to the assets of the debtor. Juster's argument depends on there being a continuing income stream and upon the assumption that the buyer has a choice, that is, he/she has liquid assets that could be used for the purchase and that the timing of the purchase reflects his/her own rate of time preference and not

exogenous demands.

Cox (1948) employed an empirical analysis of the process involved in the purchase of durable goods as the basis for his description of the practices of credit grantors and the characteristics and motivations of credit users. His focus is exemplified by his statement that "...the economic and social significance of installment buying can be understood only if the significance of consumer durables is understood....its distinctive contribution...lies in its relations to the accumulation and maintenance of consumer capital" (Cox, 1948, p. 19). This leads us directly into the next major focus of the literature and a review of the demand studies which have taken consumer debt into account.

The Role of Credit in Household Financial Management or the Demand for Durable Goods

Studies which focus primarily on the role of credit in the households financial management pattern are rare. Those directly related to this study are discussed in the next section. Those which address the issue of whether or not households benefit from the use of credit generally do so from the point of view of a typical household or the aggregate effect on all households. Waddel (1970) argues that even though there may not be an aggregate danger of consumer insolvency, there is a real concern over an increase in the number of individual families who cannot make their debt payments. The main problem he sees concerns the opportunity cost of credit, especially the finance charges which erode one's purchasing power. He calculates that the "typical family" spends 5.7 percent of their average annual income or $17,775.45 on interest payments over a life time. The opportunity cost of this is

$66,001.70 since the family would have this sum if they had deposited $32.19 a month in a savings account for forty-five years at five percent interest compounded quarterly. He further calculates that if a family saves first and buys for cash, they will save about one-third of the purchase price of the item.

Cox refutes the argument against the use of credit promulgated by Waddel. He claims that rising prices will more than offset the difference between money saved and money spent at an earlier date. Furthermore, he claims that whatever products the household acquires by using installment debt have been purchased from increases in income rather than by redistributing expenditures. At least in the aggregate, he argues, the consumption of basic necessities has not decreased with an increase of installment credit (Cox, 1965, p. 431).

The Survey Research Center at the University of Michigan under the direction of George Katona has, since 1946, collected data on the distribution of consumer income, assets, debts and expenditures, and since 1960, on consumer attitudes and expectations. Trends and changes in the data are published annually (Katona, 1960-1972). Installment credit data is one type of household economic data analyzed in these annual reports.

Hendricks, Youmans and Keller (1973) using Survey Research Center data, provide one of the only comprehensive studies of demand for durables which is based specifically upon the relationship of this demand to installment debt. They found that those who have frequent increases in income spend a greater than expected amount on durable goods and those who have decreases in income a lesser than expected amount. Hendricks, Youmans and Keller also confirm Lee's finding that

families, at least within specified income groups, are more homogeneous with respect to the amount they spend on durables than they are with respect to the amount they borrow (Lee, 1967). Further findings indicate that at current levels of installment debt, most American families are in a favorable position not only to maintain repayments on current levels of debt, but to sustain even higher levels of debt (Hendricks, Youmans and Keller, 1973, p. 158). Their sample also shows that even among the most optimistic users of installment credit, there exist fairly clear-cut notions about how much debt they could repay and they regulated themselves quite well.

Debt has been incorporated in various ways as an explanatory variable in studies of demand for durable goods. Fisher (1963) and Lee (1964) incorporated debt as a negative wealth component and found, as expected, that both the probability of using credit and the price of purchases increased with the use of credit, but Lee found that credit users had lower income elasticities than those paying cash. Tobin (1957) estimated the effects of the size of existing debt on three kinds of subsequent behavior, namely expenditure on durable goods, change in personal debt, and change in liquid asset holdings. He found that a large stock of durable goods, as measured by outstanding debt, had a negative effect on current expenditures for durables and dampened the amount of new debt. The stock of liquid assets were found to be independent of consumers' purchase decisions except at very high income levels. On the other hand, Klein and Lansing (1955) found that the presence of debt was positively correlated with the probability that the household would buy a durable good.

Stock adjustment models are common in the literature on demand for durable goods, but Dunkelberg and Stafford (1971) use such a model to look at consumer debt as part of the household portfolio. They regress the change in installment credit in one year on the difference between the predicted equilibrium (desired) levels and initial levels of installment debt, durable goods, and liquid assets, the ratio of annual debt payments to income and the wife's labor earnings. Disequilibrium in the ratio of debt payments to income, in the level of installment debt, and in wife's earnings were significant in that order of importance. They suggest that the difference between current and desired debt may be a proxy for households' inventories and if that is so, it is redundant to include both variables in the same equation. They present the results for families of various size and caution that if adjustment takes place in less than one year, the model gives ambiguous results.

Kisselgoff (1952) found that the size of the monthly payments and current income are the most significant variables explaining the variation in demand for installment sales credit of all types.

Suits (1958) in a study of the demand for automobiles in the United States, uses the average number of months necessary to pay off the installment contract as part of one explanatory variable. He found that it had a significant effect and improved the prediction of automobile sales, even though it made the price an insignificant variable.

Ackley points out that we do not know to what extent credit operates as a causal or a permissive factor in consumer spending. (Ackley, 1971, p. 286) The answer seems to lie, at least in part, in the consumer's attitude towards credit use and future welfare. Attitude

variables have proved significant in explaining and predicting the use of credit and the purchase of durable goods by Katona (1970), Hendricks, Youmans, and Keller (1973) and Juster and Watchel (1972).

Studies for the demand for nondurables have almost universally ignored the existence of debt as an explanatory variable or as an explicit factor in the budget constraint. This is probably due to at least two historical facts. 1) When basic economic theories of consumer behavior were formulated, the use of large amounts of credit was uncommon. 2) Until recently, expenditure data available for use in empirical studies did not include the necessary detail to determine the method of financing purchases or the debt-income ratios, or the change in debt over time.

Studies Related to Household Debt and Household Welfare

In their 1967 study Bymers and Rollins reclassified expenditures of households in a unique attempt to represent their intertemporal nature. Stepwise multiple regression analysis was used to rank the relative importance of different types of expenditures in determining current consumption. Some of the findings are: 1) All except one family in the sample spent more than their annual income. 2) Cash receipts, not income, represent the flow out of which families manage their expenditures. This means families will rearrange assets and liabilities in order to acquire commodities desired in the current year. 3) Those who were spending over 105 percent of their income were building inventories and were able to do so because they rearranged assets and incurred debt. 4) Families who had more dollars committed to debt

payments accumulated more, but the commitments represented a smaller percentage of their income. The question of whether committed payments are a cause or a result of accumulation remained unanswered.

Bymers (1967) examined the financial vulnerability of various households in debt and found that higher education-occupation groups were less vulnerable but certainly not immune from financial troubles. Interesting findings in this study are: 1) Households in either of the vulnerable categories[25/] were more likely to have experienced an income decline than the nondebtor population. 2) Households with installment debts were more likely to have experienced increases than nondebtor households and they also expected increases the following year. However, as Hendricks, Youmans, and Keller (1973) pointed out, having attitudes favorable to the use of credit and being confident about one's financial welfare, and income increases, are highly correlated.

Ryan (1968) classified debtors as being in either deep trouble or some trouble, and like Bymers, she found higher income households were not immune from trouble.[26/] She also found that either an increase or decrease in income of twenty-five percent was more likely to lead to trouble. She tested a "pressure displacement hypothesis" by defining

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25/ Compare Bymers' vulnerability criteria and Ryan's trouble criteria. (p. 52) Bymers vulnerability criteria: 1) Vulnerable if owed installment debt for greater than one year and had less than $200 in liquid assets. 2) Very vulnerable if in addition to the first criteria, the installments were greater than 20% of family disposable income. 3) Not vulnerable in all other cases. Ryan's scale of some-deep trouble: 1) The greater the debt payment/income, the greater the probability of trouble. 2) If liquid assets minus a "transaction balance" of $200 is greater than outstanding debt, there should be no trouble. 3) The higher the family income, ceterus parabus, the higher debt/income ratio it can sustain without leading to trouble.

26/ See footnote 25 for the classification criteria.

four independent variables which measure relative over and under spending in four categories: housing, automobiles, durables, and the algebraic sum of the three.[27/] Two dependent variables, some trouble and deep trouble, were used in separate regression equations. In each case the zero-one dicotomous dependent variable was estimated using ordinary multiple regression analysis. The estimated dependent variable was then interpreted as the probability of being in some (deep) trouble given the four calculated expenditure deviations. She found that the explanatory power of the independent variables was small, but that the automobile and summation variables behaved as predicted, that is, high levels of spending led to greater probability of trouble. Her graphic and tabular presentations showed that instead of finding a positive relationship between the four independent and two dependent variables, a U shaped distribution exists, which implies that within categories of spending, both relative overspenders and underspenders were more likely to be in trouble. Ryan explained that the underspenders were usually very low income debtors for whom such behavior was not unexpected. The discovery of the U shaped distribution is most interesting and leads to a hypothesis that a range of debt, which will contribute in a positive way to household welfare, exists.

[27/] Independent variables calculated as $A_{ij} = a_{ij} - \bar{a}_j/y_{ij}$ where A_{ij} is the relative expenditure on automobiles in the j^{th} income category by the i^{th} household. (H_{ij}, D_{ij}, and S_{ij} calculated the same way) a_{ij} is the actual expenditure for autos by the i^{th} household in the j^{th} income cateogry. $\bar{a}_j$ is the average expenditure for autos in the j^{th} income category. Y_{ij} is the income of the i^{th} household in the j^{th} income category.

While studying the relationship of installment debt and demand for durable goods, Hendricks, Youmans and Keller (1973) examined the attitudes of families regarding their financial progress. They developed an index which accounts for the stated beliefs by one member of each household surveyed about their past and expected financial progress each year for a four year span. They used this index as an independent variable to explain expenditures on durable goods and installment debt. They found that the index of financial well being was a more important determinant of expenditures on durables than income and they found little evidence that the strength of the relationship between expenditures and personal evaluations of financial well being was largely the result of a spurious correlation between attitudes and demographic characteristics which were themselves important determinants of expenditure levels. They found an even stronger relationship between the attitude index and commitments to installment debt. For families with income below $10,000, those who were highly optimistic maintained debt three times greater in relation to their incomes than families with pessimistic outlooks and eighty percent higher than all families in this income range. For those families with income over $10,000, those who were generally pessimistic and those who were highly confident maintained an average outstanding installment debt balance that differed by twenty percent or more from the average amount of debt held by other families in that income category. This analysis by Hendricks, Youmans, and Keller (1973) is the only study discovered that correlates "revealed utility" with installment debt. They used revealed utility as an independent variable whereas the present study uses it as the dependent variable.

Nevertheless, since the panel data used by Hendricks, Youmans, and Keller (1973) is exactly the same as is used in this study, it provides important information for explaining the results of the present work.

Studies Which Define "Economic Welfare" of the Household

Many attempts have been made to measure the "economic welfare" of individuals and/or households. This is not necessarily the same as trying to measure utility. Economic welfare, usually refers to a calculable number which a third party invents in the belief that the calculations can be ranked so that the higher the number the greater the welfare of the household. The variables used in the calculations are usually money values of assets and liabilities held by the household. Utility, on the other hand, refers to the satisfaction or sense of well being the individual or household obtains from the consumption of a bundle of commodities which were acquired through some economic transaction. It implies that individuals intuitively know when their well being has changed and that they can rank economic transactions with respect to their potential ability to increase or decrease that sense of well being.

Calculations of economic well being include:

1. Bymers, (1976) who calculated the difference between income and estimated annual consumption where consumption is not equal to current spending. Her goal was to measure the effect of debt on "getting ahead".

2. Several adaptations of the Orshansky ratio[28/] have been used by

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28/ The Orshansky ratio was developed by Mollie Orshansky while working for the U.S. Department of Health, Education, and Welfare. It has been used extensively to measure poverty in the United States. (Orshansky, 1969).

Smith and Morgan (1970) in an attempt to develop and test various measures of well being. The basic Orshansky ratio is family income divided by family needs where income is wages and salaries, mixed wage-capital income, asset income and regular money transfers. Needs are calculated by finding minimal foods costs for each family member according to age and sex which are summed to arrive at a total family food cost. This food cost is adjusted for economies of scale and multiplied by a factor, based on family size to arrive at "family consumption needs". Variations of this ratio use variables for housing, the United States Department of Agriculture's estimated costs of the low cost food plan, leisure, and real income. In the exhaustive studies of economic well being by Morgan, Dickensons, Benus, and Duncan (1974) numerous measures of well being were devised. One of the more complex measures was [(net income-housing costs)/food needs]$^{\frac{1}{2}}$ [leisure]$^{\frac{1}{2}}$ and the simplest was the net taxable income of husband and wife.

3. A welfare measure which allows inter-household comparisons is developed by Muelbauer (1974). This measure is based on the linear expenditure system and the Klein-Rubin utility function (Klein and Rubin, 1947). It is the supernumary income adjusted by a general adult equivalent to account for varying family composition.

Measures of utility include:

1. Cardinal measures based on intertemporal utility functions dependent upon total expenditure per time period and the amount available to spend were proposed by Yarri (1964 and 1965), Phlips (1974) and Green (1971). Empirical applications of this measure are still very limited.

2. Felicity, which dates back to 1843 and Jerry Bentham, implies a dynamic measure of the intensity of utility. It has recently been referred to in studies utilitizing optimal control theory such as those by Glycopantis (1972) who measured current satisfactions as a function of current consumption and total consumption in the immediate past or future, and by Takayama (1972) whose felicity (demand) function is a measure of consumption intensity.

3. Revealed utility, which was interpreted from a statement by individuals regarding the direction of change in her/his financial well being over some time period and/or due to some financial transactions, was used by Hendricks, Youmans, and Keller (1973). They constructed an index of the subjective evaluation of past and expected changes in financial well being over the four year period covered by the study. The utility measure in this study is the perceived change in utility over a one year period. Revealing the direction of change in utility involves a qualitative choice on the part of the interviewees. They must decide whether their utility has increased, decreased, or stayed the same. Methods of analyzing qualitative choice models is the subject of Chapter IV.

CHAPTER IV

THEORETICAL MODELS FOR EMPIRICAL ANALYSIS OF QUALITATIVE CHOICE

Utility Model

The utility functions used for empirical analysis in this study are:

$$\Delta U = f(\Delta x, d) \tag{4.1}$$

where x is a vector of financial attributes; d is a vector of demographic states, and $\Delta U \equiv Y$ is the set of three discrete choices regarding the perceived change in financial well being of a household in the past year, that is, y_1 = better off, y_2 = worse off, and y_3 = the same.

$$\Delta U = f(\Delta x, d_i | d_{jk}) \tag{4.2}$$

where i = 1....n-1 demographic states which are allowed to vary across family units; j is the n^{th} demographic state which is held constant for this particular equation, and k is a specific category of the j^{th} demographic state. Example: j = marital status, k = married.

These utility functions ignore the problem of discounting since this study looked at changes in financial ratios between two consecutive time periods. The following assumptions were made:

1. The five assumptions detailed in footnote thirteen (page 27) namely existence, sensitivity, separability, stationarity, and monotonicity.

2. Changes in utility are ordinal. The family unit perceives and one of its members reports the direction of change in utility and can rank his/her preferences according to the direction of change, but no numerical measure of the magnitude of the change or the absolute level of change exists.

3. The perceived change in financial well being which is reported by the respondent is relative to the family unit's own past financial well being.

These utility functions are designed to answer the questions: 1) What is the conditional probability that individual family members will perceive their financial well being as having increased or decreased, given the change in their financial circumstances and the demographic characteristics of their household. 2) What is the significance of each of the explanatory variables in explaining the variance of the probability of a household's perceived change in financial well being? Other related questions of interest are: How much will the probabilities of a perceived change in financial well being change with a given change in one of the explanatory variables and what are the relationships between the explanatory variables?

The analysis of these utility models is similar to the analysis of other qualitative choice models where the choice setting is described by the observed characteristics of the individual and the attributes of the choice alternatives. The alternative selected by an individual can be interpreted as a drawing from a multinomial distribution for which the selection probabilities are functions of the described choice setting. "The 'model' of choice is a specification of the probability function" (McFadden, 1975a).

The selection probability function may be specified as a linear probability function estimated using ordinary least squares or a multinomial logit model estimated using maximum likelihood estimates.[29] Estimated values for these models are derived from regression equations in which the dependent variable is discrete rather than continuous, which is the case when selections are made from a set of qualitative alternatives. It should be noted that even though the choices are discrete, the probabilities of the selection of any one alternative is continuous and it is the probability of selection which is mathematically estimated in these models.

Linear Probability Functions

The problem is to estimate the conditional probability that alternative y_1 will be selected. If it is assumed that the data in choice set Y was generated by binary choices, the dependent variable is dichotomous, that is, $y_1 = 1$ and not $y_1 = 0$. The conditional probability statement may then be written in the Bayesian form as:

$$(4.3) \qquad P_1 = P(y_1|x,d) = p_1 f_1(x,d)/[p_2 f_2(x,d) + p_1 f_1(x,d)]$$

$$= 1/1 + [p_2 f_2(x,d)/p_1 f_1(x,d)]$$

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[29] A third technique, discriminate analysis, could also be used to arrive at approximately the same answers, but the initial question is not one of the conditional probability of an event, but one of sorting individuals into appropriate categories given the observed financial and demographic variables. (As a practical matter, discriminate analysis for the binary case may be treated as a linear probability function analyzed by ordinary least squares.)
Probit analysis with maximum likelihood estimators is also appropriate, particularly when the dependent variable is scaled ordinally. This is shown by Zavoina and McKelvey (1969).

where p_j (j = 1,2) is the prior probability that individual households perceive their utility as having increased, that is, $y_1 = 1$. These prior probabilities are the expected proportions of individual households in each subpopulation, or, to follow the example above, the proportion of the total population which actually chooses y_1. The joint density (probability function) of the distribution of characteristics (x,d) in each subpopulation is $f_j(x,d)$.

The conditional probability statement is a linear probability function which is simply a classic linear regression model with a dichotomous dependent variable, Y. The calculated value of Y, ($\hat{Y}^*$) is interpreted as an estimate of the conditional probability that y_1 will be selected.

$$E(Y|x,d) = P(y_1|x,d) = P(x,d) = X'\beta \tag{4.4}$$

where X is a partitioned vector which combines both x and d variables. $X = (x_1 \ldots . x_n, d_1 \ldots . d_m)$ Ordinary least squares may be used to estimate $P(y_1|x,d) = F(X'\beta)$ or

$$y_j = X_j'\beta + \varepsilon_j \tag{4.5}$$

where j = 1....J observations. This yields the estimates

$$\hat{Y}^* = X'\hat{\beta}.\underline{30/} \tag{4.6}$$

However, this procedure is not a theoretically acceptable method since the estimates of β are inefficient (although unbiased) due to the

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30/ $\hat{\beta} = \hat{\lambda}$ up to a multiplicative constant, where λ is the discriminate coefficient in discriminate analysis of a binary case. $\hat{\lambda} = (N/SSE)\hat{\beta}$; (N/SSE) = the constant. (Haggstrom, 1974a) N = the sample size. SSE = residual sum of squares.

presence of heteroskedasticity in the model. The heteroskedasticity arises because the residual term is not normally distributed about the regression line with a constant variance and zero mean when the dependent variable is dichotomous. (A valid application of ordinary least squares usually requires that the error term, e_j, be normally distributed or else approximately normally distributed where the error term is interpreted as the net effect of a sum of independently distributed random variables and the central limit theorem is invoked.) In this case, e_j has a discrete distribution as shown in (4.7) and the variance of e_j depends upon the values of the explanatory variables as shown in (4.8).

(4.7)

e_j	$f(e_j)$
$-X_j'\beta$	$1-X_j'\beta$
$1-X_j'\beta$	$X_j'\beta$

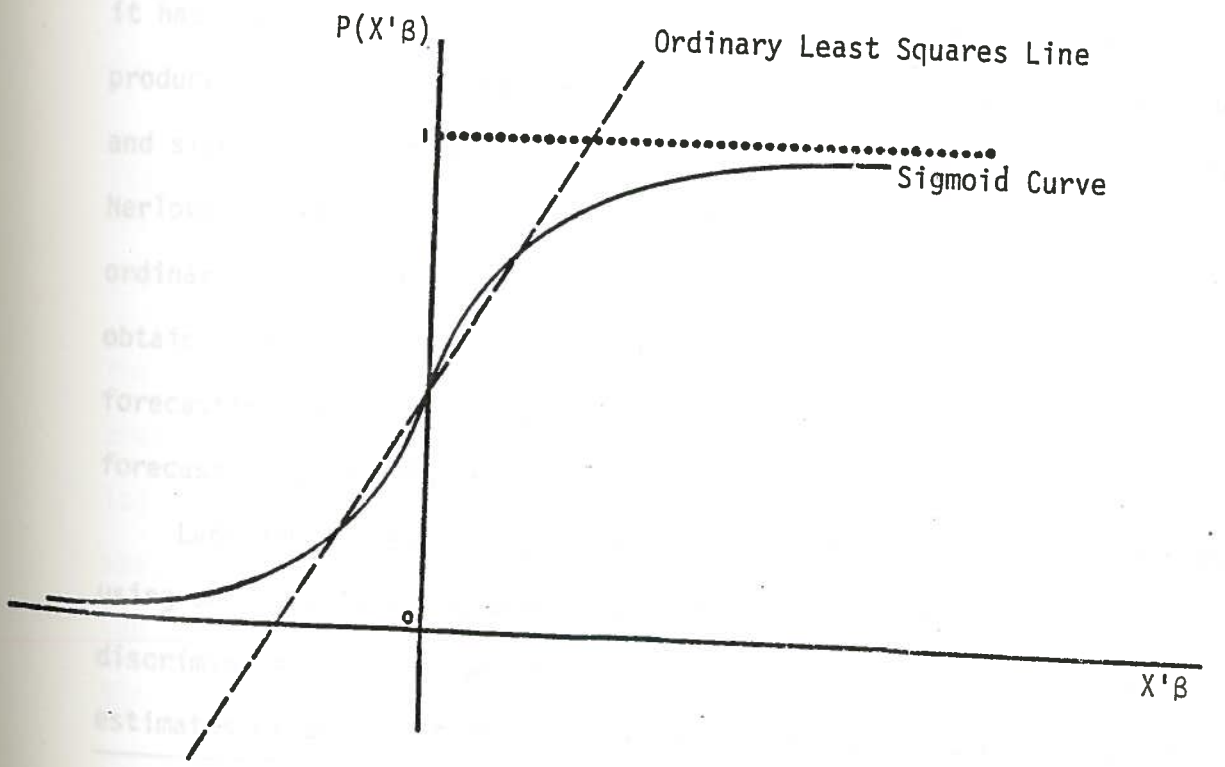
(4.8) $\quad \text{Var} = E(e_j)^2 = X_j'\beta(1 - X_j'\beta) = Ey_j(1 - Ey_j)\text{:} \quad \hat{\varepsilon}_j = e_j$

If the coefficients, β, are not normally distributed and the estimated standard errors are not consistent, the usual tests of significance cannot be performed. (Nerlove & Press, 1973, p. 5-7) Generalized least squares can be used to correct for the heteroskedasticity by replacing the variance of e_j in the variance-covariance matrix with $\hat{y}_j^*(1 - \hat{y}_j^*)$ where $\hat{y}_j^*$ is the estimated value of y_j using ordinary least squares. (Goldberger, 1964, p. 250) This procedure, termed weighted least squares, does allow asymptotically valid t and F tests of significance since the asymptotic means of β are assumed to be equal to

the true means, but the procedure does not guarantee that $\hat{y}_j^*$ (the probability of an individual selecting y_1 over y_2) lies between zero and one. In addition, this method makes estimates highly sensitive to specification error. Since a probability function is a comulative distribution function which lies between zero and one and is non-decreasing, it should be represented by a curve which lies between zero and one such as a Sigmoid curve. The logit distribution has such a curve. Figure one illustrates ordinary least squares regressions can yield estimates of $\hat{y}_j^* \equiv P(X'\beta)$ which lie outside of zero and one.

Figure 4.1

Comparison of Linear and Logistic Regression



In addition, the ordinary least squares regression line is sensitive to the values of the independent variables and will shift to the right if there are many high values of $X'\beta$ and to the left for low values of $X'\beta$. (Nerlove and Press, 1973, p. 7) A given change in the explanatory variables causes the same change in the estimated probability regardless of the true value of the probability in the linear probability function while in the logit distribution a given change in the value of an explanatory variable effects the estimated probability less if the probability is near zero or one than if the probability is near one-half. This means that an individual household's selection as indicated by a 0-1 dependent variable is more responsive to changes in the explanatory variables if the household is "flexible" as indicated by a probability near .5. (Morgan, V.I, 1974, p. 378)

In spite of the violation of the ordinary least squares assumptions, it has been found that using ordinary least squares for this model produces estimates of the parameters which are consistent in magnitude and sign with estimates emanating from logit analysis. (McFadden, 1974; Nerlove & Press, 1973; Haggstrom, 1974b; Ladd, 1966) Therefore, ordinary least squares may be used for screening the estimates and to obtain initial estimates of β. It is inappropriate for use in forecasting selection probabilities since the requirements that such forecasts lie between zero and one is not met.

Ladd and Haggstrom both show that the estimates of the parameters using ordinary least squares ($\hat{\alpha}$ and $\hat{\beta}$) can be transformed into discriminate estimates which are closer to the maximum likelihood estimates of the logit model. The transformed parameters ($\tilde{\alpha}$ and $\tilde{\beta}$)[31/]

[31/] $\tilde{\beta} \equiv \hat{\lambda}$. See footnote number 30.

can be used as initial estimates in the logit program and/or as a basis of comparison for the logit estimates, or as acceptable estimates of the parameters themselves. $\hat{\alpha}$ & $\hat{\beta}$ are transformed to $\tilde{\alpha}$ & $\tilde{\beta}$ as follows:

$$\tilde{\alpha} = \log(P_1/P_2) + [n/SSE(\hat{\alpha} - \tfrac{1}{2}) + n(1/n_1 - 1/n_2)]/2 \tag{4.9}$$

$$\tilde{\beta} = (N/SSE)\hat{\beta} \tag{4.10}$$

where SSE is the residual sum of squares; N is the number of units observed in the whole sample and n_1 is the number of units in group one. This transformation does not require the explanatory variables to be sampled from a multivariate normal population, but if they are, the estimates ($\hat{\alpha}$ and $\hat{\beta}$) will be asymptotically efficient and t and F tests will be valid. (Haggstrom, 1974a; Ladd 1966, p. 35)

Motivation for Logit Analysis

Logit analysis of the $P(y_1|x,Y)$ is based upon the assumption that $F(X'\beta)$ is a standard logistic distribution function which is

$$1/1 + e^{-t} \quad \text{or} \quad 1/1 + e^{-X'\beta}. \tag{4.11}$$

This distribution function can be derived using different mathematical procedures and assumptions. Haggstrom, (1974a, 1974b) shows that a logit transformation on a linear function produces the logistic form assuming that the vector of X_i's has a multivariate normal distribution and that the variance in each group is equal to the overall variance.[32/]

[32/] If $\lambda'X$ has a normal distribution and the same variance under both subpopulations, y_1 and y_2, the conditional probability that an individual belongs to y_1 given his/her discriminate function $\lambda'X$

(continued)

The logistic model has been used in biometrics to estimate appropriate tolerance levels for assignment to certain subpopulations y_j.[33/] The tolerance level T for an individual with characteristics X can be decomposed into $T = h(X) + \varepsilon$ where ε is a random variable that is independent of X and has a symmetric distribution F about zero. Thus:

$$(4.12) \qquad P(y_1|X) = P(T \geq 0|X) = P(-\varepsilon \leq h(X)|X) = F[h(X)]$$

(Haggstrom, 1974c)

The principle of the tolerance level is used by economists to develop random utility models.[34/] In order to maximize their perceived utility from belonging to subpopulation y_1 or y_2, individuals make choices among alternative attributes of each subpopulation. If an individual with characteristics X perceives his/her utility as placing him/her in y_i, $(i = 1,2)$ then

$$(4.13) \qquad U_i = V_i(X) + \varepsilon_i$$

where $(\varepsilon_1, \varepsilon_2)$ is a random vector that is independent of X. If it is assumed that for those individuals in y_1, $U_1 \geq U_2$, then,

$$(4.14) \quad P(y_1|X) = P(U_2 - U_1 \geq 0|X) = P(\varepsilon_2 - \varepsilon_1 \leq v_1(X) - v_2(X)|X) = F[h(X)]$$

32/ continued
reduces to the logistic form. Therefore, "one can treat the logistic form as arising from conditioning of the value $\lambda'X$ instead of the vector X itself." (Haggstrom, 1974c) Even if one or more of the components of X are clearly nonnormal, such as dummy variables, the logistic model is justified if the values of $\lambda'X$ are approximately normally distributed in both subpopulations and the variances are not appreciably different. See Appendix B for tests of normality on $\hat{Y}^* = X'\hat{\beta}$ in this study. $\hat{\lambda}'X$ is the discriminate function. $\hat{\lambda} = \hat{\beta}(N/SSE)$

33/ For an example see Berkson, 1953.

34/ For an example see McFadden, 1975a.

where F is a cumulative density function of $(\varepsilon_2 - \varepsilon_1)$ and $h(X) = v_1(X) - v_2(X)$.[35/] To justify the logistic model it is sufficient that $v_1(X)$ is linear in unknown parameters and that the joint distribution of $\varepsilon_2\varepsilon_1$ is such that some multiple of $(\varepsilon_2 - \varepsilon_1)$ has a logistic distribution.[36/]

An Application of Logit Analysis to Utility Models

McFadden (1974, 1975a, 1975b) specifies a utility maximizing model as follows:

$$U = V(S,Y) + \varepsilon(S,Y) \tag{4.15}$$

where S is a vector of observable individual characteristics. These characteristics could be financial attributes as well as demographic states. Y is a matrix of attribute vectors each belonging to one of J alternatives in the universal choice set. $Y = \{y_1, y_2, \ldots y_J\}$ where y_1

35/ Define $h_w(X)$ to represent a unique decision rule or an individual behavior rule which maps the attributes X into the selected alternative y_1. This decision which determines the distribution of choices depends upon unobservable characteristics w. w may arise because of the inability to measure the observable characteristics or because of taste variations, loss of information by the decision maker or other "states of nature". In the latter case the model is interpreted as a model of stochastic choice. (McFadden, 1974, 1975a, 1975c.) In either case, unobserved effects w have a probability distribution π associated with each set of alternatives for which there exists data (X). The probability that an individual drawn at random from the population will choose y_1, given observable characteristics X, equals the probability of occurrence of the decision rule yielding this choice or $P(y_1|X) = \pi(w|h_w(X) = y_1)$.

36/ It has been shown by McFadden (1974, 1975c) and Haggstrom (1974c) that if ε_j are independently and identically distributed with a Weibull distribution $(e^{-e^{-\varepsilon_j}})$, then $\varepsilon_2 - \varepsilon_1$ and consequently $P(y_1|X)$, have logistic distributions. $P_1 = e^{v_1(X)} / \sum_{j=1}^{J} e^{v_j(X)}$. The Weibull distribution has a bell shape and is well behaved and differs little from the normal distribution in appearance.

is a vector of attributes belonging to the first alternative. It is assumed that a specific vector of observable attributes (S^i), (i=1...J), is associated with each alternative. V(S,Y) is assumed to be a nonstochastic representation of tastes over the population. $\varepsilon(S,Y)$ is a stochastic representation of the deviation of individual's tastes for the alternatives with m attributes. The probability of an individual selecting the first alternative is

$$P_1 = P(y_1|S,Y) = P\{U(y_1,S) > U(y_j,S)\} \qquad (j = 2...J) \tag{4.16}$$

If $v(y_1,S)$ is defined as the expected utility from selecting alternative one and ε_1 is defined as the deviation of the expected utility from the actual utility, then,

$$v(y_1,S) = E_1U(y_1,S) \text{ and } \varepsilon_1 = U(y_1,S) - v(y_1,S) \tag{4.17}$$

Moreover,

$$P_1 = P\{\varepsilon_1....\varepsilon_j|v(y_1,S) + \varepsilon_1 > v(y_j,S)\} \qquad (j = 2...J) \tag{4.18}$$

or

$$P(\varepsilon_j - \varepsilon_1 < v(y_1,S) - v(y_j,S). \tag{4.19}$$

Note that both equations 4.18 and 4.19 make the same statement as equation 4.14.

If ε_j are independent and identically distributed with a Weibull distribution,

$$P_1 = e^{v(y_1,S)} / \sum_{j=1}^{J} e^{v(y_j,S)} \tag{4.20}$$

where $V(S,Y) = v(y_1,S) - v(y_j,S)$. V(S,Y) is assumed to be linear in

unknown parameters (β) and can be written as

$$V(S,Y) = \beta_1 v^1(y_1,S) + \ldots\ldots \beta_k v^K(y_1,S), \tag{4.21}$$

where $v^k(y_1,S)$, (k = 1...K variables) is a nonstochastic numerical value of the observed characteristics of the individual unit being studied.[37] β_k is an unknown parameter to be estimated. Define $x^k_{1n} = v^k(y_1,S)$ where k refers to the observable characteristics which become explanatory variables, 1 refers to the first alternative, and n refers to the n^{th} individual. $x_{1n} = (x^1_{1n}, x^2_{1n}, \ldots x^K_{1n})$ and X_1 is a matrix of nonstochastic numerical values of financial and demographic characteristics belonging to the individual households who selected alternative y_1. Therefore;

$$V(S,Y) = X'\beta \tag{4.22}$$

The probability that the n^{th} individual will choose the first alternative is

$$P_{1n} = e^{x'_{1n}\beta} \Big/ \sum_{j=1}^{J} e^{x'_{jn}\beta} \tag{4.23}$$

The probability that the first alternative will be chosen may also be written as

$$P_1 = e^{X'\beta_1} \Big/ \sum_{j=1}^{J} e^{X'\beta_j} \tag{4.24}$$

where β_j refers to the parameter vector associated with the j^{th}

37/ In general $v^k(y_j,S)$ may be: 1) A component of Y. 2) A function specifying a nonlinear transformation of interaction between components of Y. 3) A function specifying an interaction between S and Y. $v^k(y_j,S)$ may not be a component of S or Y which is invariant over each alternative set. This shifts the origin on the "representative" utility function, leaving all selection probabilities unchanged and the parameters unidentified. (McFadden, 1973, p. 114)

alternative.[38/]

Two axioms of logic satisfied by the multinomial logit model include the independence of irrelevant alternatives[39/] and the irrelevance of alternative set effects which imply that the relative odds (P_1/P_2) of alternative y_1 being chosen over alternative y_j is independent of the presence or absence of third alternatives.[40/] Another attribute of the model is positivity which implies that the

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38/ In cases where only the parameters β_j vary in j, β_j is called a specific alternative effect. Since the translation of all β_j leaves the selection probabilities unchanged, identification requires a normalization on one set of β's such as $\beta_1 = 0$. (McFadden, 1974, p. 114) In that case,

$$P_1 = e^{X'0} / \sum_{j=3}^{3} e^{X'\beta_j} = 1/1 + \sum_{j=2}^{3} e^{X'\beta_j}$$

An alternative type of normalization in the multivariate case is $\beta_k = 0$. (Nerlove and Press, 1973, p. 19)

39/ The axiom of the independence of irrelevant alternatives follows from the assumption that the attributes of each alternative are independent, that is, the attributes of alternative three do not influence the selection of alternative one. Mathematically, this means that the error terms in the logit model (ε_i's) are also independent.

40/ Luce develops the properties. (Luce, 1959, p. 9) 1. If $P(y_1,y_2) \neq 0$ for all $y_i \in Y$, then for any $Y_F \subset Y$ such that $y_1, y_2 \in Y_F$, where Y_F is a subset of feasible alternatives from the total choice set Y.

$$\frac{P(y_1,y_2)}{P(Y_2,y_1)} = \frac{P_{Y_F}(y_1)}{P_{Y_F}(y_2)}$$

2. If it is true that $P(y_1,y_2) \neq 0$ for all $y_i \in Y$, then for $Y'_F \subset Y_F \subset Y$, $P_Y(Y'_F) = P_{Y_F}(Y'_F)P_Y(Y_F)$

Together these statements say that the ratio of the probabilities is independent of Y_F and the alternatives which should be irrelevant are, in fact, irrelevant. It should be noted that it is only the ratio of the probabilities, not the probabilities themselves that is invariant with changes of the irrelevant alternatives. This is explained further in footnote 41.

choice probabilities are all positive and that $\sum_{j=1}^{J} P_j = 1$. These three axioms allow the odds of y_1 being chosen to be written as the odds of a binary choice of y_1 over y_j. The independence of irrelevant alternatives introduces both a computational ease and weakness into the model. When alternatives are added to the choice set, the denominator of equation 4.23 or 4.24 is simply expanded to include the new alternative. Adding more alternatives results in obtaining the same percentage change for the probability of choosing each of the old alternatives, although the absolute changes are different.[41/] The favorable feature of these properties is that the same parameters determine choice probabilities for selection from a subset of alternatives and choice probabilities for selection from the full set. Therefore, consistent estimators of β may be obtained from data on alternatives in a limited subset of choices. But this is only true if there is sufficient variation in the explanatory variables for the subset of alternatives to allow identification of β (McFadden, 1975a).

Logit analysis may still be applicable if choices fail to satisfy the axiom of the independence of irrelevant alternatives. There are only three alternative answers from which the interviewee could select

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41/ If y_3 is added to the choices of $Y = \{y_1, y_2\}$, the proportional decrease in the selection probability of each old alternative (y_1 & y_2) equals the selection probability of the new alternative. For example: If $P(y_1) = .60$ and $P(y_2) = .40$. Introducing y_3 with $P(y_3) = .40$ leaves the new probabilities of y_1 and y_2 in the same ratio. That is $P'(y_1) = .36$ (.60 x .40 = .24; .60 - .24 = .36) $P'(y_2) = .24$ (.40 x .40 = .16; .40 - .16 = .24) Note: 60/40 = 1.5 = 36/24; The ratio of the old probabilities remains the same. This points out a limitation in the model in that when the y_j alternatives are close substitutes the results may be counter intuitive. Close substitutes violate the axiom of irrelevant alternatives.

in this study and only one choice set presented. Individuals were asked, "We are interested in how people are getting along financially these days. Would you say that you and your family are better off or worse off financially than you were a year ago?" One could argue that there are two feasible subsets: 1) Answering better off or the same. 2) Answering worse off or the same.[42/] However it appears more reasonable to assume that all three alternatives in the choice set were feasible answers for each individual household. The qualitative choice model in this study is specified differently from the utility models discussed because the alternatives from which to choose in this study are not an argument in the utility function. The choice alternatives are the perceived direction of change in the level of utility itself and the choice setting is described by the observed changes in financial attributes and demographic characteristics of the individual household. This difference in the choice structure does not alter the applicability of the logit estimation technique. In the case where the independence of irrelevant alternatives axiom may not hold (and the choices are not

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42/ If these hypothesized feasible choice sets were used, normalization would take place on the set of B_k's belonging to the choice y_3 (Financial Well Being is the same). Y_3 is assumed to belong to each feasible subset of Y. McFadden (1974) calls this the "benchmark" member of set Y.

$$P_3 = e^{X'\beta_3}/e^{X'\beta_3} + \sum_{j=1}^{2} e^{X'\beta_j} = 1/1 + \sum_{j=1}^{2} e^{X'\beta_j}; \quad \beta_3 = 0$$

$$P_1 = e^{X'\beta_1}/1 + \sum_{j=1}^{2} e^{X'\beta_j}$$

$$P_2 = e^{X'\beta_2}/1 + \sum_{j=1}^{2} e^{X'\beta_j}$$

an argument in the utility function) a generalized multinomial logit form is used. This form is

$$(4.25) \qquad P_i^*(x,d) = e^{v_i(x,d)} / \sum_{j=1}^{J} e^{v_j(x,d)} \quad (i=1....J \text{ alternatives})$$

i indicates the alternative which was selected, x includes all of the attributes of the alternatives, $x = (x_1, x_2 ..... x_j)$ and x_j is a vector of attributes for alternative y_j. d is a vector of demographic characteristics.

$v_j(x,d)$ can be linearized by the same procedure as shown in equations 4.21 through 4.22 above so that $v_j(x,d) = X_j'\beta_j$ where $X_j = [X_j^1(x,d) .... X_j^K(x,d)]$. K refers to the variables and j refers to the alternative selected. McFadden (1975b) concludes that if $P_i^*(x,d)$ are arbitrary continuous probabilities defined on a closed domain, then they can be approximated uniformly to any desired degree of accuracy by a multinomial model of the form $P_i^*(x,d) = e^{\beta_i X_i} / \sum_{j=1}^{J} e^{\beta_j X_j}$. This allows one to separate the use of multiple logit analysis from the question of choice structure and the question of whether the independence of irrelevant alternatives axiom is applicable. Whether or not the choice model is derived from behavioral foundations, it can be written as a multinomial logit model without loss of empirical generality (McFadden, 1975b).[43/]

43/ In some cases the general logit model may require modification to allow for interactions between the attributes of different alternatives.

Estimating the Logit Probability

Having derived and established the applicability of the conditional logit estimation model, the next task is to identify the logarithmic odds of the logit $P_j \equiv Z_j$. In the binary case ($j = 1,2$) $P_j = 1/1 + e^{-X'\beta}$ yields

$$X'\beta = \log(P_j/1-P_j) \equiv Z_j \quad (4.26)$$ 44/

In this study it is assumed that all three alternatives are relevant and feasible selections for the individual households. Therefore, two binary cases are estimated. They are:

$$Z_1 \equiv \log(P_1/1-P_1) = \log(1/1 + e^{-X'\beta}). \quad (4.27)$$

which is the probability of being better off as opposed to not being better off, and

$$Z_2 \equiv \log(P_2/1-P_2) = \log(1/1 + e^{-X'\beta_2}) \quad (4.28)$$

which is the probability of being worse off as opposed to not being worse off. A multinomial case is estimated to check for the appropriateness of the independence axiom.

$$P_1 = e^{X'\beta_1} / \sum_{j=1}^{3} e^{X'\beta_j} \quad (4.29)$$

In the multinomial logit model the odds are estimated from the binary choice of one alternative over a second alternative regardless of the

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44/ $Z_j = X'\beta + e_j$ can be estimated by ordinary least squares. This method requires that the data be grouped. This is because every cell for continuous variables would have zero or one observation unless it was categorized, in which case there may be a great loss of information in small samples.

presence or absence of other alternatives. Therefore the probability of y_1 being chosen over y_3 is $\log(P_1/P_3)$. The binary odds defined to correspond with the multinomial choice model with normalization on β_3 are:

$$(4.30)\quad Z_1 \equiv \log(P_1/P_3) = \log(e^{X'\beta_1}/1 + \sum_{j=1}^{2} e^{X'\beta_j} + 1/1 + \sum_{j=1}^{2} e^{X'\beta_j})$$

$$= \log(e^{X'\beta_1}), \text{ taking the log of both sides,}$$

$$Z_1 = X'\beta_1$$

$$(4.31)\quad Z_2 \equiv \log(P_2/P_3) = \log(e^{X'\beta_2}/1 + \sum_{j=1}^{2} e^{X'\beta_j} + 1/1 + \sum_{j=1}^{2} e^{X'\beta_j})$$

$$= \log(e^{X'\beta_2}) \quad \text{Taking the log of both sides,}$$

$$Z_2 = X'\beta_2$$

$$(4.32)\quad Z_3 \equiv \log(P_2/P_1) = X'\beta_2 - X'\beta_1 = X(\beta_2 - \beta_1)$$

The parameter, β_j, as well as the values for Z_j are estimated. When the variables are continuous in nature, maximum likelihood estimation produces consistent estimates using the conditional logit estimation model. To use maximum likelihood estimates, formulate the likelihood function:

$$(4.33)\quad L(y_j|x_1.....x_n) = \prod_{j=1}^{N} f(y_j) \qquad j = 1.....N \text{ observations}$$

$$(4.34)\quad = \prod_{j=1}^{N} [P_j^{\,y_j} (1 - P_j)^{1-y_j}]$$

(4.35) $$= \prod_{j=1}^{N} [1/1 + e^{-X'\beta})^{y_j} (e^{-X'\beta}/1 + e^{-X'\beta})^{1-y_j}]$$

(4.36) $$= (1/1 + e^{-X'\beta})^{\Sigma y_j} (e^{-X'\beta}/1 + e^{-X'\beta})^{N-\Sigma y_j}$$

Take the log of the likelihood function in equation 4.34 and maximize with respect to P_j.

(4.37) $$\log L = \Sigma y_j \log P_j + (N-\Sigma y_j)\log(1-P_j)$$

$$\partial L/\partial p_j = \Sigma y_j(1/P_j) + (N-\Sigma y_j)(1/1-P_j)(-1) = 0$$

After algebraic manipulation

(4.38) $$\hat{P}_j = \Sigma y_j/N$$

In practice, $\hat{P}_j$ is the sample cell frequencies in a contingency table divided by the total number of observations i.e. $\hat{P}_j = N_j/N$ which is the number of observations in the j^{th} cell divided by the total number of observations in the contingency table. This is equal to the cell probabilities or the relative frequency of success.

The maximum likelihood estimates of β is found in an analogous way. Take the log of the likelihood function in equation 4.36 and maximize with respect to β.

(4.39) $$\log L = \Sigma y_j \log (1/1 + e^{-X'\beta}) + N - \Sigma y_j \log(e^{-X'\beta}/1+e^{-X'\beta})$$

(4.40) $$\partial L/\partial \beta = \Sigma y_j(X\, e^{-X'\beta}/1+e^{-X'\beta}) + (N - \Sigma y_j)(-X/1+e^{-X'\beta}) = 0$$

After algebraic manipulation:

(4.41) $$\hat{\beta} = \log(\hat{P}_j/1-\hat{P}_j)X^{-1}$$ 45/

(4.42) $$X'\beta = \log(P_j/1-P_j)$$

which is the same as equation 4.26.

Statistical Properties of Logit Analysis

There are no specific assumptions regarding the stochastic nature of the explanatory variables required by this model because the explanatory variables are taken as given in a conditional probability estimation.46/ If the explanatory variables are preset (constants) the maximum likelihood estimates of α and β are really maximum likelihood estimates whereas if they are random variables, the estimates of α and β are conditional maximum likelihood estimates. (Haggstrom, 1974c)

Maximum likelihood estimates of the conditional logit model produce estimates which are square error consistent, asymptotically efficient and normally distributed. (Kamenta, 1971, p. 216, McFadden, 1974, p. 119). The second order conditions show that the log likelihood function is globally concave and that a maximum can be reached.

(4.43) $$\partial^2 L/\partial\beta^2 = -N(X_i^2 e^{-X_i\beta})/(1 + e^{-X_i\beta})^2 < 0$$

Hypothesis testing using t and F tests can be performed if

45/ The maximum likelihood estimates of β, $\hat{\beta}$, must satisfy the equation $\sum_{j=1}^{N} (1 + e^{-X'\beta})^{-1} X_j = \sum_{j=1}^{N} X_j Y_j \equiv t$, if there is only one observation per cell. (Nerlove & Press, 1973, p. 16). t is the sum of the vectors for which a response $y_j = 1$ was obtained. t is a sufficient statistic for β.

46/ In discriminate analysis the x_i's are assumed to be stochastic and the vector of x_i's has a multivariate normal distribution.

asymptotic properties are assumed. Even if $\hat{\beta}$ is not normally distributed, the asymptotic mean of $\hat{\beta}$ is assumed to be approximately equal to the actual mean for β. The asymptotic variance of $\hat{\beta}_i$ is obtained from the diagonal elements of the Information Matrix (I^{-1}) where

$I_{jj} = \sum_{j=1}^{J} P_j(1 - P_j)X_j'X_j$; $I_{ji} = -\sum_{j=1}^{J} P_{ji}P_{j1}X_j'X_j$. Values in $||I_{ji}||$ are the negatives of the expected values of the second derivatives of the log of the likelihood function with respect to β.

One measure of the goodness of fit is the Likelihood Ratio Index, which is 1 - likelihood ratio and designated as ρ^2. The likelihood ratio is $L(\beta)/L(\beta^H)$ where $L(\beta)$ is the logarithm of the likelihood function where β is an unconstrained maximum likelihood estimate (the log likelihood at convergence) and $L(\beta^H)$ is the logarithm of the likelihood function where β is estimated under the null hypothesis (the log likelihood at zero). (McFadden, 1974, p. 119) Other goodness of fit measures are the Adjusted Likelihood Ratio Index[47/] and the Likelihood Ratio Statistic which is $-2[L(\beta^H) - L(\beta)]$. The Likelihood Ratio Statistic has a Chi Square distribution with degrees of freedom equal to the number of parameters being estimated and tests the hypothesis that all the β's are equal to zero.

Why Use Logit Analysis?

The logit distribution is simple, symmetric, forces the conditional probabilities to be between zero and one, is close to the normal cumulative distribution function, and is convenient when using grouped data. However, with maximum likelihood estimators, grouped data is not

47/ For a detailed explanation of the Adjusted Likelihood Ratio Index see Chapter V, p. 102.

required. In fact, when one is interested in looking at decisions by individuals rather than group behavior, logit analysis is preferred to discriminate analysis which looks only at groups. Moreover, in logit analysis, the explanatory variables need not be assumed to be normally distributed. McFadden (1975b, p. 10) argues that the computational advantage of multiple logit models suggests that all qualitative choice models be written as multiple logit models.

Using logit analysis it is possible to estimate how changing one or more of the explanatory variables might affect the probabilities of an alternative being chosen. By taking the derivative of the logit equation 4.27 and 4.28, with respect to each explanatory variable, the marginal change in the probability distribution due to changes in those variables as well as the elasticity of the changes can be determined.[48/]

The major disadvantage of using logit analysis is that it is an iterative process, seeking out the maximum likelihood estimate of the β coefficients and the probability that $y_j = 1$. Initial estimates of β

[48/] The elasticity of the probability is $(dp/dX_i)(X_i/P) = \beta_i X_i(1-P)$ where P is the probability, X_i is the i^{th} argument of the logit equation and β_i is the estimated logit coefficient. Taking the total derivative of the logit equations with respect to X_i

$$\log(P/1-P) = 1/1+e^{-X'\beta} \text{ or } e^{\Sigma\beta_i X_i} = P/1-P$$

$$\frac{d(P/1-P)}{dP} = \frac{1}{(1-P)^2} \; ; \; d(P/1-P) = \frac{dP}{(1-P)^2} = \frac{\partial e^{\Sigma\beta_i X_i}}{\partial X_i} dX_i$$

$$dP = \beta_i e^{\Sigma\beta_j X_j} \, dXi(1-P)^2$$

$$dP - (1-P)^2 \beta_i X_i e^{\Sigma\beta_j X_j} = 0$$

Solving for the elasticity yields $dP/dX_i \cdot X_i/P = \beta_i X_i(1-P)$. (Miklius, 1976) The point elasticity of the probability with respect to X_j is then $\beta_i \overline{X}_i(1-\overline{P})$ where $\overline{X}_i$ is the sample mean of X_i and $\overline{P}$ is the observed proportion of the total sample observed to select a given alternative.

are not necessary but if they are all entered as zero, more iterations are needed for the final estimate to be reached. Because of the iteration process and the time the computer is in use, logit analysis is considerably more expensive than is ordinary least squares or discriminate analysis.

CHAPTER V

EMPIRICAL ESTIMATION OF THE EFFECT OF DEBT AND OTHER HOUSEHOLD CHARACTERISTICS ON PERCEIVED HOUSEHOLD WELFARE

The Data Set and Definition of Variables

The data set used in this study was purchased from the Survey Research Center of the Institute for Social Research at the University of Michigan. The data set was collected and compiled by the Survey Research Center under a grant from the Ford Foundation and is available under the title, "Panel Study of Consumer Durables and Installment Debt, 1967-1970". The collection of data from a cross sectional sample representative of all households in the coterminous United States was begun in 1967. The original sample consisted of 2604 primary family units whose heads were under sixty years of age.[49/] Each family unit was interviewed in January or February in each of the survey years. Four years later, 1434 family units had completed all four interviews. These families are the cases from which the individual observations on the four year merged data set were drawn. Hendricks, Youmans, and Keller (1973, pp. 181-191) show that the final sample of 1434 family units remains representative, on the basis of a large number of demographic and financial variables, despite the forty-five percent panel mortality rate.

49/ Family unit is defined as all persons living in the same dwelling unit who are related by blood, marriage or adoption. For a copy of the questionnaire see Hendricks, Youmans, and Keller (1973, pp. 195-226).

The purpose of the four year study was to investigate two major aspects of consumer behavior: expenditures on major durable goods and the use of installment credit. This data set is the only set found containing extensive and detailed information on family units' assets and debts and pooling cross-sectional and time series data for the same family units in a sample this large.

The Survey Research Center's panel data has been used for other studies. In the 1968 and 1969 Survey of Consumer Finances (Katona, 1968, 1969) changes in income, liquid assets and the purchases of durables for the family units, who comprised the panel up to that time, were analyzed. Dunkelberg and Stafford (1971) used this data to estimate the equilibrium level of debt in a consumer portfolio. Hendricks, Youmans, and Keller (1973) report an extensive analysis of the data in their book, Consumer Durables and Installment Debt.

For this study 1426 cases were selected from the merged four year data tape. The selected cases constituted all of the cases available who provided an answer to the question, "Would you say that you and your family are better off or worse off financially than you were a year ago?" (Question G.1, See Hendricks, Youmans, and Keller, 1973, p. 207). The 1969 and 1970 interview years were chosen primarily because of a wider distribution of answers in those two years and because they represent the most recent data available.[50/] Data from 1969 and 1970 were used to construct change variables and 1970 data were employed for demographic variables. A description of the variables used for

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50/ The percentage of answers in each year was:
1969: 42 percent better off; 42 percent the same; 15 percent worse off.
1970: 43 percent better off; 38 percent the same; 19 percent worse off.

analytic purposes follows:

Dependent Variable:

Perceived change in household welfare = $\log(P_1/1-P_1)$ where P_1 is the probability of feeling better off

= $\log(P_2/1-P_2)$ where P_2 is the probability of feeling worse off.

Explanatory Variables:

The calculated variables are explained first and those variables that were used as they appear in the raw data last.

1. Constant

2. $\Delta(TD/\$)$: Change in the ratio of total debt to income

   $TD/\$_{1970} - TD/\$_{1969} = \Delta(TD/\$)$

   TD_t = (Total Installment debt)$_t$ + (Total Noninstallment Debt)$_t$ where t = (1969, 1970).

   Installment Debt = Sum of all installment debt reported for the following categories: (Home mortgage debt and rental commitments are EXCLUDED from this study.)

   1. Automobiles
   2. Durable goods other than automobiles (past and current in terms of when debt occurred)
   3. Additions and repairs to homes (past and current)
   4. Estimated other debt (Reported monthly payments on commodities other than those included under one, two and three above, multiplied by twelve.)

   Noninstallment Debt = Sum of all noninstallment debt reported for the following categories.

   1. Automobiles
   2. Durable goods other than automobiles
   3. Additions and repairs to homes
   4. Medical and dental expenses
   5. Other commodities

   Income = total family income after taxes (disposable income).

3. Δ(ID/\$) = Change in the ratio of installment debt to income

4. Δ(NID/\$) = Change in the ratio of noninstallment debt to income

5. Δ(INVESTD/\$) = Change in the ratio of investment debt to income

   Investment Debt = Sum of all noninstallment debt reported for the following categories of data.

   1. Money owed on stocks
   2. Money owed on real estate other than the home the family unit lives in (past and current)

6. Δ(TD/LA) = Change in the ratio of total debt to liquid assets

7. Δ(ID/LA) = Change in the ratio of installment debt to liquid assets

8. Δ(NID/LA) = Change in the ratio of noninstallment debt to liquid assets

9. Δ(INVESTD/LA) = Change in the ratio of investment debt to liquid assets

   $\text{Debt/LA}_{1970} - \text{Debt/LA}_{1969} = \Delta\text{(Debt/LA)}$

   Liquid Assets = Sum of the following reported assets.

   1. Checking accounts
   2. Savings accounts
   3. Stocks
   4. Bonds

10. Δ(TD/NLA) = Change in the ratio of total debt to nonliquid assets

11. Δ(ID/NLA) = Change in the ratio of installment debt to nonliquid assets

12. Δ(NID/NLA) = Change in the ratio of noninstallment debt to nonliquid assets

13. Δ(INVESTD/NLA) = Change in the ratio of investment debt to nonliquid assets

    $\text{Debt/NLA}_{1970} - \text{Debt/NLA}_{1969} = \Delta\text{(Debt/NLA)}$

    Nonliquid Assets = Sum of the following reported assets.[51/]

51/ Equity in the home that the family unit lived in was not used because data on this value were not available for 1970.

1. Certificates of deposit
2. Value of automobiles
3. Estimated value of newly purchased durable goods (Net outlay on durable goods purchased in the current year)
4. Estimated value of newly purchased hobby and recreation equipment (Outlay for this equipment in current year)
5. Value of real estate other than home
6. Value of inheritance in current year

14. %Δ$ = Percentage change in real income

$$\frac{(\text{Income}_{1970}/1.098) - \text{Income}_{1969}}{(\text{Income}_{1970} + \text{Income}_{1969})/2} \times 100 = \%\Delta\$$$

(1.098 = Factor to adjust for the change in consumer price index from 1969 to 1970)

15. %ΔTWHHH = Percentage change in time worked by the head of the household

16. %ΔTWSP = Percentage change in time worked by spouse

Variables fifteen and sixteen were calculated as follows:

1. (Number of weeks worked) x (Number of hours worked per week) = Number of hours worked per year.

2. (Number of hours worked per year/1920) x 100 = Percent of full time worked in a given year.

3. $(\text{Percent full time worked})_{1970} - (\text{Percent full time worked})_{1969}$ = Percentage change in time worked by the head of the household or spouse.

17. ΔM.S. = Change in marital status
If the status of the head of the household changed from married to single, M.S. was coded -1. If the status of the head of the household changed from single to married, M.S. was coded + 1. No change was coded 0.

18. UNEMPLY = Number of weeks the head of the household was unemployed during the past year.

19. FAMILYSIZE = The actual size of the family unit.

20. UNUSUALEXSP = Unusual expenses in the past year (actual expenses)

21. AGE = Age of the head of the household. Four categories were designated. Each category is a dummy variable which equals one if the head of the household is in that age group and equals zero otherwise.

Age younger than 35	24.6 percent of the sample
Age 35 to 44	25.7 percent of the sample
Age 45 to 55	28.8 percent of the sample
Age older than 55	20.8 percent of the sample

22. SEX-F = Sex of the head of the household (female = 1; male = 0)

Male = 88 percent of the sample
Female = 12 percent of the sample

23. M.S. = marital status of the head of the household (single = 1; married = 0).
Married = 84 percent of the sample
Single = 16 percent of the sample

24. RACE-NW = Race if the head of the household (nonwhite = 1; white = 0)
White = 90 percent of the sample
Nonwhite = 10 percent of the sample

25. RURALITY = A dummy variable which equals one if the household is in a rural or a rural standard metropolitan statistical area and equals zero otherwise.

Rural = 20 percent of the sample
Urban = 80 percent of the sample

26. EDUCATION-C = The level of education attained by the head of the household. (College graduates = 1; noncollege graduates = 0).

College graduates = 16 percent of the sample
Noncollege graduates = 84 percent of the sample

27. INCOME = Income levels by two categories separated at the average income level and at the near poor level. (The approximate average income in 1970 was $10,000 and the near poor level was $5,000). This dummy variable equaled one if the income was less than $10,000 ($5,000) and equaled zero if the income was more than $10,000 ($5,000).

Income less than $10,000 = 52 percent of the sample
Income more than $10,000 = 48 percent of the sample
Income less than $5,000 = 15 percent of the sample
Income more than $5,000 = 85 percent of the sample

General Problems with Household Survey Data

Household survey data are commonly gathered in personal interviews conducted by trained interviewers querying at least one respondent in each family unit in the sample. Associated with this method of gathering detailed data are two obvious problems, namely reliability and cost. It is expensive to train and employ personnel to conduct personal interviews, but it is generally considered to be the most effective way of obtaining household data (Ferber, 1966, pp. 6-8). Other costs include travel expenses, incentive payments to respondents (if used), and the costs of the respondents' time spent reviewing records and answering questions.

Two types of errors are involved in assessing the reliability of household data: sampling errors and nonsampling errors. The first type of error may be controlled by careful selection of the initial sample. The sample can be designed to produce unbiased estimates and the probability of sampling error can be calculated.

Nonsampling errors cause the largest part of the estimation problems which arise when using survey data. These errors generally lead to understating the aggregate figures which increases the total variance in the data to such an extent that confidence intervals are often meaningless (Ferber, 1966, p. 361). Furthermore, as sample size increases, these errors tend to be magnified. Ferber illustrates mathematically how this type of bias due to non-random errors in individual observations will increase the standard errors of an estimate and lead to faulty intervals (Ferber, 1966, pp. 12-24). Most non-sampling errors occur because the respondent fails to report ownership of a particular asset or debt. During the interview the

respondent may have a lapse of memory, make arithmetical errors, or deliberately decieve the interviewer for reasons ranging from privacy to gamesmanship. Sometimes questions receive no response because they are considered too personal or irrelevant for the particular household. Even when financial transactions are reported, the exact date of the transaction is often not accurate. This problem is called telescoping in studies by Neter and Waksberg (1964). They conclude that reports of expenditures are telescoped forward in time and the longer the time span of the recall period, the greater the decay in the number of transactions reported. They also found that "bounded" interviews, in which the respondent is reminded of what he/she reported during a previous interview, produced better results.

Two types of data are usually collected from consumer surveys: factual and attitudinal data. The accuracy of attitudinal data cannot be verified, but validation studies have been conducted for factual data. Ferber analyzed several validation studies and found the largest errors occurred when those who held a greater than average amount of debt did not respond (Ferber, 1966, p. 54). Time deposits were found to be the most inaccurately reported holding; again nonreporting led to underestimates (Ferber, 1966, p. 123). The face value of insurance policies tended to be overestimated and the balance in demand deposits underestimated (Ferber, 1966, p. 157). Ferber found nonreporting to be associated with increasing age rather than with income. Accuracy of reports improved with the use of records, higher educational levels, conducting the interview in one's office instead of at home, and using a form which asked for change in debts and assets rather than the level of holdings (Ferber, 1966, p. 158).

There is no reason to believe validation studies were conducted on the Survey Research Center's panel data, but there was careful checking for year to year consistency of reports from each family unit. One advantage of panel data is that as a family unit is interviewed over and over again, conditioning occurs. This conditioning may bias attitudinal responses but it tends to improve the accuracy of reporting of financial data. Nevertheless, these data are subject to all the nonsampling errors described and these errors will probably have the predicted effect on statistical results. Using cross-sectional data in regression analysis typically produces low measures of goodness of fit (R^2). Studies using this type of data rarely produce R^2's of greater than .3.[52/] The Likelihood Ratio Index which is the reported goodness of fit measure for logit analysis is often compared to R^2 for ordinary least squares and it also is typically reported to be less than .3 and often between .0 and .1.[53/] Hendricks, Youmans, and Keller's (1973) regressions with continuous dependent variables obtain R^2's ranging from .00 to .345. They found that the using of four year averages rather than a single year's data decreased the standard errors of the regression estimates. They report, "A great deal of random variation does not greatly bias fitted relations in ordinary least squares models or remove simple correlations based on group means ...but it does decrease the amount of variance explained (R^2) and the conventional significance test are tenuous" (Hendricks, Youmans, and Keller, 1973, p. 38). When the dependent variable is dichotomous, low R^2's are the

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52/ See Hendricks, Youmans, and Keller, 1973: Morgan et al., 1974; Morgan and Smith, 1974; Duncan and Morgan, 1975 and 1976.

53/ See McFadden, 1975a and 1976.

rule rather than the exception and models should not be judged on this criterion alone (Morgan, et al., 1974, p. 380).

With all their limitations, household surveys in general and this panel study in particular provide invaluable information concerning household economic behavior. When using the data, there is an implicit assumption that the data are accepted as reasonably accurate. Analysis then proceeds using a given set of data. It is when conclusions are drawn and recommendations made on the basis of such analysis, that biases in the original data must be accounted for.

Screening Models

Due to the large number of variables and observations involved, and the estimation expense for logit equations, the potential model was screened by estimating various linear probability functions using ordinary least squares. This is equivalent to using discriminate analysis with a binary dependent variable and estimates so obtained should have the same sign and relative magnitude as maximum likelihood estimates from logit analysis. (See Chapter IV, pp. 63-64) In addition, computer programs for ordinary least squares provide correlation matrices that are useful for examining relationships between variables and eliminating multicollinearity.

All the equations used for this purpose had the same binary dependent variable for household welfare. The dependent variable assumed a value of one when the respondent said his/her family unit was better off and zero otherwise. Table 5-1 shows the models screened, the expected sign of the coefficients, the estimated coefficients, and the

TABLE 5-1

Ordinary Least Squares Screening Models Estimating the Probability of Interviewed Family Units Feeling Better Off verses the Probability of Family Units not Feeling Better Off

Explanatory Variable	Expected Sign	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
		Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)	Estimated Coefficient (t statistic)
1. Change in the ratio of total debt to income	-			-.0247 (.66)	-.0245 (.65)			
2. Change in the ratio of total debt to liquid assets	-			.00005 (.85)	.000057 (.90)			
3. Change in the ratio of total debt to noninstallment assets	-			.00169 (1.01)	.0016 (1.01)			
4. Change in the ratio of installment debt to income	-	.0178 (.53)				.0255 (.77)		
5. Change in the ratio of installment debt to liquid assets	-	.000044 (.64)						
6. Change in the ratio of installment debt to nonliquid assets	+	.00931 (1.5)						
7. Change in the ratio of noninstallment debt to income	-	-.0162 (.40)				.00146 (.057)		
8. Change in the ratio of noninstallment debt to liquid assets	-	.00013 (.37)						
9. Change in the ratio of noninstallment debt to nonliquid assets	-	.00109 (.61)						
10. Change in the ratio of investment debt to income	-		-.00195 (.34)		-.00187 (.33)	-.00526 (1.36)		
11. Change in the ratio of investment debt to liquid assets	-		-.0006 (1.2)		-.00062 (1.24)			
12. Change in the ratio of investment debt to nonliquid assets	-		-.0118 (.92)		-.01187 (.93)			
13. Change in installment debt	-						.00001 (1.30)	
14. Change in noninstallment debt	-						-.000007 (1.07)	
15. Change in investment debt	-						-.0000004 (.90)	
16. Change in total debt	-							-.000006 (.12)
17. Change in liquid assets	+							.0000005 (1.24)**
18. Change in nonliquid assets	+							.000001 (1.38)
19. Percentage change in real income	+	.00062 (2.8)*	.0152 (.46)	.03729 (.76)	.0375 (.76)	.00062 (2.83)*	.00053 (2.46)*	.000529 (2.45)*
20. Percentage change in time worked by the head of the household	+	.00098 (2.8)*	.00103 (3.01)*	.00104 (3.02)*	.001 (2.99)*	.00098 (2.36)*	.00097 (2.37)*	.00098 (2.89)*
21. Percentage change in time worked by the spouse	+	.0015 (2.99)*	.00157 (3.15)*	.0016 (3.22)*	.0016 (3.22)*	.00142 (3.04)*	.00137 (2.9E)*	.0014 (3.05)*
22. Number of weeks unemployed	-	-.00597 (2.13)*	-.0063 (2.26)*	-.00637 (2.28)*	-.0064 (2.30)*	-.00625 (2.25)*	-.004 (1.44)	-.00414 (1.49)
23. Family Size	-	-.0240 (2.68)*	-.0239 (2.67)*	-.0232 (2.59)*	-.0237 (2.65)*	-.0256 (2.38)*	-.0272 (3.13)*	-.0256 (3.01)*
24. Unusual Expenses	-	-.000052 (2.27)*	-.00005 (2.27)*	-.00005 (2.27)*	-.000053 (2.29)*	-.00005 (2.22)*	-.00005 (2.3)*	-.00005 (2.19)*
25. Age younger than 35	+	.0168 (4.73)*	.1785 (5.02)*	.1726 (4.85)*	.17767 (4.98)*	.1756 (4.96)*	.2029 (5.68)*	.202 (5.67)*
26. Age between 35 and 45	+	.0925 (2.57)*	.0921 (2.55)	.0937 (2.59)*	.09345 (2.59)*	.0929 (2.58)*	.09755 (2.74)*	.0957 (2.69)*
27. Age older than 55	-	-.03901 (1.01)	-.0348 (.91)	-.03316 (.86)	-.0337 (.88)	-.04195 (1.10)	-.0224 (.59)	-.0219 (.58)
28. Sex of the head of the household-female	-	-.0875 (1.31)	-.0892 (1.32)	-.0938 (1.39)	-.0934 (1.39)		-.1216 (2.77)*	-.1232 (2.8C)*
29. Marital Status-single	-	-.10393 (1.79)**	-.0107 (1.79)**	-.10063 (1.67)**	-.1024 (1.7)**	-.1617 (4.27)*		
30. Change in marital status	+	-.02162 (.28)	-.00152 (.02)	-.00325 (.04)	-.0031 (.04)			
31. Race-nonwhite	-	-.00004 (.0008)	.00629 (.14)	.000875 (.02)	.0051 (.11)	-.0032 (.07)	.0255 (.57)	.0272 (.61)
32. Rurality	-	-.02181 (.77)	-.0200 (.71)	-.02039 (.72)	-.01385 (.70)	-.0205 (.72)	.0111 (.38)	.0136 (.47)
33. Education-college	+	.02717 (.76)	.0263 (.74)	.0279 (.78)	.0257 (.72)	.0273 (.77)	-.0115 (.32)	-.00702 (.19)
34. Income less than $10,000 a year	-						-.1572 (5.47)*	-.1535 (5.33)*
35. Constant	+	.507 (11.7)*	.503 (11.7)*	.5007 (11.6)*	.502 (11.64)*	.5112 (11.92)*	.564 (13.13)*	.553 (12.35)*
36. Dependent Variable		For all equations, the dependent variable = 1 if the respondent reported feeling better off and 0 otherwise.						
R^2		.075	.07	.068	.071	.073	.09	.092
Residual Sum of Squares (SSE)		324.0	325.7	326.3	325.2	324.8	318.1	317.9

* Significant at 95 percent level or more

** Significant at 90 percent level or more

level of significance attained. Decisions regarding which variable to use in the logit model were based on the degree of multicollinearity between variables, the levels of significance of the coefficients and on how germane a particular variable was in testing the main hypotheses in this study.

The expected signs reflect the hypotheses regarding each explanatory variable. Utility theory implies rational consumers will allocate financial resources so as to attain a combination of assets and credit which maximizes their intertemporal utility. However, the optimum combination is a function of the individual's rate of time preference and it is not possible for a third party to determine whether an increase in the ratio of debts to assets increases individual's perceived welfare. (See Chapter II, p. 19) Traditional literature on consumer credit implies increasing debt-asset ratios decreases household welfare. Increased use of consumer credit accompanied by changing attitudes towards deficit financing provides evidence that increasing debt-asset ratios do not decrease, and may well increase, household welfare. The expected signs for the changes in debt-asset ratios on Table 5-1 and Table 5-2 emanate from the traditional literature.

Variables nineteen through twenty-two in Table 5-1 reflect a change in income or earning potential. Working more hours and being unemployed for lesser periods were expected to result in more income which was expected to increase financial well being.

Increasing family size means resources per person will decrease. One of the common measures of household welfare, the Orshansky ratio,[54/]

[54/] See Chapter III, p. 54 and p. 55.

utilizes this concept by dividing household income by family needs. With a given level of income the greater the family needs, the lower the measure of welfare. The expected sign implies the household will perceive this decrease in financial welfare.

Unusual expenses were expected to decrease well being since they require the use of funds which had been allocated for other commodities. Since these expenses were not part of the original spending plan, it is safe to assume resource reallocation falls below the optimum level and utility probably decreases.

Younger family units tend to be more optimistic (Hendricks, Youmans, and Keller, 1973, p. 100). This could be, in part, because younger families typically experience increasing incomes. Therefore, it is plausible that being less than forty-five years old would tend to make individuals perceive their changes in financial welfare as being positive while those who are over age fifty-five will perceive their changes in welfare as negative.

In 1972 median wages for female heads of households with one child under eighteen years old were $5,750 compared to $13,840 for a family unit with a married, male head (U.S. Department of Commerce, 1973). The median real after tax earnings for married males increased two percent per year between 1963 and 1973 as their median real income rose from $5,170 to $6,276. Other male heads of households experienced a 1.7 percent per year increase as their median real income rose from $4,349 to $5,139. Female heads of households received a .8 percent per year increase as their median real income increased from $2,647 to $2,865 in the same time period. The female and unmarried male heads of households made less money and experienced smaller percentage increases

in income (National Consumer Finance Association, 1975). Changes in income are a major factor affecting changes in financial welfare and therefore single and/or female heads of households were expected to perceive smaller increases in financial well being than married, male heads of households.[55/] In addition, job opportunities for females have increased more slowly than for males and their incomes have been less stable. Both of these facts were expected to incline females to perceive fewer increases in financial well being.

Other studies have found marrying (becoming single) increased (decreased) perceived well being (Hendricks, Youmans, and Keller, 1973, pp. 57, 100-101; Morgan et al., 1974, pp. 104, 177; Morgan, 1974, p. 29; Duncan and Morgan, 1976, pp. 28-29). Since marrying assumed a value of +1, becoming single assumed a value of -1, and no change in marital status was valued at 0, the expected sign is positive when the dependent variable is the probability of being better off.

It was hypothesized that being nonwhite, living in rural areas and having lower than average incomes would disincline the respondent to perceive improvements in economic welfare. Duncan and Morgan (1975, pp. 35-45) found being black and living in rural areas were associated with poverty over the long run and later found that living in a rural area had a negative effect on changes in economic well being[56/] since wages increased faster the nearer one lived to a large city (Duncan and Morgan, 1976, pp. 421-427). Between 1969 and 1970 mean income of farm

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55/ In the sample used for this study, 156 out of 157 female heads of households were single, 81 out of 1269 male heads of households were single.

56/ Economic well being was measured by income divided by needs in this case.

households increased $718 or 11 percent and the nonfarm mean income increased $780 or 8.9 percent (U.S. Department of Commerce, Series P-60, Number 65, 10/31/69 and Number 72, 8/14/70). However, "rural" residents in this sample are not necessarily farm families and the Duncan and Morgan finding leads to an expectation of a negative sign for the coefficient for rurality.

Being nonwhite is correlated with lower average incomes and lower percentage growth in income. In 1970 the mean income for nonwhites was $6,539; for whites it was $9,898. This represents an increase over the 1969 average incomes for nonwhites of 8.18 percent and for whites of 9.06 percent (U.S. Department of Commerce, Series P-60, Number 65, 10/31/69 and Number 72, 8/14/70). This nonwhite heads of households were expected to be less likely to perceive a positive change in welfare.

The group of households who earned less than $10,000 per year is positively correlated with rurality and being nonwhite and therefore the expected sign on this coefficient should be the same as on rurality and race.[57/] Looking at three levels of income for the head of the household reveals that the lower the income level the smaller are the absolute and percentage increases in family income between 1969 and 1970.[58/] Hendricks, Youmans, and Keller (1973, p. 100) also found that

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57/ It may be observed in the following pages that race, rurality and education, all of which are correlated with income, are insignificant in explaining changes in perceived financial well being. Income, which tends to be correlated to varying degrees with virtually all demographic variables is not used as an explanatory variable in the final estimating models.

58/ Statistics from the U.S. Department of Commerce, Bureau of Labor Statistics, Series P-60, Number 65, 10/31/69 and Number 72, 8/14/70 were used to calculate the following changes in income.

(continued)

lower income groups tended to be more pessimistic about past and expected financial progress. Thus, the lower income household is less likely to perceive a positive change in financial well being than a higher income group.[59/]

Those with college degrees probably have more control over their own destinies and face greater opportunities. In addition, since they earn higher incomes and higher income groups tend to be more optimistic (Hendricks, Youmans, and Keller, 1973, p. 100) it is hypothesized that this group would be predisposed to feeling better off as opposed to lesser educated groups.

Findings From the Screening Models

It may be noted from the values from models one, two, three and four in Table 5-1, variables twenty-eight and twenty-nine, "sex of the head of the household" and "marital status", had a joint correlation coefficient of .78. "Marital status" was significant at the ninety percent level while "sex of the head of the household" was not significant. Examination of values from model five revealed omitting "sex of the head of the household" increased the coefficient for "marital status" and raised the level of significance to ninety-nine

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58/ continued

Income earned by the Head of the Household	Change in Mean Family Income 1969-1970	
	Absolute Change	Percentage Change
$4000-$4999	$121	1.87
$6000-$6999	$208	2.38
$10,000-$14,999	$397	2.87

59/ The author recognizes the possibility of diminishing marginal utility of income but the evidence from other studies, sociological and economic, lead to the designated expected sign.

percent. Omitting "marital status" (models six and seven) raised the coefficient for "sex of the head of the household" also raising the level of significance to ninety-nine percent. "Sex of the head of the household" was omitted and "marital status" was used for the logit models. This means "marital status" captures the effects of both of these variables and thus, its coefficient will tend to be biased in the direction of overstating the effect of "marital status".

The "change in marital status" was included in the first four models because other studies on household welfare found that marrying (becoming single) increased (decreased) perceived well being.60/ In this case, "change in marital status" was not significant (t statistics from .02 to .28). "Change in marital status" was omitted from the final models.

Three other variables hypothesized to be significant which were not, were "race", "rurality", and "educational level". These three variables were retained in the final model in the hope that maximum

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60/ See Hendricks, Youmans, and Keller (1973, pp. 57, 100-101). Hendricks also found that the most optimistic group, those who changed from single to married, had the highest debt-income ratios (unless their income was more than $15,000 a year). Also, see Morgan et al. (1974, pp. 104, 117). In Morgan (1974, p. 29) changes in family composition are discussed. Morgan points out that one of the important economic consequences of marrying or divorcing comes through the changed working hours of family members and therefore, the changed income of the family unit. In the same volume, (pp. 163-187) Robert Hampton reports that after divorce the economic status of former husbands improves and that of former wives deteriorates. S. Hoffman and John Holmes confirm this in Duncan and Morgan (1976, pp. 28-29). On pages 80-106 in this same volume, Duncan reports that those who married almost doubled their family income. Women were more likely to increase their economic well being by marrying than were men.

Thus, "change in marital status" may be collinear with "the percentage change in real income" and "the percentage change in time worked by spouse". The respective correlation coefficients from the data used in this study (Table 5-1, Model 1) are .10 and .36.

likelihood estimates would produce different results and because they are traditionally believed to be related to changes in financial well being.[61/] The remainder of the explanatory variables, which were not debt ratios, were significant except for "age greater than fifty-five". However, "age greater than fifty-five" was retained in the logit model to complete the dummy variable set for age. In each of the dummy variable sets the most usual category was the one omitted from the equation. All variables reported in each model that were not debt ratios have the expected sign except for "change in marital status" which is not significant.

61/ Even though whites and residents of urban areas earn more income, on the average, than nonwhites and residents of rural areas, this apparently does not enter into their perception of change in their financial well being. (U.S. Department of Commerce, Series P-60, 12/24/70)

Typically the cost of living in urban areas is thought to be higher than in rural areas, but Stafford and Dunkelberg (1969) found that interest rates paid on automobile loans were somewhat less in urban and suburban areas than in rural areas.

Using data from a sample of five thousand families, Morgan and others looked at the significance of "race", "rurality" and "educational level" to the incidence of poverty and changes in economic status. (Economic status being some measure of income divided by needs.) An examination of factors effecting changes in economic status showed that the larger the nearest city, the faster wages increased and therefore living in rural areas had a negative effect on personal economic progress. (Age was the other significant demographic variable.) "Race", "marital status" and "education" were not significant (Duncan and Morgan, 1976, pp. 421-427).

The factors which were found to be associated with low incomes and with poverty in the short run were old age, poor education, being black, being female and the head of a household and being a rural resident. Over the long run, however, only being black and living in rural areas were significantly associated with poverty (Duncan and Morgan, 1975, pp. 35-45). Rising out of poverty was not associated with education, attitudes, behavior, race, mobility, or sex. The variables which were significant were age, age of the youngest child, changes in family composition, test scores, and marital status for those who were single, especially if divorced.

Debt-income ratios were found to be collinear with several debt-asset ratios. In model one the correlation coefficient between the "change in the ratio of installment debt to income" and "change in the ratio of non-installment debt to nonliquid assets" was .74. None of the change in debt ratio variables were significant.

In model two the "change in the ratio of investment debt to income" and the "change in the ratio of investment debt to nonliquid assets" had a correlation coefficient of .55 and none of the debt ratios were significant.

In model three, where total debt ratios were used, the "change in the ratio of total debt to income" had a correlation coefficient of .58 with the "change in the ratio of total debt to nonliquid assets" and .60 with the "percentage change in real income".

Model four provides further evidence that debt-income ratios were multicollinear with debt-asset ratios. In this model the "change in the ratio of total debt to income" was correlated to the same degree with the same variables as in model three. In addition the "change in the ratio of investment debt to income" had a correlation coefficient of .59 with the "change in the ratio of investment debt to nonliquid assets". Due to this evidential multicollinearity, the "change in the ratios of debt to income" were omitted from the logit model.

Screening model five contains only the debt-income ratios. Again, coefficients for the changes in the debt ratios were insignificant. It does not appear that any vital information is lost by not using debt-income ratios even though they have been a standard measure of the burden of debt in other studies at the micro and macroeconomic

levels.[62] The values and levels of significance of the coefficients for the changes in debt ratios in models two, three and four were about the same. Thus, investment-debt ratios appear to act independently of the other debt ratios and both may be used as explanatory variables in the same equation. In the logit models investment debt, installment debt and noninstallment debt ratios were used.

Models five and seven contain variables which measure the absolute change in debts and assets instead of ratios of the two. While the coefficient of determination (R^2) improved slightly, this was most likely due to the addition of the income level dummy variable rather than to the use of nonratio change variables. The dummy variable was not retained for the logit models because it was correlated (although at fairly low levels such as .10 and .23) with several other variables such as "family size", "age", "sex of the head of the household", "race",

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[62] The Federal Reserve Board's Monthly Bulletin reports consumer debt as the debt-income ratio. Most studies of aggregate credit growth such as those in the U.S. Board of Governors, Federal Reserve System's Consumer Installment Credit Study (1957) use debt-personal disposable income ratios or the expenditure on durable goods - income ratio as a measure of the burden of debt. For specific examples see: Tobin, p. 521 and Miller, p. 169 in U.S. Board of Governors, Federal Reserve System, Volume I, Part II, 1957.

Ryan and Maynes (1969) used debt payments to income as a measure of the burden of debt.

Gwen Bymers (1963) used the ratio of installment debt to income to measure the vulnerability of family units to financial trouble.

Hendricks, Youmans, and Keller (1973) examine the debt-income ratio for various income levels using the same data set used in this study.

In the November 7, 1975 report of the Federal Reserve Board of San Francisco, Joan Walsh writes, "The common rule of thumb holds the burden of consumer debt becomes excessive if it exceeds fourteen percent of disposable income"..in the aggregate.

Barnett (1975) writes, "The literature in family financial management indicates the debt-income ratio as the most important variable to look at when evaluating family financial management techniques."

"rurality", "educational level", and "number of weeks unemployed". This means that these other variables will capture the income effects and the estimated coefficients will tend to overstate the effects these variables have on perceived changes in financial welfare. The change in liquid assets was significant at the ninety percent level but the remainder of the new variables in these models were not significant. These variables were not used in the logit model since they added no new information, were not significant, and had extremely small coefficients.

Logit Models

Table 5-2 contains estimates from the two primary logit models, the expected signs for the coefficients, elasticities of significant explanatory variables, and a comparison of the maximum likelihood estimates of the coefficients with transformed estimates from identical equations estimated using ordinary least squares. Logit model one and two are identical except for the dependent variable. Model one estimates the log likelihood ratio of the probability of feeling better off and model two estimates the log likelihood ratio of the probability of feeling worse off.

The Likelihood Ratio Index for model two was considerably higher than for model one (.37 versus .07). This holds true even for the Adjusted Likelihood Ratio Indices, therefore the difference is not totally a function of the different relative portions of the sample

TABLE 5-2

Values From Binary Logit Models Estimating the Logarithmic Odds of the Probability of Feeling Better off to the Probability of not Feeling Better off and the Probability of Feeling Worse off to the Probability of not Feeling Worse off, Households Surveyed in Coterminous United States, 1969-1970

Explanatory variables	Logit Model I			Linear Probability Function	Logit Model II			Linear Probability Function
	Estimated coefficients (t statistic)	Expected sign	Elasticity $\hat{\beta}_i \bar{X}_i (1-\bar{P})$ [1]	Transformed coefficients $\tilde{\beta} = \hat{\beta}(4.4)$ [2] (t statistic)	Estimated coefficients (t statistic)	Expected sign	Elasticity $\hat{\beta}_i \bar{X}_i (1-\bar{P})$	Transformed coefficients $\tilde{\beta} = \hat{\beta}(7.22)$ (t statistic)
1. Change in ratio of installment debt/liquid assets	.00022 (.672)	-		.000211 [3] (.717)	-.00072 (1.67)**	+	.00157	-.00079 (2.14)*
2. Change in ratio of installment debt/nonliquid assets	.06180 (1.55)	-		.00442 (1.64)	.02002 (.488)	+		.02259 (.65)
3. Change in ratio of noninstallment debt/liquid assets	.00043 (.289)	-		.00042 (.29)	.00255 (.799)	+		.00187 (1.01)
4. Change in ratio of noninstallment debt/nonliquid assets	.00305 (.374)	-		.00176 (.34)	.00631 (.46)	+		.00462 (.70)
5. Change in ratio of investment debt/liquid assets	-.00160 (1.13)	-		-.00295 (1.38)	.00806 (1.37)	+		.00722 (2.65)*
6. Change in ratio of investment debt/nonliquid assets	-.08548 (1.11)	-		-.06358 (1.33)	-.06323 (.73)	+		-.04108 (.67)
7. Percentage change in real income	.00702 (3.48)*	+	.0004	.002684 (2.82)*	-.01255 (5.16)*	-	-.0001	-.00375 (3.09)*
8. Percentage change in time worked by head of household [4]	.00422 (2.65)*	+	.0058	.004268 (2.84)*	-.00446 (2.11)*	-	-.0089	-.00476 (2.49)*
9. Percentage change in time worked by spouse	.00550 (2.49)*	+	.0044	.00624 (3.02)*	-.00446 (1.59)	-		-.00620 (2.34)*
10. Number of weeks unemployed	-.03432 (2.09)*	-	-.020	-.027808 (2.27)*	.02959 (2.29)*	+	.0246	.05220 (3.33)*
11. Family size	-.12336 (3.03)*	-	-.2598	-.11352 (2.91)*	.17018 (3.58)*	+	.5131	.1644 (3.28)*
12. Unusual expenses	-.00028 (2.15)*	-	-.0264	-.00023 (2.27)*	.00063 (4.70)*	+	.0851	.00079 (6.14)*
13. Age younger than 35	.73374 (4.68)*	+		.7744 (4.98)*	-.59386 (2.79)*	-		-.60193 (3.01)*
14. Age between 35 and 45	.40681 (2.55)*	+		.4127 (2.62)*	-.24211 (1.23)	-		-.27913 (1.37)
15. Age older than 55	-.19994 (1.17)	-		-.19052 (1.14)	-.06403 (.30)	+		-.08548 (.39)
16. Marital status-single	-.73955 (4.19)*	-		-.7172 (4.31)*	.91735 (4.69)*	+		1.1155 (5.22)*
17. Rurality	-.07072 (.55)	-		-.08135 (.66)	-.19510 (1.17)	+		-.12425 (.78)
18. Education-college degree	.09705 (.62)	+		.11492 (.74)	.01268 (.06)	-		-.00584 (.029)
19. Race-nonwhite	-.01136 (.05)	-		.0175 (.09)	-.13644 (.538)	+		-.18966 (.75)
Constant	.1321 (.688)	+		1.9447 (11.94)	-2.2523 (9.32)*	-		.4987 (2.86)*
Dependent variable	$\log (P_1/1-P_1)$			Probability of better off	$\log (P_1/1-P_2)$			Probability of worse off
	$\log \left(\frac{P(\text{better})}{1-P(\text{better})}\right)$				$\log \left(\frac{P(\text{worse})}{1-P(\text{worse})}\right)$			
Likelihood Ratio Statistic	147 > 37.5 ∴ all parameters ≠ 0 [5]				739.3 > 37.5 ∴ all parameters ≠ 0			
Likelihood Ratio Index R^2	.0746			.0767	.3747			.092

* Significant at 95% or more.

** Significant at 90% or more.

1/ The point elasticity is calculated as $\hat{\beta}_i \bar{X}_i (1-\bar{P})$ where $\hat{\beta}_i$ is the estimated coefficient; $\bar{X}_i$ is the mean value of the variable; $\bar{P}$ is the observed proportion of respondents who felt better off (Model I) or worse off (Model II).

2/ $\tilde{\beta}$ is the discriminate estimate obtained by transforming the ordinary least squares estimated by the constant N/SSE. (N is the number of observations and SSE is the residual sum of squares from the ordinary least squares estimation).

3/ Underlined means transformed OLS estimate is within one standard deviation of MLE of Logit Analysis.

4/ Percentage calculated on basis of full-time equivalent. See page ___

5/ The Likelihood Ratio Statistic is -2[log likelihood at convergence - log likelihood at zero]. This has a Chi-Square distribution with degrees of freedom equal to the number of parameters (20 in this case). The table value of Chi-Square with 20 degrees of freedom is 37.5 at the 99% level of significance. Since the calculated Chi-Square is greater than 37.5 the hypothesis that all parameters are equal to zero is not accepted in each model.

comprising the dependent variable.[63/] The explanatory variables selected for the logit models explained the probability of feeling worse off more thoroughly than they explained the probability of feeling better off. One possible explanation for this is that Americans tend to expect their financial welfare to improve over time and small improvements in financial well being do not necessarily make them feel better off whereas small decreases in financial well being immediately make them feel worse off. The dependent variable for model two was used in all the models testing whether coefficients were the same for different categories of demographic groups.

The results from the logit models are reported in the remainder of this chapter. Analysis of the results is presented in Chapter VI.

63/ Although the Likelihood Ratio Index is the goodness of fit measure typically reported in studies using logit analysis, Tardiff (1976) shows that the value of the Likelihood Ratio Index depends on the relative proportions of sampled individuals selecting the various alternatives. It may not be expected to have a zero value. The dependence on the sample proportions also prevents comparison of indices emanating from different models. He proposes an Adjusted Likelihood Ratio Index. This index is more accurately compared to the R^2 measure obtained from ordinary least squares models since both measure the explanatory power of a model in addition to the variance explained by the constant. The typically reported Likelihood Ratio Index measures the explanatory power of a model with all the initial coefficients, including the constant, set equal to zero. The formulas for adjusting the Likelihood Ratio Index are: 1) Log Likelihood of the model with the best constant = L*(C). $L^*(C) = N \log (N/T) + (T-N) \log (T-N/T)$ where N = number of observations selecting the first alternative and T = the number of observations in the total sample. 2) Adjusted Likelihood Ratio Index = $1 - L^*(B)/L^*(C)$ where L*(B) is the log likelihood function of the hypothesized model with non-zero coefficients. (This is the log likelihood at convergence.) See Appendix C for a comparison of the reported Likelihood Ratio Index with the Adjusted Likelihood Ratio Index for binary logit models in this study. Caution should be taken when judging a model by this criterion since there is some controversy over this measure of the goodness of fit.

None of the changes in debt ratios were significant at the ninety-five percent level. However, in model two, the "changes in the ratio of installment debt to liquid assets" was significant at the ninety percent level. Answering one of the main questions posed at the beginning of this study, the change in debt ratios was not found to be a significant factor in explaining the probability of feeling better or worse off financially, with the possible exception of a decrease in the installment debt-liquid asset ratio increasing the probability of feeling worse off. The coefficient implies that the mean value of the log of the probability of feeling worse off divided by the probability of not feeling worse off would increase .00072 with a unit decrease in the installment debt-liquid asset ratio. The elasticity of .00157 implies that a one percent decrease in the installment debt-liquid asset ratio will cause a .157 percent increase in the probability that the respondent will feel worse off financially.

The hypothesis that the estimates of individual coefficients equal zero was rejected (accepted) in both model one and model two at approximately the same level of significance for each variable except that in model two the "percentage change in time worked by spouse" and "age thirty-five to forty-five" were insignificant whereas in model one they were significant at the ninety-five percent level. However, the coefficient on "percentage change in time worked by spouse" in each model is approximately .005 indicating that a one percent increase in time worked by the spouse increases (decreases) the probability of feeling better (worse) off by .5 percent. The variable "percentage change in time worked by spouse" would be zero for those family units who had no working spouse or were single. These family units were most

likely to be pessimistic and to have relatively low incomes.[64/] This reinforces the finding that being a single head of the household increases the probability of feeling worse off.

A one percent increase in the "time worked by the head of the household" leads to a .422 percent increase in the probability of feeling better off and a .446 percent decrease in the probability of feeling worse off. The elasticities show that decreasing the number of weeks unemployed by one percent increased the probability of feeling better off by two percent and decreased the probability of feeling worse off by 2.46 percent.

"Age group less than thirty-five" was significant in explaining both the probability of feeling better off and the probability of feeling worse off, except for the subgroups of single persons, rural residents, and those who earned over $10,000 and under $5,000 a year. "Age group thirty-five to forty-five" was significant in explaining the probability of feeling better off but insignificant in explaining the probability of feeling worse off. One exception was in the model for single persons where "age group thirty-five to forty-five" was significant at the ninety percent level. The "age group older than 55" was not significant in any model. The coefficients for each age group show the younger the head of the household, the greater was the effect on the probability of feeling either better or worse off. The age groups are zero-one dummy variables. The younger ages with the larger coefficients shift the logistic curve to the left which results in its

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64/ Hendricks, Youmans, and Keller (1973, p. 100) found that single heads of households and low income households were the most pessimistic and therefore the most likely to have reported feeling worse off.

intersecting the Y coordinate at a higher probability.[65/]

The results from the screening models with respect to the insignificance of the variables "race", "rurality", and "educational level" were confirmed using logit analysis. Having a college degree, being nonwhite or living in a rural area was not significant in explaining the probability of feeling better or worse off.

The most elastic variable was "family size". A one percent increase in family size leads to a 51.3 percent increase in the probability of feeling worse off whereas a one percent decrease in family size leads to a 25.9 percent increase in the probability of feeling better off. Since family size does not grow by increments as small as one percent (adding one person to a four person family resulted in a twenty-five percent increase) the impact of changing family size is considerable.

Increasing "unusual expenses" by one percent decreased the probability of feeling better off by 2.6 percent and increased the probability of feeling worse off 8.5 percent. This was an entirely expected result.

The "percentage change in real income" had the lowest elasticity in model one and model two. However, keeping in mind that a one percent change in the "percentage change in real income" is a very small change,[66/] the results show that a one percent <u>increase in the percentage change</u> in real income leads to a .04 percent increase in the probability of

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65/ For a graph of the logistic function see Chapter IV, p. 62.

66/ Consider that a one percent change in real income is 16.6 percent change in the "percentage change in real income" and leads to a .664 percent increase in the probability of feeling better off. The average annual increase in real median incomes in the U.S. between 1947 and 1969 was three percent (U.S. Department of Commerce, Series P-60, Number 75, 1970).

feeling better off and a .01 percent decrease in the probability of feeling worse off. Looking at the coefficients, a one percent increase in real income leads to a .7 percent increase in the probability of feeling better off and a 1.25 percent decrease in the probability of feeling worse off.

Tests on Demographic Groups

Table 5-3 shows the results of testing the null hypothesis that coefficients for different categories within each demographic group are the same, that is, changes in financial well being are perceived similarily by each category of family units. The dependent variable in each of these models was the log likelihood ratio of the probability of feeling worse off divided by the probability of not feeling worse off. The expected signs were the same as those designated for logit model two on Table 5-2. The test for each demographic group involves at least three equations. The dummy variable for the group being tested is omitted from each equation. One equation uses all of the observations in the sample; the number of other equations depends upon the existing number of categories, usually two. For example: the categories for the demographic variable, "marital status" are married and single. The equation for "married" includes only those observations for family units with a married head of the household and the equation for singles includes only those observations for family units with a single head of the household.

Employing the example of marital status, the Chi Square test was performed using 2 [Log Likelihood$_m$ + Log Likelihood$_s$ - Log Likelihood$_N$] where m is observations on households with married heads, s is

Table 5-3

Estimates from Logit Analysis for Separate Categories of Demographic Groups. The Chi Square Test of the Null Hypothesis that Separate Categories of Family Units Perceive Changes in Financial Well Being Similarly

Explanatory variables	Marital Status			Rurality		
	Total sample	Married	Single	Total Sample	Rural[3/]	Urban
	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)
Constant	-1.812 (8.26)*	-2.29 (8.19)*	-1.159 (2.95)*	-2.3147 (9.79)*	-2.6695 (5.48)*	-2.2212 (7.98)*
1. Change in ratio of installment debt/liquid assets	-.00071 (1.63)	-.00080 (1.72)**	.00473 (.63)	-.0007 (1.70)**	-.0006 (.19)	-.0007 (1.59)
2. Change in ratio of installment debt/nonliquid assets	.01910 (.47)	.03906 (.74)	-.09607 (1.04)	.0195 (.48)	.0058 (.08)	.0299 (.53)
3. Change in ratio of noninstallment debt/liquid assets	.00253 (.78)	.00336 (.902)	-.01038 (.638)	.0024 (.78)	.0026 (.65)	-.0001 (.01)
4. Change in ratio of noninstallment debt/nonliquid assets	.00692 (.39)	.00341 (.135)	.00838 (.33)	.0064 (.48)	.0516 (.49)	-.0046 (.18)
5. Change in ratio of investment debt/liquid assets	.00767 (1.28)	.008214 (1.31)	.04615 (.83)	.0079 (1.42)	-.0269 (.94)	.0286 (1.95)**
6. Change in ratio of investment debt/nonliquid assets	-.05991 (.70)	-.06046 (.676)	-1.6555 (.84)	-.0596 (.72)	.0137 (.18)	-.3607 (1.81)**
7. Percentage change in real income	-.01302 (5.37)*	-.01687 (5.32)*	-.00486 (1.18)	-.0123 (5.10)*	-.0105 (2.45)*	-.0141 (4.54)*
8. Percentage change in time worked by head of household[1/]	-.00421 (2.02)*	-.00580 (2.31)*	-.00165 (.35)	-.0046 (2.18)*	-.0076 (1.83)**	-.0028 (1.10)
9. Percentage change in time worked by spouse	-.00565 (2.07)*	-.00506 (1.52)	-.00203 (.34)	-.0046 (1.64)**	-.0016 (.30)	-.0053 (1.59)
10. Number of weeks unemployed	.03447 (2.69)*	.03256 (1.88)**	.02369 (1.1)	.0299 (2.31)*	.0342 (1.07)	.0281 (1.90)**
11. Family size	.09418 (2.08)*	.15600 (2.75)*	.22549 (2.39)*	.1695 (3.57)*	.2468 (2.50)*	.1456 (2.62)*
12. Unusual expenses	.00063 (4.64)*	.00058 (4.06)*	.00111 (2.63)*	.0006 (4.65)*	.0005 (2.45)*	.0008 (4.12)*
13. Age younger than 35	-.60565 (2.87)*	-.59044 (2.42)*	-.69436 (1.41)	-.5897 (2.78)*	-.6118 (1.45)	-.5559 (2.21)*
14. Age between 35 and 45	-.19336 (.99)	-.11191 (.49)	-.88203 (1.84)**	-.2357 (1.20)	-.5911 (1.46)	-.1018 (.44)
15. Age older than 55	-.08427 (.401)	.03674 (.145)	-.40692 (.97)	-.0653 (.31)	.1687 (.42)	-.1780 (.70)
16. Marital status-single				.9337 (4.79)*	1.0329 (2.38)*	.8937 (4.00)*
17. Rurality	-.24340 (1.47)	-.18351 (.98)	-.18037 (.44)			
18. Education-college degree	.01546 (.07)	-.00420 (.018)	.11567 (.26)	.0431 (.21)	.3510 (.75)	-.0800 (.35)
19. Race-nonwhite	.12891 (.54)	.08233 (.25)	-.40085 (.90)	-.1263 (.50)	-.9880 (1.46)	.0625 (.22)
20. Dependent variable	For all equations:	Log (probability of feeling		worse off/1-probability of feeling worse off)		
21. Likelihood ratio index	.3638	.4202	.1990	.3740	.4267	.3629
22. Number of observations	1426	1189	237	1426	428	998
23. Degrees of freedom	1404	1168	217	1404	408	977
24. Log likelihood	-627.4853	-447.028	-131.027	-617.41	-169.68	-439.82
Table $\chi^2_{(i)}$	i = 19; 27.20			i = 19; 27.20		
Calculate $\chi^2_{(i)}$	i = 19; 38.86[2/]			i = 19; 15.81		
Accept null hypothesis						
Reject null hypothesis		X			X	

(table continued)

(Table 5-3 continued)

Explanatory variables	Income Groups				
	Total sample	> $10,000	< $10,000	> $5,000	< $5,000
	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)
Constant	-2.2523 (9.32)*	-2.55 (6.73)*	-1.99 (6.05)*	-2.4385 (8.91)*	-1.2846 (2.09)*
1. Change in ratio of installment debt/liquid assets	-.00072 (1.67)**	-.00100 (1.34)	-.00024 (.36)	-.0007 (1.65)**	.0003 (.05)
2. Change in ratio of installment debt/nonliquid assets	.02002 (.48)	.05634 (.68)	-.02341 (.38)	.0241 (.50)	.0229 (.21)
3. Change in ratio of noninstallment debt/liquid assets	.00255 (.79)	.00235 (.29)	.00121 (.30)	.0026 (.48)	-.0001 (.02)
4. Change in ratio of noninstallment debt/nonliquid assets	.00631 (.46)	-.15564 (1.12)	.01047 (.51)	-.0200 (.53)	.0243 (.69)
5. Change in ratio of investmet debt/liquid assets	.00806 (1.37)	.04007 (2.39)*	.00634 (1.56)	.0094 (1.31)	-.0241 (.58)
6. Change in ratio of investment debt/nonliquid assets	-.06323 (.73)	.02279 (.19)	-.11196 (.66)	-.0714 (.78)	.2378 (.24)
7. Percentage change in real income	-.01255 (5.16)*	-.01482 (2.58)*	-.01052 (3.71)*	-.0131 (3.67)*	-.0086 (2.22)*
8. Percentage change in time worked by head of household	-.00446 (2.11)*	-.00688 (1.87)**	-.00434 (1.61)	-.0047 (1.92)**	-.0042 (.86)
9. Percentage change in time worked by spouse	-.00446 (1.59)	-.00633 (1.53)	-.00264 (.66)	-.0035 (1.18)	-.0136 (1.51)
10. Number of weeks unemployed	.02959 (2.29)*	.03173 (.66)	.02556 (1.87)**	.0593 (3.08)*	-.0030 (.14)
11. Family size	.17018 (3.58)*	.15574 (2.09)*	.21846 (3.31)*	.1925 (3.58)*	.1426 (1.23)
12. Unusual expenses	.00063 (4.7)*	.00049 (2.96)*	.00094 (4.05)*	.0006 (3.81)*	.0012 (2.24)*
13. Age younger than 35	-.59386 (2.79)*	-.18064 (.51)	-1.0068 (3.58)*	-.6567 (2.75)*	-.6274 (1.04)
14. Age between 35 and 45	-.24211 (1.22)	-.07606 (.24)	-.43236 (1.58)	-.1751 (.82)	-.6849 (1.07)
15. Age older than 55	-.06400 (.30)	.19854 (.56)	-.30259 (1.10)	-.0007 (.003)	-.4810 (1.03)
16. Marital status—single	.91735 (4.69)*	.88844 (2.07)*	.79164 (3.32)*	.8401 (3.35)*	.7236 (1.75)**
17. Rurality	-.19510 (1.17)	-.52936 (1.57)	-.24889 (1.20)	-.1013 (.54)	-.7694 (1.88)**
18. Education—college degree	.01268 (.06)	.19777 (.73)	.07462 (.21)	.0839 (.39)	.0382 (.04)
19. Race—nonwhite	-.13644 (.54)	-.07190 (.12)	-.27122 (.94)	-.2239 (.64)	-.3127 (.72)
20. Dependent variable	For all equations: log (probability of feeling worse off/1-prob. of feeling worse off)				
21. Likelihood ratio index	.3747	.4599	.3219	.4039	.2631
22. Number of observations	1426	678	748	1226	200
23. Degrees of freedom	1403	656	727	1203	180
24. Log likelihood	-616.70	-253.06	-351.07	-505.28	-102.15
Table $\chi^2_{(i)}$	i = 20; 28.41			i = 20; 28.41	
Calculate $\chi^2_{(i)}$	i = 20; 25.41			i = 20; 18.55	
Accept null hypothesis		X		X	
Reject null hypothesis					

(table continued)

Explanatory variables	Age Groups				
	Total sample	Age < 35	Age 35-44	Age 45-55	Age > 55
	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)	Estimated coefficient (t statistic)
Constant	-1.9232 (10.47)*	-2.5244 (5.21)*	-1.868 (4.07)*	-2.1075 (6.46)*	-1.965 (4.5)*
1. Change in ratio of installment debt/liquid assets	-.00072 (1.65)**	.00107 (.12)	-.00108 (.82)	.00047 (.24)	-.00061 (.24)
2. Change in ratio of installment debt/nonliquid assets	.01696 (.42)	.00462 (.08)	-.00632 (.06)	.00483 (1.03)	-.08139 (.65)
3. Change in ratio of noninstallment debt/liquid assets	.00259 (.81)	.00300 (.73)	.00223 (.21)	.00268 (.67)	-.01176 (.52)
4. Change in ratio of noninstallment debt/nonliquid assets	.00641 (.38)	.02106 (.34)	-.02932 (.28)	.00692 (.23)	.08129 (.63)
5. Change in ratio of investment debt/liquid assets	.00773 (1.19)	.00196 (.07)	.01042 (.61)	.02438 (1.48)	-.05493 (1.18)
6. Change in ratio of investment debt/nonliquid assets	-.07619 (.86)	-.07453 (.32)	1.93648 (2.17)*	-.02272 (.14)	.11714 (.32)
7. Percentage change in real income	-.01337 (5.52)*	-.01533 (2.37)*	-.01361 (2.56)*	-.01740 (3.93)*	-.00741 (1.34)
8. Percentage change in time worked by head of household	-.00435 (2.11)*	-.00180 (.38)	.00127 (.32)	-.00003 (.007)	-.01659 (3.22)*
9. Percentage change in time worked by spouse	-.00518 (1.93)**	-.00618 (.87)	-.00906 (2.00)*	-.00224 (.45)	-.00927 (1.01)
10. Number of weeks unemployed	.03338 (2.62)*	.08925 (2.29)*	.04608 (2.02)*	.01221 (.36)	.04374 (1.38)
11. Family size	.07048 (1.75)**	.12383 (1.16)	.07822 (.93)	.17529 (2.39)*	.10217 (.65)
12. Unusual expenses	.00064 (4.71)*	.00042 (1.75)**	.00073 (2.06)*	.00046 (2.20)*	.00085 (2.79)*
13. Age younger than 35					
14. Age between 35 and 45					
15. Age older than 55					
16. Marital status-single					
17. Rurality	-.23563 (1.43)	.16947 (.48)	-.72615 (1.96)*	-.22491 (.78)	-.02547 (.07)
18. Education-college degree	.00003 (.0001)	.12062 (.24)	-.32162 (.79)	.08261 (.23)	-.35630 (.62)
19. Race-nonwhite	.12479 (.52)	.52345 (.82)	.53281 (1.22)	.20230 (.44)	-.92232 (1.32)
20. Dependent variable	For all equations: Log (probability of feeling worse off/1-probability of feeling worse off)				
21. Likelihood ratio index	.3591	.4576	.3637	.2969	.4032
22. Number of observations	1426	351	368	413	294
23. Degrees of freedom	1407	334	351	395	278
24. Log likelihood	-632.0959	-131.5695	-161.853	-200.2780	-121.6001
Table $\chi^2_{(i)}$	i = 100; 118.494				
Calculate $\chi^2_{(i)}$					
Accept null hypothesis					
Reject null hypothesis	(for all pairwise comparisons)	X	X	X	X

* Significant of 95% or more.

** Significant at 90% or more.

1/ Percentage calculated on basis of full-time equivalent. See page ___

2/ The Chi-Square Test of the Null Hypothesis that separate categories of family units in each demographic group perceive changes in financial well being similarily is calculated thus. $2[\text{Log likelihood}_1 + \text{Log likelihood}_2 - \text{Log likelihood}_N]$ where 1 is model one and 2 is model two and N is the model using the total sample. See the text for a complete explanation.

3/ "Rural" includes those who live in areas classified by the census as rural and rural standard metropolitan statistical area. Urban includes all cities and other standard metropolitan areas.

observations on households with single heads and N is the total number of observations. This formulation has a Chi Square distribution with degrees of freedom equal to the degrees of freedom in each of the equations used for the test and calculated as $-(-d.f._m + d.f._s) + d.f._N$ = degrees of freedom for the Chi Square test. If the calculated value of Chi Square is less than the value in the Chi Square table with the specified degrees of freedom, the hypothesis that the response of the two categories is the same is accepted.

For the test for "marital status" using values from three equations the calculated Chi Square with nineteen degrees of freedom is 38.86 which is greater than the value in the Chi Square table of 27.20.[67] Therefore, the hypothesis was rejected at the ten percent probability level. Family units with a married head of the household perceived their changes in financial well being differently than family units with a single head of the household. The variability in the coefficients and the t statistics between the equation for married and the equation for single persons supports this finding.[68] (See Table 5-3, columns two and three)

The null hypothesis that rural and urban dwellers perceived changes in financial well being similarly was accepted using the Chi

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67/ 2[-447.028 + (131.027) - (-627.4853)] = 38.86. Chi Square with nineteen degrees of freedom = 27.70 at the ten percent probability level.

68/ Only the constant and two variables, "family size" and "unusual expenses" were significant in both equations. The Likelihood Ratio Index for single heads of households is .1990 and it is .4202 for married heads of households. The coefficient for "change in the ratio of installment debt to liquid assets" changes signs between married and single households.

Square Test.[69] Five of the same variables were significant for each group and had the same sign. "Change in percent time worked by the head of the household" was significant for rural dwellers but not for urban dwellers while "number of weeks unemployed" was significant for urban dwellers but not for those who lived in rural areas. Change in both investment debt ratios had a significant impact on urban dwellers but the signs of the two ratios were different. An increase in the ratio of investment debt to liquid assets increased the probability they would feel worse off. An increase in the ratio of investment debt to nonliquid assets decreased the probability of feeling worse off.

The Chi Square test comparing groups with incomes more and less than $10,000 a year led to acceptance of the null hypothesis that they responded similarly.[70] Those who earned more and less than $5,000 a year also perceived changes in financial well being similarly.[71] $10,000 was chosen as one point of demarkation for income levels because it was close to the mean income in 1970[72] and because Hendricks, Youmans, and Keller (1973) chose $10,000 as a point of demarkation and they found differences between the two income groups.[73] $5,000 was chosen as a

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[69] 2[-169.6839 + (-439.8241) - (-617.4109)] = 15.806. Chi Square with nineteen degrees of freedom at the ten percent probability level is 27.20.

[70] 2[-253.06 + (-351.07) - (-616.70)] = 25.14. Chi Square with twenty degrees of freedom at the ten percent probability level is 28.14.

[71] 2[-102.15 + (-505.28) - (-616.70)] = 18.55. Chi Square with twenty degrees of freedom at the ten percent probability level is 28.14.

[72] The mean income in 1970 was $10,001 for a family of four in the United States. (U.S. Department of Commerce, Series P-60, Number 79, July 27, 1971)

[73] See Hendricks, Youmans, and Keller (1973, pp. 25, 164-166)

second point of demarkation because incomes less than $4,676 were less than one hundred and twenty-five percent of the poverty level and represented the near poor.[74/]

Columns of estimated coefficients under "income more or less than $10,000" on Table 5-3 disclose that at the ninety-five percent level the same variables remained significant (or not significant) except that "age less than thirty-five" was significant for households with incomes less than $10,000 and "change in the ratio of investment debt to liquid assets" was significant for households with more than $10,000 in annual income. Significant variables did not change sign and the Likelihood Ratio Indices are similar. Only two variables were significant at the ninety-five percent level for those who earned less than $5,000 a year: "percentage change in real income" and "unusual expenses". At the ninety percent level, "marital status" and "rurality" were significant. Being single increased and living in a rural area decreased the probability that those who earned less than $5,000 a year would feel worse off.

Findings regarding the hypothesis that different age groups responded similarly led to rejection of the null hypothesis for all pairwise combinations of age groups.[75/] The estimated coefficients

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[74/] The poverty level in 1969 was $3,743 for nonfarm families. (U.S. Department of Commerce, Series P-60, Number 81, 11/71)

[75/] The degrees of freedom for the Chi Square tests were all greater than 100 when comparing age groups. The table value of Chi Square with 100 degrees of freedom is 118.494. The value was used as the table value for each of the tests on age groups.

Age less than 35 compared to Age 35-45.
$2[-131.57 + (-161.85) - (-632.10)] = 677.35$: Reject Similarity

Age less than 35 compared to Age 45-55.
$2[-131.57 + (-200.28) - (-632.10)] = 600.49$: Reject Similarity

(continued)

reported on page three of Table 5-3 reveal considerable differences between age groups. The Likelihood Ratio Indices, a measure of the goodness of fit, are similar except that "age group forty-five to fifty-five" is lower than the rest. Only the constant is significant in all five equations. The group of households whose head was age thirty-five to forty-five had the most significant variables of any age group. Of the seven significant variables two were significant in only one other equation in this study: "change in the ratio of investment debt to nonliquid assets" was significant for those who were urban dwellers but the impact was in the opposite direction: "rurality" was significant for those who earned less than $5,000 and its impact was in the same direction as for this age group. The "percentage change in time worked by spouse" was not significant for any other subsample of family units. Only two variables (but not the same two) were significant at the ninety-five percent level for the youngest and oldest age groups. "Percentage change in time worked by the head of the household" was significant only for the oldest age group. "Percentage change in real income" and "number of weeks unemployed" were significant for those who were under age thirty-five. One of three variables significant for those who are between ages forty-five and fifty-five is not significant

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75/ continued

Age less than 35 compared to Age greater than 55
$2[-131.57 + (-121.60) - (-632.10)] = 757.85$: Reject Similarity

Age 45-55 compared to Age greater than 55
$2[-200.28 + (-121.60) - (-632.10)] = 620.43$: Reject Similarity

Age 45-55 compared to Age 35-45
$2[-200.28 + (-161.85) - (-632.10)] = 539.93$: Reject Similarity

Age 35-45 compared to Age greater than 55
$2[-121.60 + (-161.85) - (-632.10)] = 697.29$: Reject Similarity

for other age groups: "family size".

Multinomial Logit Model

Since there are three alternative answers in the choice set comprising the dependent variable, estimation of coefficients from a multinomial logit model would account for a simultaneous decision model. However, the multinomial logit program assumes the applicability of the axiom of the independence of irrelevant alternatives. The probability odds are stated for the binary choice of one alternative as opposed to another regardless of the presence or absence of the third alternative[76/]. This axiom may be tested by estimating coefficients from a binary logit equation omitting the third alternative, hypothesized to be irrelevant, from the sample. If the estimated coefficients of the multinomial and the binary models are the same, then the axiom holds for the data being analyzed. The results of the multinomial logit model with a trichotomous dependent variable: 1. "Probability of feeling better off", 2. "Probability of feeling worse off", 3. "Probability of feeling the same", appear in columns one and two on Table 5-4. The results from a new binary logit model with the dependent variable specified as "the probability of feeling worse off divided by the probability of feeling the same" appears in column three.[77/]

[76/] See Chapter IV, pp.69-70.

[77/] The researcher predetermines which alternative will be in the denominator of the probability odds ratio by setting all the variables for that alternative equal to zero in the multinomial computer run. In this study the variables for the probability of feeling the same were set equal to zero. This decision was based on the argument that if there are any feasible subsets in the simultaneous choice set, it is most reasonable that they are the probability of feeling better off as opposed to the probability of feeling the same and the probability of feeling worse off as opposed

(continued)

TABLE 5-4

Multinomial Logit Model with Trichotomous Dependent Variable, i.e. (1.) Probability of Feeling Better off (2.) Probability of Feeling Worse off (3.) Probability of Feeling the Same. Test for Applicability of the Axiom of the Independence of Irrelevant Alternatives Comparing Coefficients from Multinomial and Binary Models.

	Multinomial Logit Model Three Alternatives in Dependent Variable		Binary Logit Model One Alternative Omitted
Explanatory Variables	Estimated Coefficients (t statistic)	Estimated Coefficients (t statistic)	Estimated Coefficients[2/] (t statistic)
1. Change in the ratio of installment debt to liquid assets	-.000115 (.257)	-.00057[1/] (1.30)	-.00100 (1.03)
2. Change in the ratio of installment debt to nonliquid assets	.08997 (1.92)**	.05773 (1.39)	.05774 (1.02)
3. Change in the ratio of noninstallment debt to liquid assets	.00098 (.55)	.00294 (1.04)	.00109 (.49)
4. Change in the ratio of noninstallment debt to nonliquid assets	.00530 (.63)	.01034 (.66)	.01189 (.33)
5. Change in the ratio of investment debt to liquid assets	-.00370 (.69)	.00717 (1.05)	.00913 (.94)
6. Change in the ratio of investment debt to nonliquid assets	-.12141 (1.11)	-.1192 (1.27)	-.14621 (.96)
7. Percentage change in real income	.00725 (3.52)*	-.00690 (3.22)*	-.01123 (4.35)*
8. Number of weeks unemployed	-.00239 (.157)	.00555 (.414)	.02777 (1.99)*
9. Unusual expenses	.00027 (1.84)*	.00034 (2.32)*	.00083 (4.28)*
10. Constant	-.254[3/] (4.22)*	-.254 (4.22)*	-.9703 (10.7)*
11. Trichotomous Dependent Variable	log(P(1)|(2,3)) $\log(\frac{\text{Probability 1}}{\text{Probability 3}})$	log P(2)|(1,3) $\log(\frac{\text{Probability 2}}{\text{Probability 3}})$	
12. Binary Dependent Variable omitting one alternative			log(P(2)/P(3)) [omitting P(1)]
13. Likelihood Ratio Index	.0258		.143
14. Likelihood Ratio Statistic	80.72 > 40 ∴ all parameters ≠ 0		159.22 > 25.18 ∴ all parameters ≠ 0

* Significant at 95 percent level or more

** Significant at 90 percent level or more

1/ Underlined estimates imply that Binary estimates in column 3 are within one standard deviation of multinomial estimates in column 2.

2/ Results from binary logit model, eliminating those who responded better off.

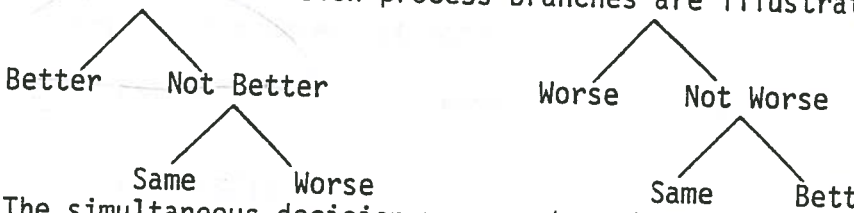
3/ The trichotomous model is one equation which estimates both the probability of feeling better off and the probability of feeling worse off simultaneously. Therefore the constant is the same for each column. This assumes the irrelevant alternative is the same for each column.

It was hypothesized earlier that the axiom does not hold for data in this study, that is, there are no irrelevant alternatives in the choice set. Comparing the multinomial estimates in column two and the binary estimates in column three it is readily seen that the significant variables and one insignificant variable are not the same for the two models. The coefficients for the remainder of the insignificant variables in the binary model are within one standard deviation of the insignificant coefficients in the trichotomous model.

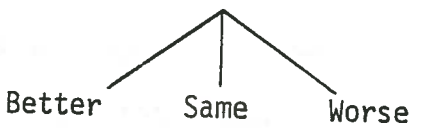
For these models it appears the axiom of the independence of irrelevant alternatives does not hold, at least not for the significant variables. This lends support to the belief that the decision process is recursive as opposed to being simultaneous. The two binary models used for the analysis of the data in this study estimate the conditional probability of the first branch of the recursive decision, that is, the probability of feeling better (worse) off as opposed to the probability of not feeling better (worse) off.[78] These models account for all the

[77] continued
to the probability of feeling the same. (If the family unit does not feel better off, then they will feel the same before circumstances change enough so that they feel worse off and conversely in the other direction).

[78] The recursive decision process branches are illustrated below.



The simultaneous decision process branches look like those below with one of the choices considered to be irrelevant when estimating the probability of one alternative as opposed to a second alternative.



alternatives in the decision process. On the other hand, the trichotomous logit model assumes a simultaneous decision process wherein one of the alternatives is irrelevant and the conditional probability estimated is that of one of the alternatives as opposed to a second alternative. This is the same as estimating the second branch of the recursive decision process, (the probability of better (worse) off as opposed to the probability of the same). The test for the applicability of the axiom of the independence of irrelevant alternatives was designed accordingly. If the estimated coefficients are the same from the simultaneous model and the second branch of the recursive model, then the third alternative is truly irrelevant in the decision process. Since all three alternatives are relevant, then the first branches of the recursive decision models are the appropriate conditional probabilities. These are the probabilities which were estimated in the primary models in this study and reported on Table 5-2.

Comparison of Maximum Likelihood Estimates of Logit Models with Ordinary Least Squares Estimates of a Linear Probability Function

Chapter IV contains a theoretical discussion of the transformation of ordinary least squares estimates ($\hat{\beta}$) to approximate the maximum likelihood estimates ($\tilde{\beta}$). To repeat the formulae:

$$\tilde{\beta} = (N/SSE)\hat{\beta}$$

$$\tilde{\alpha} = \log(P_1/P_2) + N/SSE(\hat{\alpha} - \tfrac{1}{2}) + N(1/n_1 + 1/n_2)/2$$

where SSE is the residual sum of squares from the ordinary least squares estimate, N is the total sample size, and n_1 is the number of

respondents who chose alternative one. P_1/P_2 can be estimated by n_1/n_2.

Two linear probability functions identical to logit model one and logit model two were estimated using ordinary least squares and the estimated coefficients were transformed using the formulas given above. The correlation coefficients for these models appear in Appendix D. The transformed (discriminate) coefficients are reported in columns four and eight of Table 5-2. If the coefficient is underlined, it is within one standard deviation of the maximum likelihood estimate from the corresponding logit model. The t statistic applies to the ordinary least squares estimates.

Comparing the transformed ordinary least squares (discriminate) estimates to the maximum likelihood estimates for logit model one (the log of the probability of feeling better off divided by the probability of not feeling better off) reveals the coefficients of seventeen out of nineteen explanatory variables were within one standard deviation of the maximum likelihood estimates and therefore, were considered to be the same. The coefficients for the variables "percentage change in real income" and the "change in the ratio of installment debt to nonliquid assets" were not the same. The constant differs. These findings are consistent with the findings of others who have compared estimated coefficients from logit and discriminate analysis. (Haggstrom, 1974c; Efron 1975; Brown, Moon and Zoloth, 1976) At the ninety-five percent level the significance (or insignificance) of each variable was the same for both estimation techniques. This was not true for the constant.

A similar comparison with logit model two revealed sixteen of nineteen variables had the same coefficients. As expected, the

coefficient for the constant was not the same. However, "percentage change in real income", "number of weeks unemployed", and "marital status" were also not the same while "the ratio of installment debt to liquid assets" was the same in contrast to the results from model one. At the ninety-five percent level, the significance (or insignificance) of sixteen from a set of nineteen variables was the same for both estimation techniques. Those which were not the same are the "percentage change in time worked by spouse", the "change in the ratio of investment debt to liquid assets" and "change in the ratio of installment debt to liquid assets". Each of these variables was significant in the ordinary least squares model and insignificant in the logit model. The "change in the ratio of installment debt to liquid assets" was significant at the ninety percent level in the logit model but at the ninety-five percent level in the ordinary least squares model.

One interesting finding was the relative efficiency of each type of estimate. Theoretically, ordinary least squares estimates are inefficient and the logit estimates are asymptotically efficient. Comparing the variances of the ordinary least squares estimates with the maximum likelihood estimates, showed that, except for the constant, all the maximum likelihood estimates had larger variances than the ordinary least squares estimates for both logit models one and two.[79/]

Transformed ordinary least squares estimates would lead to similar conclusions as the maximum likelihood estimates for logit model one.

79/ Since the transformed ordinary least squares estimates are the same as discriminate function estimates, this finding is consistent with Efron (1975) who shows that discriminate analysis estimates are more efficient than logit estimates. He argues for using logit analysis on its robustness and because it does not assume normality.

Moreover, the Likelihood Ratio Index and the R^2 for this model are very similar. (.0746 and .0767 respectfully) The transformed ordinary least squares estimates were somewhat less consistent with the maximum likelihood estimates from logit model two. Furthermore, the Likelihood Ratio Index for logit model two is considerably greater than the R^2 for the ordinary least squares equation (.3747 versus .092 respectfully).[80/]

The results did not lead to a recommendation for using ordinary least squares instead of logit analysis, especially for estimating the probability of feeling worse off divided by the probability of not feeling worse off. The theoretical development of the transformed ordinary least squares coefficients is based upon the multivariate normal distribution of the explanatory variables. However, it was found in prior studies (Haggstrom, 1974c) - and this was true in this study - that even the ordinary least squares coefficients for dummy variables can be very close to maximum likelihood estimates. Each of the explanatory variables used in this study was tested for normality using the Chi Square test of the hypothesis that explanatory variables were normally distributed.[81/] According to this test, none of the variables were normally distributed. Haggstrom (1974a) points out this does not violate the theoretical development if a linear combination of the continuous variables is normally distributed. Since $X'\hat{\beta} = \hat{Y}^*$, $\hat{Y}^*$ is a linear combination of the explanatory variables. The ordinary least squares estimates of the probabilities of feeling worse off and the probabilities of feeling better off were tested using the same Chi

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[80/] See Appendix C for the Adjusted Likelihood Ratio Indices.

[81/] See Appendix B for the normality tests.

Square test. The results of these tests show the estimates of the probability of feeling better (worse) off are not normally distributed. This is true even if those estimates less than zero and greater than one were ignored. Furthermore, the variance of each subsample (those whose actual responses were coded one and those whose actual responses were coded zero) was not the same and their variances were not equal to the variance of the total group. It is worth noting, however, that the mean and the variance for the total group and the group whose actual responses were coded zero (meaning the probability of not feeling better (worse) off) were very similar for each model. Partially, this is because the groups whose responses were coded zero were a majority of the total (56 percent and 81 percent) and more likely to reflect the characteristics of the total group. In addition this result reflects the ability to distinguish between those who feel better or worse off and the rest of the group.

The implication is that even though the normality and equal variance assumptions of the discriminate function are violated with the data used in this study, the transformed ordinary least squares estimates are sufficiently robust to approximate the maximum likelihood estimates of the logit model and lead to very similar conclusions.

One other test, Fisher's F test, was performed to compare the results from logit analysis and ordinary least squares for two different income groups.[82/] The conclusions drawn from the F test using ordinary

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[82/] See Fisher (1970) and Kamenta (1971, p. 373). The F test used was:

$$\frac{SSE_{(total)} - SSE_{(1)} - SSE_{(2)}/K}{SSE_{(1)} + SSE_{(2)}/n + m - 2K} \sim F^{K}_{n+m-2K}$$

where K is the number of explanatory variables, n is the number of

(continued)

least squares estimates and the Chi Square test using logit analysis were compared on Table 5-5.

The F and Chi Square tests do not lead to the same conclusions except at the ninety-nine percent level of significance. At ninety-five percent and ninety percent the Chi Square test still leads to acceptance of the hypothesis and the F test leads to rejection of the hypothesis.

Table 5.5

Comparative Tests of the Null Hypothesis that Two Different Income Groups Perceive Changes in Financial Well Being Similarly

	Ordinary Least Squares F^{19}_{1386}		Logit Chi Square$_{20}$	
Table Values (F^{20}_{∞})		Level of Significance		
	1.87 A[1/]	99	37.56	A
	1.57 R[2/]	95	31.40	A
	1.42 R	90	28.40	A
Calculated Value	1.7769		25.14	

1/ A means the hypothesis is accepted

2/ R means the hypothesis is not accepted

Logit analysis and ordinary least squares are both very robust estimating techniques. Similar conclusions would have been drawn using

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82/ continued
observations in group one and m is the number of observations in group two. SSE is the residual sum of squares from the respective ordinary least squares models.

either method, but logit analysis is a theoretically substantiable and statistically viable technique for analyzing choice problems such as the one presented in this study. The fact that ordinary least squares (discriminate) estimates verify the results, strengthens the credibility of the findings, but it does not imply that discriminate analysis or ordinary least squares are viable alternative estimating techniques for this study.

CHAPTER VI

ANALYSIS OF THE EFFECT OF DEBT AND OTHER DESIGNATED VARIABLES ON HOUSEHOLD WELFARE

Debt-Asset Ratios

Two of the hypotheses tested were:

1. Changes in debt-asset ratios and other selected financial and demographic characteristics have a significant impact on perceived financial well being as reported by one member of a family unit.

2. Increases in debt-asset ratios will decrease the probability of feeling better off and increase the probability of feeling worse off.

The change in six debt-asset ratios were designated as explanatory variables in the logit models designed to estimate the probability of feeling better (worse) off. Coefficients for three of these ratios, i.e., "change in the ratio of installment debt to nonliquid assets", "change in the ratio of noninstallment debt to liquid assets", and "change in the ratio of noninstallment debt to nonliquid assets" were insignificant in all equations. Coefficients for all debt-asset ratios were insignificant in equations explaining the probability of feeling better off and all except the "change in the ratio of installment debt to liquid assets" were insignificant in equations explaining the probability of feeling worse off for the total sample and for two subsamples.

The general insignificance of debt-asset ratios[83/] indicates family units accept consumer credit as a normal part of conducting the business of the household. Borrowing is not a traumatic experience. Rather, family units appear to be in control of their debts. As the National Commission on Consumer Credit (1972, p. 18) pointed out, increased debt ratios often indicate a greater ability to incur and carry debt. Family units who use credit appropriately do not see changes in debt-asset ratios as significantly affecting their financial welfare. Consumer credit may be viewed as one of several money management tools available to the family unit. Given the constraints of an intertemporal budget family units manipulate debts and assets in a manner entirely consistent with economic theories regarding rational utility maximizing consumers.

Economic theory as proposed by Fisher and Hirshleifer suggests family units will invest in assets (liquid or otherwise) until their subjective rate of return equals the rate of interest earned on the asset. Then they borrow until the interest rate paid on borrowed funds equals their rate of time preference for certain commodities.[84/] Other studies have found households follow cycles of indebtedness and repayment and/or of cash expenditures and saving.[85/] This study suggested family units tended to adjust their debts and assets within the constraints they faced in order to achieve an optimum combination that would maximize

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83/ Investment debt ratios were significant for three subsample groups. These ratios will be discussed separately because the incurring of investment debt is motivated by different incentives than debt used to acquire commodities at an earlier date.

84/ These commodities are generally thought to be durable goods or other items which cost more than can be paid for from uncommitted cash income during one time period.

85/ See Mueller (1967); Tobin (1957); Katona (1957); Dunkelberg and Stafford (1971).

their utility. Furthermore, the results of this study implied that the use of consumer credit for the purchase of commodities did not increase (decrease) the probability of feeling worse (better) off. The latter conclusion was drawn from the fact that changes in debt-asset ratios were generally insignificant and from the negative sign of the coefficient on the variable "change in the ratio of installment debt to liquid assets".

Change in the Ratio of Installment Debt to Liquid Assets

At the ninety percent level, the "change in the ratio of installment debt to liquid assets" was significant in explaining the probability of feeling worse off for the total sample and for subsamples of those who were married and those who earned more than $5,000 a year. In each case where the ratio was significant the sign of this coefficient was the opposite of that hypothesized. The result that a decreasing installment debt-liquid asset ratio increased the probability of feeling worse off contradicts edicts from traditional literature on consumer credit, but is consistent with observed increases in aggregate debt-income ratios[86/] and increasingly tolerant attitudes towards the use and extension of consumer credit. This result confirms the existence of a low rate of time preference for some commodities and implies that consumers prefer to use installment credit to obtain these commodities rather than do without them.

Some portion of the family unit's disposable income is typically allocated to providing a fund of liquid assets and/or expenditures involving the repayment of debt. Consider the installment debt-liquid

86/ See Appendix A.

asset ratio to be the optimum division of that fund. This fund (q) represents the utility maximizing amount of money spent (and saved) in each period for the purchase of certain relatively expensive commodities. This fund (q) may be divided into payments to liquid assets (direct saving) and payments to installment debt (forced saving). When either a decrease in installment debt or an increase in liquid assets occurs, within the limits of q, a decrease in the installment debt-liquid asset ratio occurs.87/ This means that the family unit is not acquiring the commodities as soon as it could and hence, there is a decrease in utility.88/

87/ This is consistent with the findings of Ryan and Maynes (1969, p. 17) and Lane (1968). Namely, the negative relationship between installment debt and liquid assets.

The idea that a "q" exists for most families is suggested by Hendricks, Youmans, and Keller (1973, p. 25) when they report that family units are much more homogeneous with respect to expenditures on durable goods than they are on the use of credit. There is no universally optimum installment debt-liquid asset ratio; it is unique for each family unit. The ability of consumers to regulate their use of credit and thus maintain their optimum debt-liquid asset ratio is discussed by Katona (1949) and Morgan (1958).

Studies by Manufacturers Hanover Trust Company show that consumers continue to expand purchases as long as the net change in their installment debt does not exceed two percent of their take home pay (Manufacturers Hanover Trust Company, 1976).

For this sample, the mean change in the ratio of installment debt to liquid assets was -2.7.

88/ In a study of family units in Maine who had been customers of small loan companies which went out of business and who had obtained new loans from other sources (probably at lower interest rates), it was found that seventy-five percent of these family units reported feeling better off. Twenty percent felt the same and seven percent felt worse off. Of those family units who did not obtain new loans from other sources, thirty-six percent felt better off, twenty-eight percent felt the same and thirty-six percent felt worse off. (Benston, 1975) One interpretation of these statistics is that being able to borrow money and carry some debt increases the probability of feeling better off.

The fact that "changes in the ratio of installment debt to liquid assets" was significant (if only at the ninety percent level) seems to imply that this debt-asset ratio was not at its optimum for most family units in this sample. There are several possible explanations for this, one of which hypothesizes that the family members miscalculated their future preferences and misallocated their resources in the past.[89/]

Perhaps the decline in consumer sentiment which began in mid 1969[90/] had slowed the incurring of new debts and by 1970 consumers found themselves with less debt than was commensurate with their low rate of time preference for commodities.

During the time when the data for this study were gathered, liquid assets increased an average of ten percent per family unit in the general economy[91/] and over sixteen percent for those family units in the sample. Although screening model seven (Table 5.1) disclosed increasing liquid assets increased the probability of feeling better off, the logit models showed that an increase in liquid assets without a corresponding increase in installment debt increased the probability of feeling worse off. Apparently, holding cash by itself does not improve perceived financial well being. Holding cash while also acquiring commodities does improve perceived financial well being.

Dunkelberg and Stafford (1971) in their study of disequilibrium levels of installment debt suggested that the difference between current and desired debt may be a proxy for households' inventories. This

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89/ Sigel (1957) calls this type of misallocation the real burden of debt.

90/ See Appendix E.

91/ See Appendix E.

implies that when more debt is desired, household inventories are below the desired level, which is consistent with the finding of a low rate of time preference for commodities among the family units in this study. They would have preferred more installment debt and/or fewer liquid assets. This was particularly true for those who earned between $5,000 and $10,000 a year - the lower middle income households.[92/] Households in this income group probably had incomes which were sufficiently stable to allow them to borrow but insufficient in amount to allow them to pay cash for commodities they desired. Finding themselves just below the average income they may have been using credit to supplement their income and raise their level of consumption; particularly the consumption of those commodities which symbolize middle class status.[93/]

Another possible reason for disequlibrium in the ratio of installment debt to liquid assets is that high interest rates in the general economy may have decreased the availability of some types of installment credit such as automobile loans. In addition, the interest rates on such loans may have increased somewhat, decreasing the

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92/ ($10,001 was the mean income for a family of four in 1970.) This conclusion was deduced from the fact that the "change in the ratio of installment debt to liquid assets" is significant for the total sample and for those who earned more than $5,000, but not for those who earned less than $5,000 or for either income group when the groups were separated at $10,000.

93/ In the American culture "being better off" is most often associated with increased levels of consumption, especially the consumption of durable household goods. Installment credit has undoubtedly enabled many families to acquire such goods who would not have otherwise done so. "The widening use of credit has stimulated a process of 'embourgeoisement' which permits lower income workers to adopt middle-class living standards". (U.S. Board of Governors, Federal Reserve System, 1973)

willingness to borrow, but this effect is expected to be minimal since interest rates on consumer credit (excluding mortgages) do not fluctuate much with changes in the prime interest rate.

In summary, the effect of the changes in the ratios of consumer debt to assets on household welfare showed that consumers prefer to use installment credit to acquire commodities as soon as possible rather than save liquid assets and pay cash for commodities at a later date. They exhibit a low rate of time preference which prescribes the use of consumer credit and they do not feel worse off for the use of credit.[94/] Neither of the two hypotheses tested were accepted on the basis of the analysis of changes in consumer debt-asset ratios. In general, changes in debt-asset ratios were insignificant in affecting perceived changes in financial well being; the one ratio which was significant indicated a desire for the use of more installment credit. Investment debt ratios which are discussed in the next section of this chapter allow the hypotheses to be accepted for some subsamples.

Changes in the Ratio of Investment Debt to Liquid Assets and Nonliquid Assets

Investment debt in this study included debts for the purchase of stocks and real estate other than the home the family unit lived in. These debts were not incurred for the immediate acquisition of a

94/ The psychological benefits from accumulating commodities through deficit financing may well reflect consumers' acquiescence to a "convenient social virtue" perpetrated by the planning system (large business in conjunction with large government) to ensure economic growth. (J. Galbraith, 1973, Economics and the Public Purpose) However, consumers perceptions and behavior will be in relation to the reality they experience, and whether or not that reality emanates from true consumer sovereignty or from systematic indocrination is academic.

consumption commodity, but rather, for the future augmentation of income or wealth.

An increase in the ratio of investment debt to liquid assets significantly increased the probability that those who earned over $10,000 a year and those who lived in urban areas would feel worse off. An increase in the ratio of investment debt to nonliquid assets increased the probability that those who were between the ages of thirty-five and forty-five would feel worse off. (Table 5-3) Investment debt is typically used to achieve some long run and possibly intangible goal. It is also not typically incurred by those who either do not have sufficient resources to purchase more than is required by their short run standard of consumption or those who have both the funds and the inclination to pay cash for such investments. When money is borrowed in order to invest, two events occur which may understandably make a family unit feel worse off. One is the reallocation of funds for acquiring tangible commodities which could have been used immediately to increase short run utility. These funds are no longer available for this purpose for two reasons: 1) The total amount of credit any one family unit can incur is limited (either institutionally or by their own financial good sense or both) and whatever amount is borrowed to invest will not be available to be borrowed for current consumption. 2) Since investment debt is a noninstallment debt, savings may have to be accumulated to repay the debt at some future time and money being used for the accumulation of liquid assets is not available for current consumption. Note the previous finding (page 128) that an increase in liquid assets without an increase in installment debt increases the

probability of feeling worse off;[95] the power of a low rate of time preference for commodities appears stronger than the preference for long run accumulation of wealth among most families.

The second event which tends to make families feel worse off when investment debt is incurred is the advent of risk. In some cases the family unit may be counting on the value of the asset to increase rapidly enough so it may be sold in time to repay the investment debt and, hopefully, to make a profit. If the value of the asset does not increase as expected, they will not make a profit and may even take a loss. If the value of the asset decreases (or if the investor truly wants to possess the asset) he/she must provide for payment of the debt out of current income or liquid assets in which case other commodities must be sacrificed.

Those family units whose head was between the ages of thirty-five and forty-five apparently considered the possibility of selling nonliquid assets to pay off investment debt. Young family units are typically novices in the world of investing and investment debts may produce more anxiety than they would for an older, more experienced investor. Also, the new investor is unlikely to have accumulated much liquid wealth with which to pay off investment debts and the possibility of losses or having to sell nonliquid assets may be a greater risk than it would tend to be in later years.

95/ For the total sample in this study, liquid assets increased 16.4 percent, nonliquid assets increased 14 percent and investment debt increased 13 percent for the period between 1969 and 1970. The mean "change in the ratio of investment debt to liquid assets" was .1968. The mean "change in the investment debt to nonliquid assets" was .059.

Financial counselors or stock brokers tend to advise younger investors to invest in stocks expected to produce capital gains. These are also the more risky investments quite capable of producing capital losses. In a year when the stock market decline sharply,[96/] those who had invested in growth stocks (very probably the thirty-five to forty-five year old sample members) were the most likely to perceive their financial well being as decreasing in some proportion to their investment debt.

Urban dwellers had mixed reactions to investment debt. An increase in the ratio of investment debt to liquid assets tended to increase their probability of feeling worse off. An increase in the ratio of investment debt to nonliquid assets decreased their probability of feeling worse off. (One can deduce from the signs on the coefficients that the latter was also true for those who earned between $5,000 and $10,000 a year.[97/]) There is no obvious explanation for this different reaction to different investment debt ratios by the same group. More detailed data and further research on the effects of this type of debt are needed. It is possible that urban family units did not perceive

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96/ The stock market began to fall in the second quarter of 1969 and continued to fall through the time when the 1970 interview was conducted. During the first quarter of 1970, the average stock on the New York Stock Exchange fell 9 and 7/8 points as ninety-five percent of all issues declined. (Colliers Yearbook, 1971, Crowell-Collier Educational Corporation, p. 130)

97/ If one ignores the level of significance and looks only at the signs on the coefficients of the variable "change in the ratio of investment debt to nonliquid assets" (Table 5-3) there is a negative sign for the total sample and all subsamples except those who are in the following groups: Earnings per year less than $5,000 or over $10,000; Rural dwellers; Age over fifty-five; Age between thirty-five and forty-five. People in these groups tend to feel worse off as the ratio of investment debt to nonliquid assets increases.

selling nonliquid assets to pay for investment debt as decreasing financial well being since the nonliquid assets being sold may very well be the assets acquired with the debt. This would be a type of self-forclosure. On the other hand, using liquid assets to repay investment debt means that current and future consumption of commodities must be foregone and the denial of consumption decreases perceived financial well being. In addition, depleting liquid assets would be expected to decrease the feeling of financial security which is tantamount to decreasing perceived financial well being.

In summary, the effect of changes in investment debt ratios was mixed depending upon the subsample, but judging by the signs of the coefficients, most consumers tended to feel worse off as the ratio of investment debt to liquid assets rose and not worse off as the ratio of investment debt to nonliquid assets rose. This appears to indicate that many people rely on liquid assets to pay back investment debt if their earnings on nonliquid assets is insufficient to cover the debt. The hypothesis that an increase in investment debt leads to a decrease in perceived financial well being cannot be accepted or rejected on the basis of this study.

Designated Income and Expenditure Variables

Variables which affected the earnings potential of the family unit or which indicated major expenditures were all significant in equations explaining the probability of feeling better off; most of them were significant in equations explaining the probability of feeling worse off for the total sample (Logit Model Two, Table 5-2) and for some of the subsamples (Table 5-3).

Percentage Change in Real Income

For almost all family units, changes in real income had a considerable impact on perceived well being as was expected. An increase in real income increased (decreased) the probability of feeling better (worse) off at a significant level except for those who were single and those who were over age fifty-five. Even though income levels tended to be higher for those over fifty-five and still employed, increases in salary may have been smaller than earlier in their careers when promotions were frequent. Therefore the changes in income were smaller causing smaller changes in perceived well being. For those who were retired, income is usually fixed. The effect of inflation on the welfare of households with fixed incomes is reflected in this result; as prices increase, real income decreases which increases the probability of feeling worse off. As the next paragraphs discuss, single persons tended not to be involved in income earning activities and were less likely to experience changes in real income.

Employment for the Head of the Household

"Percentage change in time worked by the head of the household" and "number of weeks unemployed" were not significant for single persons. For those single people over fifty-five and still working, temporary unemployment is rarely a problem due to seniority and for those who are retired, the time spent working is clearly irrelevant. The insignificance of income and employment variables for single persons may reflect their relative flexibility. They can adjust their own consumption habits more easily than a family which experiences the fluctuations in income.

It must not be assumed, however, that none of the single persons had dependents. "Family size" was a significant variable for this group as it was for married persons. The insignificance of changes in income and employment may also reflect non-participation in the labor force. Sixty-six percent of the single respondents were female, sixty-two percent of the single respondents were over age forty-five and sixty-five percent of the female heads of households in this sample were over age forty-five. Over half of those whose incomes were less than $5,000 a year were single and fifty-nine percent of the females had incomes of less than $5,000. It seems fair to assume that many of the single persons in this study were not employed and were living on fixed incomes. This partially explains why changes in income and employment were not significant for households with single heads.

An increase (decrease) in the "number of weeks unemployed" by the head of the household significantly decreased (increased) the probability of feeling better (worse) off for the total sample and for all other groups except those who earned over $10,000 a year, were over forty-five, lived in rural areas, or, as discussed above, were single. For those who earned less than $5000 a year, an increase in the "number of weeks unemployed" did not significantly increase the probability of feeling worse off. Those who earn less than $5,000 a year had a fifty-three percent chance of being single and a forty-two percent chance of being a female head of household. As previously noted, many of these are probably living on fixed incomes from retirement or transfer payments and were not concerned with temporary unemployment.[98/]

98/ To what extent transfer payments from social welfare agencies influenced the nonparticipation is not known. One can speculate that some people in this sample received welfare payments which may or may not have discouraged them from working.

Apparently sample members who earned more than the average income in the United States held jobs which were relatively steady and secure. This may be because the workers were older and had seniority or because the jobs were professional or managerial in nature and therefore, not as subject as others to lay offs, strikes, or seasonal fluctuations. This generalization will not necessarily hold true through time if the wages of unionized workers reach or surpass professional salary levels and if the supply of professionals in some fields exceeds demand for their services.

An increase in the percentage of time worked by the head of the household significantly decreased the probability of feeling worse off for the total sample and for households whose heads were married, households who had incomes of more than $10,000 and households whose heads were over fifty-five years old. The significance reflects entry and exit from the labor force as well as changes in the number of hours worked. Those over fifty-five are more likely to leave the labor force and must adjust their consumption plans to fixed and possibly declining incomes. For reasons previously discussed, this adjustment tends to make them feel worse off. Those who were married may be more likely to work overtime or take a second job in order to increase income. The more hours one works, the more money one makes, the greater is the financial well being. The last statement would not be true for those who have jobs where salary is not directly related to the hours worked, but apparently most family units (even those who earned over $10,000) believe that working more hours leads to an increase in financial well being.

Employment for the Spouse

An increase in time worked by spouse did not significantly decrease the probability of feeling worse off for the total sample or any subsample except those between the ages of thirty-five and forty-five. This is the age when most household possessions have been or are being acquired; children of parents in this age group are usually in their teens and may even be entering college. Many extra expenses occur during this period and a wife's participation in the labor force often makes a considerable difference in the life style and level of consumption a family can enjoy. In addition those women who stayed home with young children often decide to return to the labor force after they are thirty-five and whether the primary motivation is to increase income or to experience stimulating activities, the more hours worked outside the home, the greater the financial rewards are perceived to be. (This variable did significantly increase the probability of feeling better off, Logit Model One, Table 5-2) For households where the female spouse is young and likely to be involved in child rearing and for households where she is over forty-five and her earning capacity is probably low, the value of her time and energy spent at home may be viewed as being at least as great as the financial contribution she could make by entering the labor force. If the loss of income earned by the wife does not significantly decrease perceived financial well being, then one may be led to agree with those who argue that the costs incurred by working wives absorbs most of what they can earn and that as long as wages and salaries for women are generally lower than they are for men, many women will remain relatively valuable as household managers.

Family Size

An increase in family size decreased (increased) the probability of feeling better (worse) off for the total sample and for all subsample categories of marital status, rurality and income except for those whose income was less than $5,000, but for only one age category: "age forty-five to fifty-five". This indicates there are few perceived economices of scale in raising families and when children grow up and leave home and begin to support themselves, there is a significant decrease in the probability of feeling worse off. Children, especially those in college, are a very expensive item for the family unit and it comes as no surprise that when they can support themselves, the family unit is financially better off and readily recognizes the fact. It is counter intuitive for "family size" not to be significant for low income family units. Fifty-three percent of those whose income was less than $5,000 were single but "family size" was significant for single people. Perhaps those with lower incomes did not consider extra family members as a financial burden but housing more people under one roof as an economy of scale and a potential source of more wage earners.

Unusual Expenses

An increase in "unusual expenses" decreased (increased) the probability of feeling better (worse) off for the total sample and for all subsamples. Unexpected expenses force the family unit's economic model into disequilibrium. In order to regain an equilibrium status, normal spending patterns must be changed. Funds which would have been used for some planned and desired purchase must be reallocated and the purchase delayed. Another possibility is that savings are used to meet the unusual expense. Depending upon the amount of liquid assets

available, they could cover the entire unusual expense leaving the consumption pattern in tact. However, as screening model seven (Table 5-1) revealed, a decline in liquid assets does not increase the probability of feeling better off. Unusual expenses have an element of surprise which creates cognitive dissonance and upsets the optimum allocation of funds, both of which increase the probability of feeling worse off.

Designated Demographic Groups

The hypothesis tested with respect to demographic groups was:

> Changes in financial well being are perceived similarly by members of family units belonging to different categories of demographic groups.

Age

Age and marital status, demographic states which change in predictable or controllable patterns, tended to be significant in explaining the probability of feeling better (worse) off. Different age groups perceived changes in financial well being differently. Younger ages were significant in more models and had a greater effect on the probability of feeling better or worse off than did older ages. Age was not a significant variable for those who earned over $10,000 a year.

The "age group thirty-five to forty-five" being insignificant in model two (Table 5-2) simply implies there is nothing special about this age group which tended to make a family feel worse off or not worse off. This age group had a somewhat lower debt-income ratio than the younger group (Hendricks, Youmans, and Keller, 1973, p. 57) but since most debt ratios were also insignificant, this would not explain why "age thirty-

five to forty-five" was significant in increasing the probability of feeling better off and not significant in explaining the probability of feeling worse off. Hendricks, Youmans, and Keller (1973, pp. 98-101) found that younger heads of households were more likely to be optimistic about past and future progress than older heads of households, especially those over age fifty. The forty to forty-nine age group was about equally likely to be optimistic as pessimistic and the thirty to thirty-nine age group was two and one half times as likely to be optimistic. The results of Logit Models One and Two, (Table 5-2) may reflect the optimism of those who were in a stage of life characterized by "moving up" financially and careerwise.

For those who were single, being between the ages of thirty-five and forty-five significantly decreased the probability of feeling worse off. Apparently, even for those who were single (and probably female) resources grew rapidly enough at this stage of life to decrease the probability of feeling worse off. Those who are thirty-five to forty-five are young enough to plan on fulfilling their dreams and old enough to have acquired skills which allow them to be employed in jobs which provide sufficient income to carry out those plans.

Being less than thirty-five years old significantly decreased the probability of feeling worse off for those who earned greater than $5,000 and less than $10,000 a year, those who were married and those who lived in urban areas. Again, the optimism of youth is reflected as well as their greater rate of mobility from school to careers and from beginning to established careers.

Marital Status

Married and single heads of households perceived changes in financial well being differently. A married head of household is male by definition; sixty-six percent of single heads of households in this sample were female. Being a single head of household decreased (increased) the probability of feeling better (worse) off for the total sample regardless of income level or rurality. To the extent that being married provides another (potential) wage earner, spreads household management responsibilities over two adults, and provides a family unit with relatively stable relationships, plans and goals, it increases the probability of feeling better off. This does not mean two can live as cheaply as one. It does mean that married people tended to perceive changes in financial well being more positively than single persons. How much of this is an objective evaluation of finances and how much is a psychological reaction having to do with personal security and settling into a desired and stable pattern of consumption is not known.

Rurality, Education and Race

Living in a rural area, having a college degree, and being nonwhite, demographic states not very likely to change in any given year, were insignificant in all models except that "rurality"decreased the probability of feeling worse off for those family units whose head was between the ages of thirty-five and forty-five and for those households who earned less than $5,000 a year. Perhaps family units in this age group who had chosen to live in the rural areas are those who can afford the luxury of extensive commuting to a city or they had established a successful lifestyle outside of the city and found relatively rural areas

more pleasant, less expensive and less harried. Parents in this age group probably believe their children are better off living outside of metropolitan areas. It is difficult to tell whether this age group prefers rurality for its living quality or for its potential status. Judging by the signs on the coefficients, the two older age groups also preferred rural living but this was not a significant variable for them. Those who earned less than $5,000 apparently believed that rural living is cheaper and more desirable, perhaps in view of their low incomes.

Rural and urban dwellers perceived changes in financial well being in a similar manner. The differences in life style and consumption habits between the two living areas are probably not very great in many instances, but more importantly, interpersonal comparisons with respect to financial well being are not in evidence. When a family member responds to a question about changes in their financial welfare, apparently, they perceive those changes relative to their <u>own</u> past experiences and not the experiences of other families who live in other places, or are of another race or another educational level.

An absence of interpersonal comparisons was also evidenced by the finding that income level did not affect how people perceived changes in their financial well being. This lends support to Duesenberry's (1949) relative income hypothesis; people compare their current financial welfare with respect to their own past financial welfare and they feel better or worse off accordingly. The level of income is much less relevant than the changes in income and other financial variables.

Although this study was not designed to look for social inequities, the results indicated some groups which appeared to be disadvantaged. The fact that changes in real income or changes in hours worked were not

significant to groups of people who were single or elderly may indicate that these groups were not catching up with the rest of society. If efforts are being made to equalize opportunities for all people, then those groups who have been behind should be progressing faster than the norm. This did not appear to be the case. Other groups for which this appeared to be true were working wives, nonwhites and rural dwellers. Further research along this line is prescribed as a result of these findings.

To conclude the analysis regarding perceived changes in financial well being, debt-asset ratios were not particularly significant. Maintaining some optimum amount of debts and assets in the household portfolio appears to be normal procedure for most family units and they did not perceive changes in debt-asset ratios as changing their financial welfare. Family units tended to show a low rate of time preference; increasing installment debt relative to liquid assets decreased the probability of feeling worse off.

Family units studied apparently felt better or worse off with respect to their own past experiences. There was no evidence of interpersonal comparisons. The most important variables influencing the perceived changes in financial well being were those which affected earnings and major expenditures. Unexpected changes in consumption patterns increased the probability of feeling worse off but increasing debt ratios did not.

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

Summary: Perceived Changes in Financial Well Being

Changes in debt-asset ratios were generally not found to be significant variables in influencing family units' perceptions concerning changes in their financial well being in this study. However, there were a few notable exceptions. A decrease in the ratio of installment debt to liquid assets increased the probability of family units feeling worse off. Two other exceptions were changes in investment debt ratios.[99/] For those who earned more than $10,000 a year and those who lived in urban areas, an increase in the ratio of investment debt to liquid assets increased the probability of their feeling worse off and for those family units whose head was between age thirty-five and forty-five an increase in the ratio of investment debt to nonliquid assets increased the probability of their feeling worse off. The probability that urban dwellers would feel worse off decreased as the ratio of investment debt to nonliquid assets increased.

Noninstallment debt for durable goods, medical bills and additions and repairs to homes was not significant in any of the models.

99/ Investment debt is noninstallment debt for the purchase of stocks or real estate other than the home one lives in. It is avered to be motivated differently than other consumer debt which is used to acquire commodities as soon as possible.

It was concluded that insignificant debt ratios implied households allocated resources between debts and assets in a generally optimum manner as economic theory suggests they would. This conclusion coupled with the fact that increases in the ratio of installment debt to liquid assets significantly decreased the probability of feeling worse off led to a second conclusion: the use of consumer credit does not make family units feel worse off.

Variables which had a significant impact on the probability of feeling better (worse) off were conditions affecting the earnings potential of the family unit, its major expenditures, and those demographic states which change in predictable or controllable patterns. Variables affecting earnings or income were the "percentage change in time worked by the head of the household" and "percentage change in time worked by spouse", "number of weeks unemployed" and "percentage change in real income". Significant demographic variables were "age", "marital status" and "family size" all of which impact major expenditures as did "unusual expenses". "Unusual expenses" was the only variable significant for the total sample and for all subsamples in this study.

Living in a rural area, having a college degree and being non-white, demographic states not very likely to change in any given year, were insignificant in all models, except that "rurality"[100/] decreased the probability of feeling worse off for those family units whose head was between ages thirty-five and forty-five and for those households who earned less than $5,000 a year.

100/ "Rural" as defined for this variable includes those who live in areas classified by the census as both rural and rural residents in standard metropolitan statistical areas. Rural does not necessarily imply a farm family unit.

Family units perceived changes in financial well being similarly regardless of income level. Rural and urban dwellers also perceived their changes in financial well being similarly. Those who were married perceived changes in financial well being differently from those who were single and each age group had its own unique view concerning changes in financial welfare.

Summary: Estimating Techniques

The appropriate conditional probabilities were determined using binary logit models designed to estimate the first branches of recursive models which accounted for all of the alternative choices reflected in the dependent variable.

Comparing coefficients from two identical models, one estimated using maximum likelihood estimators from logit analysis and one estimated by transforming ordinary least squares coefficients, using a constant, to obtain discriminate estimates[101/] it was found that eighty-four percent to eighty-nine percent of the discriminate coefficients were within one standard deviation of the maximum likelihood estimates. The significance or insignificance of each variable was the same in both types of models used for estimates of the probability of feeling better off. When estimating the probability of feeling worse off, the significance of eighty-nine percent of the variables was the same in both types of models. Conclusions drawn from models estimated by either technique would be very much the same for the data in this study in spite of the fact that none of the explanatory variables nor the

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101/ See Table 5-2, page 101.

estimated probabilities were normally distributed. Comparing the coefficients for two different categories of income groups using the Chi Square test for the logit estimates and the F test for the ordinary least squares estimates did not, however, lead to accepting the null hypothesis at the same level of significance.

Recommendations: Educational Policy

The findings of this study imply that American family units are willing and able to employ consumer credit in a manner which does not increase the probability of diminishing their perceived financial welfare. Consequently, those who teach about the use of consumer credit are advised to focus on providing students with adequate and accurate information about how to obtain, evaluate and use consumer credit. In order to fulfill their role in the market place consumers must have adequate information and objective education is one way to ensure a continued supply of informed consumers. A need for better education about the use of investment credit is particularly evident, since this type of credit tended to decrease perceived financial well being.

It is the opinion of the author that too many educators have spent too much time espousing the ideas in the traditional literature on consumer credit. The present recommendation does not mean to suggest that warning about the consequences of overindebtedness is inappropriate, only that it is a small part of the total lesson on consumer credit. Educators should not associate the use of credit in achieving an optimum level of living with guilt.

Virtually every consumer will be confronted with choices between cash and credit and different types of credit. It is incumbant upon educators in the field of consumer finance to equip students with adequate and objective information so that when those students must decide on methods of financing their own purchases, they have knowledge concerning alternatives.

Recommendations: Governmental Policy

On the basis of the findings in this study no specific legislation or regulations can be recommended. However, a general policy recommendation seems appropriate. Family units do not believe their financial welfare decreases when they employ installment credit as a means of financing goods and services. A low rate of time preference, evidenced by consumers' increased use of credit and by the fact that increases in the ratio of installment debt to liquid assets decreases the probability of feeling worse off, suggests that consumers prefer having the choice of financing commodities in whatever manner best suits their own household's resource allocation plan. For this reason it is recommended that government policies move in the direction of making consumer credit available to all households who want to use it. Obviously the amount that any one household can borrow in any one time period is limited by their current resources and expected future income, but to deny access to the legitimate credit market, to disallow them to decide whether their rate of time preference is greater than or equal to the rate of interest, is to deny the freedom of choice, and freedom of choice, coupled with accurate and adequate information, is the overriding goal which the present recommendation seeks to achieve.

Recommendations for Further Research

Public Policy for Consumer Credit

There are several trends in law and public policy which are expected to affect and be affected by the use of consumer credit. Those policies which reduce uncertainty concerning future income are expected to reduce the risks of using (and extending) consumer credit and would be expected to increase the probability of family units' feeling better off. In general, these policies include all forms of indexing of wages or transfer payments, insurance against loss of income, equal employment and equal credit opportunities, and revised income tax laws. Exactly how these policies influence the use of consumer credit and how widespread commitments to consumer debt influence policies in these areas needs to be examined. In addition, the effect of these policies on perceived financial well being is in need of documentation.

The abolishment of usury laws would theoretically enable more consumers to use credit and may enable them to raise their standard of consumption. At the very least, this action would increase consumer sovereignty. Whether or not this would make consumers feel better off, whether it would raise or lower interest rates in general and whether it would increase or decrease the satisfactory use of consumer credit is still not known.

Transferring funds by electronic methods is now a reality. We know what this does to the old habits of writing checks and carrying cash. We do not know how the use of installment and noninstallment credit will change. We do not know if this spells the demise of revolving charge accounts or even if consumers will retain a choice

between charging or paying "cash" (that is an instant debit to their electronic account). We do not know how much this system will cost consumers or how much it will profit retailers and banks. It may even cause major changes in the structure of the credit industry. There are many uncertainties created by the advent of electronic funds transfer systems and many ideas for research projects present themselves in this area.

Theoretical Economics

From the standpoint of theoretical economics fully accounting for consumer credit in theoretical microeconomic models is still a pending task. Incorporating consumer credit into demand models is also still to be accomplished but studies by Diewert and Muelbauer approach this problem. Diewert (1974) starts by examining an intertemporal utility function for the consumption of nondurables and moves to examining the demand for durables. Although he does not use debt as a variable, he assumes a single financial asset, namely bonds, which have a set yield per year. It seems plausible that, in the supply of assets formula, holding of bonds and changes in bonds could either include debt (assets - debts = net assets) or be replaced by debt (a negative bond) on which there is an interest payment each year. This revision is especially compatible with Diewert's suggestion that one way to earn the expected rate of return on financial assets is to purchase durable goods. However, if by using installment credit, the monthly payments amortized the debt more slowly than the durable good depreciated, the rate of return could be negative.

The linear expenditure system suggested by Klein and Rubin (1947) and used most often to study demand contains a constant subsistence element reflecting necessary and committed quantities which the consumer must buy. It seems that contractual debt payments could be included in the constant element. Muelbauer (1974) uses this concept when he suggests incorporating household composition into the linear expenditure system and later develops a measure of household welfare based on supernumary income weighted by a general adult equivalent scale.

Life cycle utility models which cope with random horizons might be modified by redefining the bequest (S(t)) in Yarri's (1965) utility function as a retirement fund. (See Chapter II, equation 2.16) If it is assumed that S(t) should be largest in the middle years of life, we can adopt Yarri's idea of weighting S(t) by the number of years (Ω) where $\Omega(t)$ is a humped shaped function, putting the greatest weight at the year of retirement age. To maximize utility using this approach maximize $U = \int_0^T e^{-\delta t} u_t(c(t))dt + \Omega(t)\phi S(t)$. Alternately, T in equation 2.16 (p. 29) may be defined to be age sixty-five and S(t) may be defined as the retirement fund. In terms of maximizing the welfare of the household, the faster and higher $\Omega(t)$ increases, the better off the household would be. For empirical work, S(t) could include all accumulated savings, liquid and otherwise; in other words, total accumulated nonhuman wealth. Life cycle models address dynamic situations and further specification of these models is needed.

Since the commodities one can acquire in any one time period is a function of available resources which includes cash income, liquid assets and the line of credit available to an individual consumer, some

method of incorporating that line of credit into the household's budget constraint needs to be devised.

Empirical Analysis

Some comparison of logit and ordinary least squares estimating techniques was made in this study, but other tests are possible. First, the same models could be analyzed using a standard discriminate analysis package to determine (1) if the transformed ordinary least squares estimates are the same as discriminate estimates and (2) how discriminate estimates obtained from a discriminate package compare to logit estimates. Estimating the multinomial model using discriminate analysis and comparing the results to the logit model with the trichotomous dependent variable would further confirm (or not) the similarities between the two estimating technqiues.

Probit analysis is particularly appropriate when there is a rank ordering of the choices being made. It might be interesting to hypothesize that the choices regarding changes in financial well being have a rank ordering and then estimate coefficients for models similar to the ones in this study using probit analysis.

Credit and Household Welfare

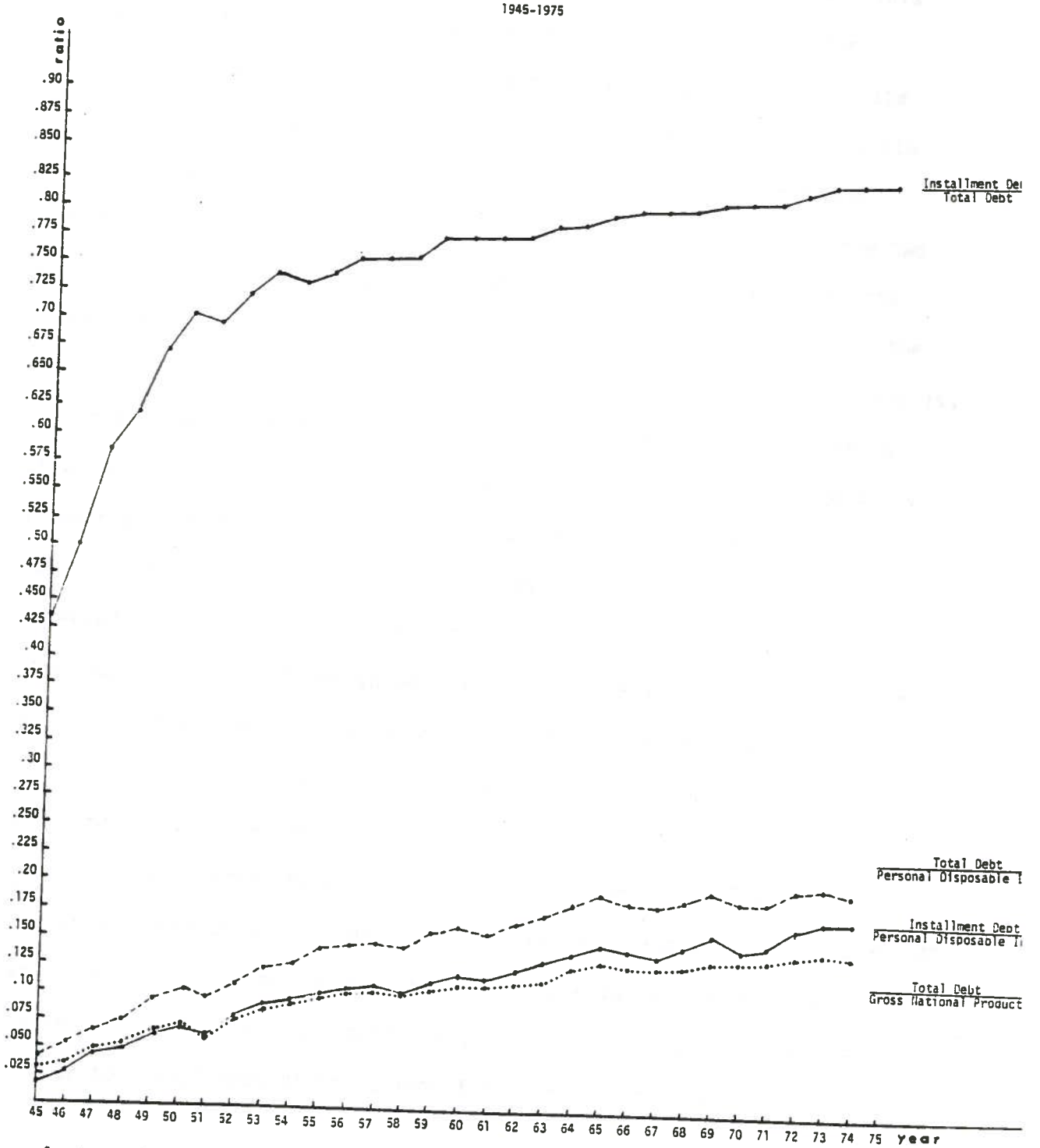
There are other questions which could be examined using methods of analysis similar to those used in this study and the same data. One, for example, is how do responses and characteristics differ between those family units who regularly use consumer credit and those who do not? The components of investment debt and the characteristics of those who use it are in need of investigation as well.

Further research is also needed to determine whether or not minority or disadvantaged groups in our society are catching up in terms of income, employment opportunities, and credit use. If increases in their perceived financial well being are no greater than the average, they are not moving ahead faster and consequently not catching up.

APPENDIX A

Appendix A

TRENDS IN AGGREGATE CONSUMER DEBT
RATIOS IN THE UNITED STATES
1945-1975



Source: U.S. Board of Governors, Federal Reserve System, Federal Reserve Bulletins, 1945-1976.

APPENDIX B

Chi Square Test of the Null Hypothesis that the Empirical Density Function is Normally Distributed

Chi Square tests of the null hypothesis that the empirical density function is normally distributed are presented in this appendix. This test involves four steps after the frequency distribution (A) for specified intervals of the variables are known. Step one: Calculate the relative frequency. For each end point in each interval calculate the "z" value. $z = (x-\mu)/\sigma$ where μ is the mean, σ is the standard deviation and x is the end point value of the interval. Locate the two values of z from a standard normal table to obtain the area under the normal curve from ± infinity for each of the values of z. Subtract the smaller from the larger area to determine the relative frequency, that is, the area under the normal curve between the end points of the interval. Step two: Calculate the absolute frequency (T). Multiply the relative frequency by the total sample size. Step three: Calculate the contribution to the Chi Square Statistic. This is $(A-T)^2/T$ where A is the observed frequency. Repeat the first three steps for each interval. Step four: Sum all of the values calculated in step three. If the sum is greater than the Chi Square value from the table with degrees of freedom equal to the number of intervals minus two, then the hypothesis of normality is rejected.

Table B-1 shows the results of this test for the explanatory variables, "percentage change in time worked by the head of the household" and "percentage change in real income". These two variables were chosen as an illustration because their frequency distribution appeared to be closer to normal than distributions for other variables.

Table B-2 shows the results of this test for the estimated probability of feeling better off and the estimated probability of feeling worse off. Table B-3 shows the frequency distributions of the estimated probabilities, and their means and standard deviations.

TABLE B-1

Chi Square Test of the Null Hypothesis that the Disbributions of the Variables "Percentage Change in Time Worked by the Head of the Household" and "Percentage Change in Real Income" are Approximately Normal.

Variable: Percentage Change in Time Worked by the Head of the Household
Range: -175.16 to 234.23 Mean: 2.44 Standard Deviation: 37.7

Intervals:	Observed Frequency (A)	Relative Frequency	Absolute Frequency (T)	$\frac{(A-T)^2}{T}$
1. -175.16 to -147.86	4	0	0	0.0
2. -147.86 to -120.57	3	.0006	.8556	5.37
3. -120.57 to -93.28	20	.0049	6.9800	4.49
4. -93.28 to -65.99	21	.0289	41.21	.10
5. -65.99 to -38.70	42	.1035	147.59	75.54
6. -38.70 to -11.41	219	.2215	315.86	29.70
7. -11.41 to 15.88	866	.2354	335.68	837.81
8. 15.88 to 43.17	152	.2193	312.72	82.60
9. 43.17 to 70.46	28	.1402	148.59	97.86
10. 70.46 to 97.75	20	.0302	43.06	12.35
11. 97.75 to 125.04	28	.0051	7.27	59.11
12. 125.04 to 152.33	9	.0006	.86	77.05
13. 152.33 to 179.62	8	0	0	0.0
14. 179.62 to 206.91	2	0	0	0.0
15. 206.91 to 234.23	4	0	0	0.0
Total Chi Square				1281.98

Table Chi Square Value with 13 degrees of freedom at the 10 percent probability level is 19.81.

Reject the null hypothesis since 1281.98 is greater than 19.81.

Variable: Percentage Change in Real Income
Range: -200.00 to 1890.75 Mean: .103 Standard Deviation: 59.26

Intervals:	Observed Frequence (A)	Relative Frequency	Absolute Frequency (T)	$\frac{(A-T)^2}{T}$
1. -200.00 to -179.10	0	.0009	2.57	2.57
2. -179.10 to -158.20	2	.0025	3.56	.68
3. -158.20 to -137.30	3	.0064	9.13	4.12
4. -137.30 to -116.40	3	.0148	21.10	15.52
5. -116.40 to -95.50	8	.0287	40.93	26.49
6. -95.50 to -74.60	11	.0501	71.44	51.13
7. -74.60 to -53.70	23	.0803	114.51	73.13
8. -53.70 to -32.80	80	.1071	152.72	34.63
9. -32.80 to -11.90	234	.1295	184.67	13.18
10. -11.90 to 9.00	643	.1389	198.07	999.45
11. 9.00 to 29.90	286	.1319	188.09	50.97
12. 29.90 to 50.80	77	.1136	161.99	44.59
13. 50.80 to 71.70	28	.0818	116.65	67.37
14. 71.70 to 92.60	13	.0537	76.58	52.79
15. 92.60 to 113.50	2	.0313	44.64	40.73
16. 113.50 to 134.40	4	.0165	23.53	16.21
17. 134.40 to 155.30	3	.0072	10.27	5.15
18. 155.30 to 176.20	0	.0029	4.14	4.14
19. 176.20 to 197.10	2	.0010	1.43	.23
20. 197.10 to 218.00	0	.0004	.57	.57
21. Greater than 218.00	1	.0001	.14	5.28
Total Chi Square				1508.93

Table Chi Square Value with 19 degrees of freedom at the 10 percent probability level is 27.20.

Reject the null hypothesis since 1508.93 is greater than 27.20.

TABLE B-2

Chi Square Test of the Hypothesis that the Distributions of the Estimated Probability of Feeling Better off and the Estimated Probability of Feeling Worse off are Approximately Normal.

Estimate of the Probability of Feeling Better off ($\hat{Y}^* = X'\hat{\beta}$)

Intervals	Total Sample Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$	Subsample of those who Chose "Better off" Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$	Subsample of those who Chose "Not Better off" Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$
1. Less than 0	6	.0009	1.2834	17.33	0	.2877	178.374	178.37	6	.0012	.967	26.19
2. 0 - .1	17	.0062	8.8412	7.53	4	.0423	26.23	18.83	13	.0101	8.141	2.90
3. .1 - .2	39	.0365	52.0490	3.27	7	.0407	25.23	13.17	32	.0530	42.72	2.70
4. .2 - .3	145	.1184	168.8400	3.37	37	.0736	45.63	1.63	108	.1593	128.39	3.20
5. .3 - .4	295	.2363	336.9600	5.22	97	.0198	12.27	585.09	198	.2724	219.55	2.10
6. .4 - .5	515	.2834	404.13	30.40	228	.0439	27.22	1480.99	287	.2774	223.58	17.90
7. .5 - .6	263	.2041	291.05	2.70	114	.0477	68.02	31.08	119	.1598	128.78	.74
8. .6 - .7	115	.0883	125.92	.94	80	.0469	29.08	89.16	35	.0549	44.24	1.90
9. .7 - .8	25	.0229	32.65	1.79	19	.0454	28.15	2.97	6	.0106	8.54	.75
10. .8 - .9	4	.0226	32.22	24.71	3	.0399	24.74	19.10	1	.0012	.96	.002
11. .9 - 1.0	1	.0003	.43	.76	0	.0412	25.54	25.54	1	.0001	.08	10.58
12. 1.0 and greater	1	0.0000	0	0	1	.2709	167.95	165.95	0	0	0	0
Total Chi Square				98.02				2611.88				68.96

Table Chi Square value for ten degrees of freedom at the 10 percent probability level = 15.9871

Total Sample: Mean: .435 Standard Deviation: .137 Sample size: 1426 Reject Normality — Reject Normality — Reject Normality

Subsample where the actual choice was "Better off". Mean: .478 Standard Deviation: .853 Sample Size: 620

Subsample where the actual choice was "Not Better off". Mean: .401 Standard Deviation: .132 Sample Size: 806

Estimate of the Probability of Feeling Worse Off ($\hat{Y}^* = X'\hat{\beta}$)

Intervals	Total Sample Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$	Subsample of those who Chose "Worse off" Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$	Subsample of those who Chose "Not Worse off" Observed Frequencies (A)	Relative Frequencies	Absolute Frequencies (T)	$\frac{(A-T)^2}{T}$
1. Less than 0	33	.0571	81.42	28.79	2	.3520	94.34	90.38	31	.0446	51.64	8.25
2. 0 - .1	184	.1726	246.12	15.68	12	.0532	14.25	.36	172	.1996	138.49	8.11
3. .1 - .2	689	.3102	442.34	137.54	83	.0589	15.78	261.36	606	.3759	435.29	66.94
4. .2 - .3	357	.2866	408.69	6.50	94	.0598	16.02	379.58	263	.2853	330.37	13.73
5. .3 - .4	99	.1361	194.08	46.58	42	.0593	15.89	42.90	57	.0861	99.70	18.29
6. .4 - .5	37	.0331	47.20	2.20	16	.0536	14.36	.18	21	.0102	11.81	7.15
7. .5 - .6	13	.0041	5.85	8.74	8	.0547	14.65	3.02	5	.0005	.58	33.68
8. .6 - .7	8	.0003	.42	136.80	6	.0507	13.59	4.24	2	0.0000	0.00	0.00
9. .7 - .8	2	0.0000	0.0	0.0	2	.0430	11.52	7.86	0	0.0000	0.00	0.00
10. .8 - .9	2	0.0000	0.0	0.0	2	.0412	11.04	7.40	0	0.0000	0.00	0.00
11. .9 - 1.0	1	0.0000	0.0	0.0	0	.0335	8.98	8.98	1	0.0000	0.00	0.00
12. 1.0 and greater	1	0.0000	0.0	0.0	1	.1401	37.55	35.58	0	0.0000	0.00	0.00
Total Chi Square				382.83				841.84				156.15

Table Chi Square value for ten degrees of freedom at the 10 percent probability level = 15.9871

Total Sample: Sample Mean: .188 Standard Deviation: .119 Sample Size: 1426 Reject Normality — Reject Normality — Reject Normality

Subsample where the actual choice was "Worse off". Mean: .26 Standard Deviation: .68 Sample Size: 268

Subsample where the actual choice was "Not Worse off". Mean: .17 Standard Deviation: .10 Sample Size: 1158

TABLE B-3

FREQUENCY DISTRIBUTION AND SUMMARY STATISTICS OF ESTIMATED PROBABILITIES OF FEELING BETTER OFF (A) AND FEELING WORSE OFF (B).

A. Ordinary Least Squares Estimate of the Probability of Feeling Better off (coded 1) versus Not Feeling Better off (coded 0).

	Total Sample N = 1426	Actual 0 N = 806	Actual 1 N = 620
*Range 1	6	6	0
Range 2	17	13	4
Range 3	39	32	7
Range 4	145	108	37
Range 5	295	198	97
Range 6	515	287	228
Range 7	263	119	144
Range 8	115	35	80
Range 9	25	6	19
Range 10	4	1	3
Range 11	1	1	0
Range 12	1	0	1
	Mean = 0.43478	Mean = 0.40141	Mean = 0.47816
	STD DEV = 0.13733	STD DEV = 0.13202	STD DEV = 0.85304

B. Ordinary Least Squares Estimate of the Probability of Feeling Worse off (coded 1) versus Not Feeling Worse off (coded 0).

	Total Sample N = 1426	Actual 0 N = 1158	Actual 1 N = 268
*Range 1	33	31	2
Range 2	184	172	12
Range 3	689	606	83
Range 4	357	263	94
Range 5	99	57	42
Range 6	37	21	16
Range 7	13	5	8
Range 8	8	2	6
Range 9	2	0	2
Range 10	2	0	2
Range 11	1	1	0
Range 12	1	0	1
	Mean = 0.18794	Mean = 0.17059	Mean = 0.26289
	STD DEV = 0.11868	STD DEV = 0.10121	STD DEV = 0.67577

* Probability Ranges

1. < 0	4. .2 - .3	7. .5 - .6	10. .8 - .9
2. 0 - .1	5. .3 - .4	8. .6 - .7	11. .9 - 1.0
3. .1 - .2	6. .4 - .5	9. .7 - .8	12. > 1.0

APPENDIX C

Comparison of Likelihood Ratio Index and Adjusted Likelihood Ratio Index

The Likelihood Ratio Index depends on the relative proportions of sampled individuals selecting the various alternatives which comprise the dependent variable in logit analysis. Tardiff (1976) proposes an Adjusted Likelihood Ratio Index which measures the explanatory power of the model in addition to the variance explained by the constant. (See Chapter V, footnote 63 for a full explanation). The Adjusted Likelihood Ratio Index is more accurately compared with the R^2 measure of the goodness of fit obtained from ordinary least squares analysis.

Table C-1 gives the Adjusted Likelihood Ratio Indices for seventeen of the binary logit models in this study and compares them to the reported Likelihood Ratio Indices.

TABLE C-1

Comparison of Likelihood Ratio Indices and Adjusted Likelihood Ratio Indices for Binary Logit Models Estimating the Probability of Perceived Changes in Household Welfare.

	Likelihood Ratio Index (LRI)	Minimum LRI Possible[1] (Percent of Response choosing one alternative)	Percentage Greater Than Minimum LRI	Adjusted Likelihood Ratio Index[2]	R^2 from Ordinary Least Squares Analysis (When Available)
Logit Model 1 (Probability of Feeling Better off)	.07	.013 (.40)	81	.056	.0767
Logit Model 2 (Probability of Feeling Worse off)	.374	.30 (.20)	20	.11	.092
Logit Model 4 (Probability of Feeling Worse off Omitting Those Who Felt Better off)	.143	.08 (.67)	44	.066	
DEMOGRAPHIC GROUPS					
Marital Status (Probability of Feeling Worse off with Total Sample)	.364	.30 (.20)	17.5	.09	
Marital Status (Probability of Feeling Worse off with Singles Only)	.199	.07 (.70)	65	.136	
Marital Status (Probability of Feeling Worse off with Married Only)	.420	.35 (.83)	16.6	.104	
Income Greater Than $10,000. (Probability of Feeling Worse off)	.459	.41 (.85)	10.6	.09	.075
Income Greater Than $5,000. (Probability of Feeling Worse off)	.40	.345 (.83)	14	.089	
Income Less Than $5,000. (Probability of Feeling Worse off)	.26	.113 (.70)	57	.170	
Rurality (Probability of Feeling Worse off with Total Sample)	.37	.26 (.80)	30	.153	
Rurality (Probability of Feeling Worse off with Rural Dwellers)	.43	.23 (.83)	47	.26	
Rurality (Probability of Feeling Worse off with Urban Dwellers)	.36	.29 (.80)	21	.11	
Age (Probability of Feeling Worse off with the Total Sample)	.359	.30 (.82)	16	.08	
Age younger than 35 (Probability of Feeling Worse off)	.457	.387 (.85)	15	.12	
Age Between 35 and 45 (Probability of Feeling Worse off)	.364	.28 (.80)	23	.12	
Age Between 45 and 55 (Probability of Feeling Worse off)	.2969	.24 (.78)	19	.08	
Age older than 55 (Probability of Feeling Worse off)	.4033	.31 (.81)	23	.14	

1/ Calculated as 1 - [Log Likelihood at Constant/T(log .5)] (Tardiff, 1976, p. 7)
The minimum possible value of the Likelihood Ratio Index is the lower bound calculated with only a constant in the model.

2/ Adjusted Likelihood Ratio = 1 - (Log Likelihood at Convergence/Log Likelihood at Constant)
Log Likelihood at Constant = N Log (N/T) + (T - N)Log (T-N/T) where N = number of respondents who selected the first alternative. T is the total sample size.

APPENDIX D

Appendix D

Correlation Coefficients for Explanatory Variables in Logit Models I and II on Table 5-2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Change in ratio of installment debt/liquid assets	1																		
2. Change in ratio of installment debt/ nonliquid assets	.0833																		
3. Change in ratio of noninstallment debt/ liquid assets	.1256	-.0211																	
4. Change in ratio of noninstallment debt/ nonliquid assets	-.0010	.0216	.0279																
5. Change in ratio of investment debt/ liquid assets	.0407	.0007	.0197	.0002															
6. Change in ratio of investment debt/ nonliquid assets	.0009	.0227	.0003	.0006	.1867														
7. Percentage change in real income	-.0163	-.0085	.0084	.0001	.0135	.0045													
8. Percentage change in time worked by head of household	.0106	-.0202	.0330	.0144	-.0139	-.0051	.0783												
9. Percentage change in time worked by spouse	-.0941	.0313	-.0284	.0001	-.0004	.0005	.1061	-.0098											
10. Number of weeks unemployed	.0095	-.0070	-.0033	.0121	.0019	-.0089	-.0447	-.0487	-.0029										
11. Family size	-.0081	-.0163	-.0306	.0299	-.0317	.0176	.0306	-.0258	.0274	.0755									
12. Unusual Expenses	.0114	.0406	.0576	.0138	-.0085	-.0110	-.0340	-.0416	-.0337	.0083	.0081								
13. Age younger than 35	.0306	.0252	.0095	.0179	.0530	.0737	.0324	.0414	.0053	.0243	.1202	-.0321							
14. Age between 35 and 45	-.0395	-.0227	-.0377	.0185	-.0382	-.0267	-.0074	.0260	-.0357	.0182	.3244	-.0034	-.3370						
15. Age older than 55	.0138	.0012	.0116	-.0555	-.0108	-.0135	.0251	-.0437	-.0049	-.0240	-.4016	-.0021	-.2912	-.3006					
16. Marital status-single	.0054	-.0012	.0068	-.0463	-.0040	-.0092	-.0593	-.0003	-.1250	.0635	-.3368	-.0161	-.0758	-.0394	.1124				
17. Rurality	.0073	.0069	-.0056	-.0369	-.0012	.0224	.0227	.0448	.0430	-.0102	.0187	.0117	-.0368	-.0191	.0369	-.0786			
18. Education-College degree	.0032	.0286	-.0597	.0189	-.0132	-.0415	.0058	.0635	.0033	-.0582	-.0302	.0426	.0371	.0290	-.0585	.0091	-.1249		
19. Race-nonwhite	.0043	-.0288	-.0001	.0105	.0792	-.0063	.0087	-.0431	-.0008	.0906	.0756	-.0615	.0112	.0129	.0149	.1788	-.0436	-.1048	

APPENDIX E

THE STATE OF THE UNITED STATES ECONOMY IN 1969 AND 1970

The general economy in 1969 and early 1970 was in a state of mild recession. Beginning in mid 1968 personal savings began to increase and consumption declined. Between 1968 and 1969 there was a ten percent increase in the average liquid assets held by family units. During this same time there were frequent and large gains in personal income. Installment debt increased twelve percent per family unit and the number of family units holding debt increased two percent. The percentage of family units refinancing debt increased from 4.8 to 5.4. Liquid assets did not increase further in 1970. (Katona, George, Survey of Consumer Finances, 1969)

Fiscal and monetary policy included a tax surcharge which seemed to have little effect in the face of rising incomes. However, government spending declined and the national budget went from having a deficit to having a surplus. (U.S. Board of Governors, Federal Reserve System, Federal Reserve Bulletin, January, 1970)

Inflationary prices, tight money, high interest rates, a decline in employment, the end of the war, and a slowing in income gains[1/] led to a decline in consumer sentiment beginning in mid 1969. The Michigan

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1/ The median household income for 1969 was $8,389; 8.3 percent greater than 1968
The median household income for 1970 was $8,730; 4.1 percent greater than 1969
The median family income for 1969 was $9,400; 9.3 percent greater than 1968
Real income increased 3.7 percent between 1968 and 1969.
Real income increased 0.0 percent between 1969 and 1970.
(U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-60, Numbers 72, 75, and 79.)

Survey Research Center reported that only sixty-one percent of those whose income had increased reported being financially better off in 1969. In 1970, fifty-five percent reported larger incomes for the past year but only twenty-eight percent of these family units reported feeling better off. In the early part of 1970, the index of consumer sentiment was higher for low income family units (those earning less than $5,000) than it was for higher income families. This has not happened since 1946. (Katona, George, Survey of Consumer Finances, 1970) In 1970, the crucial question was how long the recession would last.

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