1986

Time use of single and married women in the home

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single and married women
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by

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A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE

Major: Economics

Iowa State University
Ames, Iowa

1986

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CHAPTER I: INTRODUCTION

Purpose

The purpose of this thesis is twofold. First, it is to describe the mean amount of time that American women spend in each of eight specific household tasks. Second, it is to explain variation in and to estimate the mean amount of time that American women spend on total household task performance.

Histograms and analysis of variance are used to accomplish the first purpose. The histograms provide a visual comparison of the mean amount of time that women, grouped according to marital status, presence or absence of minor children in the household, and employment status, spend in each of the eight specific household tasks. These eight tasks represent all work accomplished that pertains to household task performance. Time spent on personal care, leisure activity and activity outside the household which is not related to household work is excluded from this analysis.

Analysis of variance is used to compare the means and to assess the impact of marital status, presence or absence of minor children in the household and employment status on the mean amount of time spent on each task.

Regression analysis is used to accomplish the second purpose. As a part of this analysis, women are grouped according to employment status. It is recognized that labor force participation does not occur on a random basis. Rather, it is a decision which is influenced both by a woman's personal characteristics and the characteristics of her family. The non-random aspect of labor force participation precludes unbiased estimation of the parameters in the equations which pertain to women who are employed and to women who are not employed when ordinary least squares regression is used. A correction of the bias, based on a method proposed by Heckman (1979), is developed using logistic regression to ascertain the probability that a woman will participate in the labor force. This correction provides separate estimates of the value of the bias for those women who are employed and for those women who are not employed. These estimates, when included in the ordinary least squares regression equations for each respective group of women, act as a control for the selection bias.

In addition to the problem of selection bias, the problem of measurement error is recognized and steps are taken to decrease its effect. Measurement error may arise with respect to the measurement of the wage received by women who are employed. This error can occur because it often happens that the employment history of women may include periods of time when they work part of the year and/or part time during the year. If asked to report their labor income during the time that they are not employed or are employed part time rather than full time, their response will underestimate these earnings where they are concerned.

Four models of the relationship between the amount of time that women spend in household task performance and the factors expected to influence that amount of time are presented. The empirical results of these four models are submitted to two comparisons. First, the results of all four models are compared against a similar model developed and tested by Gronau (1980). Second, selected aspects of each of the four models themselves are compared.

Four examples are presented which illustrate how the equations which estimate the amount of time that women spend in household work can be used to calculate the amount of time that a particular woman could be expected to spend in household work, depending on her characteristics and those of her family. These equations can be used by persons who need to make an estimate of the contribution which a woman makes to her household. For instance, economists who are asked to estimate a monetary judgment to be awarded in the settlement of a tort case concerning the wrongful injury or death of a homemaker may find these equations useful.

Data

General characteristics of the data set

The data used for empirical work in this thesis were obtained from the 1975-1981 Time Use Longitudinal Panel Study. Eight waves of data were collected for this panel study, four in 1975-1976 and four in 1981. The data collected in 1981 are used in this thesis.

The panel study was conducted by Dr. F. Thomas Juster, Dr. Frank Stafford, Dr. Martha Hill and Dr. Jacquelynne Eccles Parsons. Funding for the panel study was provided by the National Science Foundation and by the Foundation for Child Development.

The goal of the panel study was to provide an accurate estimate of yearly productive time use in American households. The study was carefully designed to accomplish this end. Panel participants were residents of 37 states in the coterminous United States and the District of Columbia. Participants in the 1975-1976 portion of the panel study were randomly selected to form a representative sample of American adults over age 18 living in the coterminous United States. Data were collected from both heads of household and spouses of household heads. Participants in the 1981 portion of the panel study were those from whom three or four waves of data had been collected in the 1975-1976 study, and who were either heads of household or spouses of household heads in 1975. The number of panel participants did decrease over time. The 1975 sample began with 1519 respondents and 887 spouses. The 1981 sample began with 620 respondents and 376 spouses. Since there was no way to control which respondents and spouses dropped out of the study and which respondents and spouses remained in the study, the 1981 sample cannot be considered as representative as the 1975 sample.

Interviews were carefully timed to accurately reflect time use patterns over the year. The survey design was virtually identical in the initial study in 1975-1976 and in the follow-up study in 1981. In each study, four interviews were conducted over the period of a year. This spacing of interviews accomplished two ends. First, seasonal differences in time use were captured as each interview took place during a different season of the year. Second, differences in time use due to day of the week were captured as interviewers gathered information regarding the way participants spent at least one weekday, a Saturday and a Sunday. At the conclusion of each study, information on time use was weighted and compiled to form a synthetic week for each panel participant that had given time diary information at least three times during the year. The synthetic week, in essence, was a time budget that delineated the number of minutes per week spent in each of

223 mutually exclusive and exhaustive activities. This study will focus on the number of minutes per week which adult females spent in activities related to care of the household and of the household members.

Interviews were administered both in person and by telephone. At every wave of data collection, panel participants were asked to recall the way they had spent each of the previous 24 hours. In addition to recalling time use, panel participants were asked questions regarding their health, employment history, earned family income, unearned family income, stock of household capital, and physical characteristics of their housing.

Preparation of data set for analysis

The original data are contained in two separate files: a household and respondent file and a household and spouse file. Not all respondents were married, therefore the household and respondent file was larger than the household and spouse file. Both the household and respondent file and the household and spouse file contained male and female individuals. To facilitate analysis, a single file was created that contained the variables of interest that pertained to both the single women and the married couples. Creation of this file involved several steps. First the female heads of household were separated from the male heads of household in the household and resondent file. Second, the female spouses were separated from the male spouses in the household and spouse file. Third, the females, both single and married, were grouped together into a single file. Fourth, family identification numbers were used to match each married female respondent with the appropriate male spouse and to match each female spouse with the appropriate male respondent. As a part of this matching process, the size of the record of each married male was reduced. Only specific variables of interest to this study were retained. Fifth, the record of each married male in the sample was placed at the end of his wife's record. The result of this elaborate process was a new file that contained the variables of interest to this study for all single women and all married couples in this sample.

Preliminary analysis of the data revealed the fact that some variables had missing data. It is a usual proceedure to replace missing data with some reasonable estimate. Commonly, a measure of central tendency such as the mean, the median, or the mode is used for this estimate. The measure of central tendency chosen usually depends on the customary practice in a given field of study. Alternatively, an estimate can be computed from other available information. In this study, however, it was decided to omit those cases that had missing data on key variables. This decision affected both the size and the nature of the sample. Records of time use were not available for 121 women involved in the 1981 panel study. Since it was thought important to have an accurate report of time use and there was no reliable means available to compute an accurate estimate of time use, these cases were omitted from the analysis. An additional case was omitted from analysis due to lack of information regarding marital status.

Elimination of these cases from consideration in the analysis in this thesis reduced the number of cases studied from 559 to 437. Both the descriptive analysis and the regression analysis begin with the same 437 cases. Different selection criteria is then imposed within each analysis. The specific criterion used is discussed as a part of the description of each analysis and, thus, is not addressed here. Note that the elimination of cases, both at this point and prior to specific analysis, does affect the random nature of the data. To the extent that, those excluded from consideration in this study on the basis of missing data share common characteristics that are not shared with those who remain in the study, the sample becomes less random and hence, less representative of the population as a whole.

Organization

This thesis is organized as follows. Chapter II contains a review of related literature from both the Home Economics and the Economics disciplines. Chapter III presents a descriptive analysis of the amount of time that women spend in household related work. The women are grouped according to their marital status (single or married), parental status (minor children present in the home or not), and employment status (employed or not employed). Household related work is disaggregated into eight subgroups. Chapter IV outlines the regression analysis of total hours worked in the household as a function of various human capital and demographic variables while controlling for sample selection bias. Chapter V presents the empirical results of this regression analysis. Selected aspects of these empirical results are compared across the models used in this thesis and against prior work of a similar nature. The thesis concludes with a brief summary. Some technical aspects of the data and estimation techniques are covered in the appendices.

CHAPTER II: REVIEW OF LITERATURE

In recent years, much attention has been focused on the increased labor force participation of women. As the proportion of women in the labor force has grown, research on the relationship between women and work has expanded. This research has revealed interesting and important information. Yet, the focus on women who either are entering the labor force or are already a part of the labor force tends to obscure an important fact. Women make a substantial contribution in an area outside the labor force - the household.

How is this contribution to be measured? In a market based economy there is no easy answer to this question. In the context of such an economy, the value of a particular good or service is assumed to be equal to the price paid to obtain possession and/or use of the same. But, no dollar price is paid for the goods and services that women provide within their own homes. In absence of dollar price, any measure of women's productive efforts in their respective households must depend on imputation and estimate.

Measurement of women's productive efforts within the household has been of interest to professionals in the fields of home economics and economics. Time-use has served as a unit of measure of productive activity within the household within each of these fields. In general, studies of time use can be broadly classified as empirical or theoretical. A majority of the empirical studies of time use have been envisioned and developed by home economists. Theoretical development of the concept of time as a resource for and as a constraint on productive activity in the home and econometric analysis of time use has come from economists.

Empirical Studies

Home economists have made a large contribution to the study of time use within the household. Most time use studies have been conducted under the direction of the Agricultural Experiment Stations in co-operation with the land grant colleges in the United States. The work of home economists begins early in the 20th century and has continued to the present time.

Over the years, home economists have used studies of the allocation of time within the household to serve a variety of different purposes. In the early 1900's, home economists applied methods used in studies of farm management to study the workload of the rural homemaker (Bailey, 1915; Bailey and Snyder, 1921). The purpose of these studies was to find ways to reduce the physical burden of the rural homemaker's job. The size of the physical burden was measured by the amount of time required for task performance.

The rise of industry in the United States had several effects on the study of time use among home economists. One, industrialization widened the focus of time use studies. Non-rural populations began to be included as a unit of analysis (see, for example, Crawford, 1927; Arnquist and Roberts, 1929; Wilson, 1929; Whittemore and Neil, 1929).

Two, industrialization altered the method of inquiry. Prior to this time, methods used to study farm management were adapted to study the farm household. In the early 1920s methods developed to study efficiency and production within the factory were adapted to study the rural and non-rural household. In particular, the methodology that Frank and Lillian Gilbraith developed to study the use of time and motion within the factory was used to study the use of time and motion within the household (Gross and Crandall, 1947). Researchers used measures of time use to find and to develop ways to improve home management through simplification of household tasks. Studies of this nature were carried out by Muse (1946), Wiegand (1954), and Steidl (1963).

Three, industrialization raised new questions to answer. As electricity, indoor plumbing and household appliances became available, some household tasks, such as lighting the gas lanterns, were eliminated. Other household tasks, such as washing clothes, became more captial intensive and less labor intensive. Time use studies conducted in the 1920s document this time of transition. As might be expected, researchers found that rural areas adopted the new technology at a slower rate than did urban areas. For example, in 1926-1927, Wilson (1929) found 43% of Oregon farm homes had neither electricity nor indoor plumbing. Whittemore and Neil (1929) report 75% of the homes they studied in Rhode Island had electric lights and 83% had plumbing.

Studies of time use in the home were used to assess the impact of acquisition and use of electricity, plumbing and household appliances on time spent in household task performance. Several researchers assert that these products of industry did not reduce the time needed for household task performance (Arnquist and Roberts, 1929; Richardson, 1933). As the goods available for the household have both increased in number and changed in nature over the years, studies of time use have been employed to investigate the impact of innovation on time required for household task performance (see, for example, Dickins, 1945; Wiegand, 1954; Hall and Schroeder, 1970; Nickols and Fox, 1983).

The increased labor force participation of women further influenced the purpose of time use studies conducted by home economics professionals. By the 1950s, home economists had begun to recognize the existence of the employed married woman and to compare her with the married full-time homemaker with respect to time spent on household task performance (Wiegand, 1954). A decade later, the hours that homemakers spent in the work force had become an essential component of time use studies. In recent research, time use of both husbands and wives has been examined to analyze the division of labor within the household (Sanik, 1981; Fox and Nickols, 1983; Abdel-Ghany and Nickols, 1983). In this thesis, the impact of a woman's employment status on her household work time is examined. Only her time use, and not that of her family, is considered.

Home economists have also pursued the study of time use within the household as a means of quantifying and valuing productive activity within the household. Warren (1938, 1940) adapted a measure of agricultural productivity, the farm work unit, to measure household production. The work unit is a measure of the amount of output in a given activity by an average worker in a given time unit under certain conditions. The use of time as the unit of measure allows comparison and/or summation of otherwise diverse and distinct activities. Her approach was replicated by Wiegand (1953), Walker (1955, 1958) and Manning (1968). Gage (1960) uses the work unit as a basis for placing a monetary evaluation on unpaid work performed within the household. Walker and Woods (1976) adapt the concept of the household work unit to include family composition which is measured by the number and ages of the children. Five categories of activity are included in their measure of household work: food preparation, care of family members, care of the house, care of clothing, marketing and management. It is this study that suggested the broad outline of the descriptive analysis presented in this thesis. Note also that in the data set analyzed in this thesis that time serves to quantify the productive effort that a woman devotes to a given household task or to all household related work in general.

While the work of Walker and Woods represents an improvement over earlier studies, it is limited in scope. One region of the country is observed, upstate New York, and one type of family is included in the study, those with two parents and two children. The decision to limit the sample to one region was due to financial constraints. The decision to focus on only one family type was made in an effort to facilitate comparison of results with other studies. Several years later, the work of Walker and Woods did serve as a basic pattern for a study of household time use in which 11 states participated (Family Time Use: An Eleven State Urban/Rural Comparison, 1981). This, in effect broadened the scope of Walker and Woods original study. The two-parent, two child family format was retained, however.

Theoretical Studies

In general, the studies conducted by home economics professionals are descriptive in nature. Most of these studies focus on the efforts of the wife alone. Some studies, notably those which date later in time, do consider the efforts of husband and children in the home. Home economists have, in general, worked to answer the question "How is time allocated within the household?". Economists have taken a different approach to the study of time use. Economists have offered an answer to "Why is time allocated in the household in a given manner?". Consequently, the studies conducted by economists are analytical in nature.

Interest of economists in the allocation of time within the household began to rise after publication of Becker's article "A Theory of the Allocation of Time" (Becker, 1965). In this article, Becker proposes a view of the household that differs from traditional, accepted micro-economic theory. In the context of traditional theory, the household is viewed as a unit which maximizes satisfaction by consuming the products of industry. In contrast, Becker asserts that the household unit is not a passive consumer. Rather, the household unit is actively engaged in a production process in which time is combined with market goods to produce utility or satisfaction. Thus, market goods are not consumed for their own sake alone, but become factors of production for which there is a derived demand.

The concept of household as producer was further refined and developed by other economists such as Muth (1966), Lancaster (1966), Michael and Becker (1973). Over the years, the set of equations which describe the behavior of the household as a producer of own utility have come to be called the "new approach to consumer theory" (Gronau, 1973a, p. 634) or the "new home economics" (Reid, 1978, p. 181).

Both the usefulness and the newness of this approach has been challenged (Pollack and Wachter, 1975; Reid, 1977; Robinson, 1977). Criticism notwithstanding, the concept of the household as a unit which uses market goods and time to produce own utility revolutionized study of the household within the economics profession.

Classical theory of the household as consumer treated "household" as synonymous with "individual" (Gronau, 1973a, p. 634). In contrast, viewing the household as producer allowed recognition that the time of one or more family members may be involved in the production process. Classical theory of the consumer assumed that only money income constrained welfare or utility maximization. The "productive household" explicitly recognizes that time is a scare resource which must be allocated among the competing and mutually exclusive ends of work in the market, work at home or leisure (Gronau, 1977). Total available time thus becomes a further constraint on welfare or utility maximization. The inclusion of time as an exogenous variable in economic models of individual choice behavior allows economists to examine the "why" of time allocation.

The model of household as producer has been used to explain decisions made within the household on topics such as fertility, (Rotterberg, 1975), child quality (Becker, 1981), and division of labor between husband and wives (Becker, 1981). The model has also been used to examine the relationship between education and non-market production (Leibowitz, 1974).

In an article entitled "Household Production - A Forgotten Industry," Gronau (1980) estimated the amount of time that married women spent in household work. The equations employed in this thesis to explain the variance in and to estimate the mean amount of time that women spend in household task performance closely parallel the equations Gronau developed in this article. Therefore, a detailed review of his work in that article is relevant here.

Beginning with the conventional theory, Gronau assumes that an individual's welfare (W) depends on goods (X) and leisure (L):

$$U = U(X,L). \tag{2.1}$$

The goods come from two sources: market purchase (X_m) or home production (Z). Market prices are used to measure home production. Market inputs (X_h) and time inputs (work at home, H) are used to produce goods at home. The home production process is subject to decreasing marginal productivity. Thus:

$$X = X_m + Z \tag{2.2}$$

$$Z = f(X_h, H). \tag{2.3}$$

Welfare maximization in this one-person, one-period model is subject to two constraints. One, market consumption cannot exceed money income:

$$X_m + X_h = WN + V \tag{2.4}$$

W is the wage rate, N is work in the market and V is non-wage income. Two, time, a scarce resource, is allocated to work at home (H), work in the market (N) and (L):

$$L + H + N = T \tag{2.5}$$

If the person works in the market ($N > 0$), the constrained welfare maximization yields:

$$f_h = s = W \tag{2.6}$$

where f_h is the marginal productivity of work at home and s represents the marginal rate of substitution between leisure and goods.

If the person does not work in the market (N = 0), the constrained welfare maximization excludes consideration of the market wage and

$$f_h = s. \qquad (2.7)$$

The purpose of Gronau's paper was to estimate the dollar value of work at home. In theory, a direct estimation of equation (2.3) would yield such an evaluation. In practice, difficulties arise. Z cannot be directly observed. Market goods used in home production (X_h) are not easily distinguished from market goods used for consumption (X_m). Consequently, Gronau chose an indirect approach. He estimated the marginal productivity of time in household production and then integrated this function to obtain the value of work at home or home production.

He explicitly assumes the functional form of the marginal productivity at home function is semi-log:

$$\ln f_h = A_0 - A_1 H + A_2 Y \qquad (2.8)$$

where Y represents a vector of variables that affect the value of marginal productivity at home. Gronau then states:

Given this specific function of the equilibrium condition (2.6) one can derive the work at home function for labor force participants:

$$H = (A_0 - \ln W + A_2 Y)/A_1 . \qquad (2.9)$$

Estimating this function,

$$H = a_0 - a_1 \ln W + a_2 Y \qquad (2.10)$$

one derives the estimates of the parameters A_i:

$$(1/a_1) = est(A_1),$$

$$(a_0/a_1) = est(A_0),$$

$$(a_2/a_1) = est(A_2). \qquad (2.11)$$

(Gronau, 1980, pp. 408-409)

Gronau uses the data in the Michigan Panel Study of Income Dynamics on the white, employed, married women to obtain parameter estimates. He estimates the parameters of equation (2.10) in two steps. First, the market wage of the wife was imputed. The wage was imputed to reduce measurement error. Statistics on labor force participation usually only present weekly or annual earnings. Some women, however, chose to work part time during the week and/or part of the year. This pattern of market work can be observed among married women and among women with young children at home. Direct measure of dollar earnings could omit data on women whose labor force participation is less than full time and/or not continuous over the year.

The imputed wage is a function of the education of the wife (EDUCW), her labor force experience since the age of 18 (EXPRNW), the experience variable squared, and the education of the husband (EDUCH). Gronau found:

$$\ln W = \underset{(3.83)}{-.4237} + \underset{(8.34)}{.0827}EDUCW + \underset{(2.25)}{.0186}EDUCH + \underset{(5.48)}{.0331}EXPRNW \underset{(3.39)}{-.0006}(EXPRNW)^2$$

$$R^2 = .16 \qquad (2.13)$$

Second, Gronau used the estimated wage obtained in equation (2.13) to estimate the number of hours the employed, married women in the sample devoted to work in the home.

To comprise the set of explanatory variables, Y, Gronau chose:

> wife's age and education, the husband's education and wage rate, the family's non-earned income, the number of children, the age of the youngest child, and the number of rooms in the house (Gronau, 1980, p. 410).

He further states :

> Education and on-the-job training (i.e. age) are expected to increase the wife's marginal productivity at home the same way they affect productivity in the market. Children increase the value assigned to the wife's services and, hence, should increase her marginal productivity at home,

> though this increase may taper off as the child grows older. Similarly, the value of marginal producivity may increase with the size of the house as measured by the number of rooms. The husband's wage and education and the family's non-earned income are proxies for the other inputs in the home production process (Gronau, 1980, p. 410).

He found:

$$H = \underset{(4.63)}{852.51} + \underset{(3.35)}{7.526}\ AGEW + \underset{(2.25)}{46.168}\ EDUCW + \underset{(2.58)}{25.813}\ EDUCH$$

$$- \underset{(0.56)}{4.614}\ WAGEH - \underset{(1.22)}{1.879}\ OTHINC + \underset{(9.58)}{190.080}\ CLD$$

$$- \underset{(3.56)}{17.494}\ AGEYC + \underset{(1.80)}{30.617}\ ROOMS - \underset{(5.18)}{1009.743}\ EXPWAGE$$

$$R^2 = .158 \qquad (2.14)$$

(Gronau, 1980, p. 410).

Gronau uses the result obtained in equation (2.14) to calculate an estimate of the value of time in household production. Estimation of the value of time in household production is beyond the scope of this thesis. For the purpose of this thesis, it is Gronau's work with respect to time spent in the household, not value of time spent in the household that is of interest.

The approach taken in this thesis differs from Gronau's in several ways. The first and most significant difference is that in this thesis the problem of selection bias is explicitly recognized and steps are taken to lessen it's effect. Gronau chose to ignore the effect of selection bias with respect to labor force participation in the wage and labor supply functions (equation (2.13) and equation (2.14))(Gronau, 1980, p. 410). Second, the set of women is broader than the one encompassed by Gronau. Specifically, Gronau estimated the household labor demand function for employed, married women only. In this thesis, marital status is entered as a control variable in the equations which pertain to estimation of time spent in household work. The inclusion of this control variable permits consideration of both women who are employed, whether single or married and women who are not employed, whether single or married. It is then possible, for example, to estimate the amount of time a single mother contributes to work in the household. Third, Gronau uses data from the Michigan Panel Study of Income Dynamics. While these data are an excellent source of information about family income and financial resources, the panel study includes only limited information about time spent in household work. The information used by Gronau is, in fact, the report of the husband on the amount of time his wife spent in household work. Besides the obvious limitations introduced by asking the one who did not perform the work to report how much time the job required, the term "household work" was described in only general terms. Therefore, it is not possible to ascertain how much time was allocated to a specific activity. Nor is it possible to be certain what panel respondents chose to include or to exclude from their report of "household work." The data which pertain to work related to household task performance is carefully classified in the Time Use in Economic and Social Accounts data set. Thus, it is possible to ascertain how much time was spent on a particular activity, such as meal preparation. The activities which comprise time spent in household task performance in this thesis are explicily listed in Appendix A. Thus, no ambiguity exists as to what has been included or excluded from this use of time. Fourth, this thesis uses a more recent data set. The data which Gronau used were collected in 1974. These data pertained to 1973. The data which are used in this thesis were collected in 1981. The data pertain to 1981 and 1980. It is expected that the equations estimated in this thesis will be superior to the equations estimated by Gronau (1980). The equations estimated in this thesis take selection bias into account, a more recent and superior data set is used, and women who are single and women who are not employed are considered.

CHAPTER III: DESCRIPTIVE ANALYSIS

Variables

The variables of interest to the descriptive analysis are those that describe the marital status and the employment status of the adult female panel participants, those that indicate whether or not minor children are present in the home and those aspects of time use in the synthetic week that pertain to care of the household and care of family members.

The martial status of the woman was indicated by a variable which describes family composition. For the purposes of the descriptive analysis, a woman was considered single if she had no spouse present in the home. She was considered married if she did have a spouse present in the home.

The employment status of the woman was based on her own report of employment status in the first wave data collection in 1981. If the woman spent no time in the labor force at all, she was categorized as not employed. If she spent any time in the labor force, whether part time or full time, she was categorized as employed. Separation of those that worked full time from those that worked part time was considered. However, a small sample size made this division impractical.

The presence or absence of minor children was ascertained in two steps. First, it was determined whether or not the household contained any children. Clearly, if no children of any age are a part of the household, minor children are absent. Then, if the household did contain children, the presence or absence of minor children was indicated by the age of the youngest child. If the youngest child was 18 years of age or older, no minor children were present in the home. If the youngest child was 17 years of age or younger, minor children were present in the home. Note that, in the descriptive analysis, the number of children in the home is not measured. Thus, if the youngest child is under 18 years of age, it is certain that one minor child is in the home. It is possible that more than one minor child may be present.

Note that the variables described, marital status, employment status, and presence or absence of minor children are categorical variables. A woman is married, or she is not. She is employed, or she is not. She has minor children in the home, or she does not. In contrast, the amount of time invested in the care of household members and the care of the household is measured on a continuous basis in terms of the number of minutes per week.

The variables that pertain to the care of household members and to the care of the household were created from information reported in the synthetic week. This involved several steps. First, from the list of all 223 activities, those activities that related to care of the household and to care of household members were separated out from all other activities. Second, specific categories of time use in the household were gathered into more general areas. The general areas are meal provision, care of house, care of grounds, care of household durables, care of clothing, care of adult family members, care of child family members, marketing and management. Time spent in the general area was the simple sum of time spent in the more specific area. The specific items included in each of the eight general categories of household time use are listed in Appendix A.

Method of Analysis

The variables marital status, presence or absence of minor children in the home and employment status were used to develop a typology of family types:

Family type I: single woman
no minor children present in the home
woman not employed

Family type II: single woman
no minor children present in the home
woman employed

Family type III: single woman
minor children present in the home
woman not employed

Family type IV: single woman
minor children present in the home
woman employed

Family type V: married woman
no minor children present in the home
woman not employed

Family type VI: married woman
no minor children present in the home
woman employed

Family type VII: married woman
minor children present in the home
woman not employed

Family type VIII: married woman
minor children present in the home
woman employed

The numbers associated with the family type simply serve as an abbreviated label. No rank or order is implied. Note, the family types may be grouped according to a shared characteristic. Single women are represented in family types I, II, III, IV. Married women are represented in family types V, VI, VII, VIII. Those women in family types III, IV, VII, VIII have minor children present in the home. Those women in family types I, II, V, and VI do not. The employed women are represented in family types II, IV, VI, VIII and the unemployed women are represented in family types I, III, V, VII. Awareness of these groupings can facilitate understanding of the histogram analysis presented in a later section.

Crosstabulation analysis was used to reveal the number of women in each family type. Breakdown analysis was used to discover the mean number of minutes per week women in each of the eight family types spent in each of eight household related activities: meal provision, care of the house, care of the grounds, care of household durables, care of clothing, care of adult family members, care of child family members, and marketing and management. If a woman did not spend any time at all in a given household activity, her case was selected out for the analysis of that activity only. Thus, for example, if a woman did not spend any time in meal preparation during the synthetic week, her case was excluded from the computation of the mean number of minutes per week that women in the panel study spent engaged in that activity. This procedure was followed for each of the eight activities. Consequently, the amount of time spent in any of the eight household related activities reflects only time spent by those women who engaged in those activities at all. Crosstabulation analysis was then used to ascertain the proportion of women in each family type that spent no time at all on each of the eight household related activities. To accomplish this end, each family type was represented by a single digit. Family type I was represented by the number one. Family type II was represented by the number two, etc. The eight categories of household activity were each recoded. If the activity was not done at all, the activity was coded zero. If any time at all was spent on the activity, it was coded one.

Crosstabulation of activity by family type was then computed.

Analysis of variance was calculated to learn whether or not a statistically significant relationship existed between household activity and family type. As with the calculation of the mean amount of time spent by women in various family types, individual cases were excluded when no time at all was spent on the activity.

Findings

The Statistical Package for the Social Sciences (SPSS Inc., 1983) was used to analyze the data for the descriptive analysis.

Variable characteristics

The descriptive analysis was based on 437 valid cases. These cases represented 116 single women and 321 married women. Ages of the women ranged from 21 years to 89 years.

No minor children were present in 224 households. The youngest child was 17 years of age or younger in 213 households. Care of preschool children is more time intensive than care of school age children. It is recognized that placing all children from birth to age 17 in one group may have introduced bias into the results. Unfortunately, the small sample size prevented further categorization of the children present in the household by age. It is of interest to note that preliminary analysis did reveal that 73 households had children under 5 years of age. Of the remaining households, 140 had at least one child present aged 5 through 17 years of age, and 224 households either had no children at all, or the "child" was of sufficient age to be considered an adult.

A greater number of women in the sample were employed than were unemployed. Only 191 women were not employed at all, while 246 women worked one or more hours per week. Here also, a small sample size limited more complete analysis.

Part time work differs from full time work in its affect on time use in the household, if for no other reason than fewer hours per week are committed to activity outside the home. It would have been preferable to divide the employment status variable into three categories: not employed, employed part time, and employed full time. In the panel survey questionnaire, part time employment was defined to be employment that required 1 to 20 hours per week on the job. More than 20 hours per week on the job was considered to be full time employment. Preliminary analysis did reveal only 34 of the women in the sample worked part time. In contrast, 212 women worked full time. The remainder, of course, did not work at all.

Comparison of time spent in household activities

Recall that the time that women chose to spend in care of the household and care of household members was summarized into eight mutually exclusive categories. These categories were: meal preparation, care of the house, care of the grounds, care of household durables, care of adult of family members, care of child family members, marketing and management.

Not all women chose to spend time in all eight activities. In the descriptive analysis of time use, the women who spent no time at all in a given activity during the synthetic week were excluded from any analysis pertaining to that and only that activity. The proportion of women in each family type that did not spend any time at all in the eight activities are summarized in table 1.

These figures are in percentage terms. For example, 92.7 percent of all women in family type I spent 0 minutes per week, on average, in care of child family members. This result is reasonable, as family type I represents single women without children, who are not employed. This group would contain both ends of the life cycle spectrum. Young women without children who have not yet begun to work would be in this group as would women who were retired, widowed and whose children had grown.

Virtually all women spent some time in meal preparation. Of the original 437 cases, only 3 individuals spent no time at all in the activity. The mean number of minutes per week spent in this activity ranged from 824.6 to 350.3. In general, married women tended to spend more time in meal preparation per week than did single women. The summary of time spent in meal preparation is presented in the form of a histogram in Figure 1. Each bar pertains to a given family type. The number at the top of each bar represents the actual mean number of minutes spent on meal preparation per week by women in the sample. The N reports the number of women of a given family type that spent any time in the activity at all during the week. The height of the bar illustrates the relative importance of the activity across family types.

Figure 2 shows the amount of time spent on care of the household was similar for each family type. Married women with children who were not employed spent the most time, on average, on household care: 433.3 minutes per week. In contrast, single women with children who were employed spent the least time on average: 246.6 minutes per week. Note, the range is much smaller for household care than it was for meal preparation.

Figure 3 reveals not many women spend time caring for grounds with the exception of the single women without minor children at home who is not employed. Women in this category spend an average of 338.2 minutes per week caring for the grounds. This group probably contains the retired women who enjoy spending time in flower and vegetable gardening. Married women, with children, who are employed spend the least amount of time in this activity: 161.2 minutes per week on average.

The mean amount of time per week spent on care of household durables in depicted in Figure 4. Again, single women, who are not employed and who are without minor children at home spent the most time in this activity. Married women who are employed and who have minor children at home spend the least amount of time. The figures are 129.0 and 60.2 minutes per week, on average, respectively. The mean time for all groups is small. This result could arise because the women in this sample do not choose to repair or to maintain household durables. Perhaps they do not know how, or, perhaps their choice reflects a sexual division of labor where repair and maintenance activities are delegated to the men.

Differences in clothing care are small. Figure 5 reveals married women who are not employed and who have minor children in the home care for clothing an average of 236.1 minutes per week. Single women who are employed and who have minor children in the home spend an average of only

101.9 minutes per week in the same activity. In general, the married women spend more time in this activity than the single women. And, those with minor children at home spend more time than those with no minor children at home.

The average amount of time that women spend on care of family members follows a reasonable pattern. As Figure 6 illustrates, it is married women who spend time caring for adult family members. This is no surprise as the single women in the sample either live alone or live with their children.

It is the women with children who spend time in child care. Figure 7 shows that married mothers who are unemployed spent the most time: 616.7 minutes per week on average. Single mothers who work spend the least amount of time: 236.1 minutes per week on average.

Time spent in marketing and management is fairly evenly distributed across family types as Figure 8 illustrates. Married women who are not employed and who have minor children at home spent 342.4 minutes per week in this activity. This suggests children increase the number of errands to be run while employment limits the time available for marketing and management tasks.

Analysis of variance is used to determine whether the variation in a dependent variable is due to one or more independent variables or to chance. Each independent variable is partitioned into 2 or more categories or groups according to specific attributes of the variable itself. Variance within each group and between groups is analyzed to ascertain whether the groups differ significantly with respect to the mean level of the dependent variable. The larger the variance between observations within a particular group, the less likely it is that differences between group means is statistically significant. It is reasonable to conclude that observed differences in group means is due to random fluctuation. And, thus, no relationship exists between the dependent variable and the independent variable in question.

The dependent variable in this analysis is the amount of time spent in a specific household task. Eight specific household tasks are examined: meal preparation, care of house, care of grounds, care of household durables, care of clothing, care of adult family members, care of child family members, marketing and management. Three independent variables are used: marital status, presence or absence of a minor child, employment status. Each independent variable is partitioned into two groups. Marital status is single or married. A minor child is or minor children are present if the age of the youngest child is 17 years of age or younger. No minor children are present if either the family unit contains no children at all or the age of the youngest child is 18 years of age or older. Employment status is not employed or employed.

Results of the analysis of variance answer the following questions:

(1) Are the differences in the mean amount of time spent in a given household task statistically significant when single women are considered as opposed to married women?

(2) Are the differences in the mean amount of time spent in a given houehold task statistically significant when women with at least one minor child present are considered as opposed to women with no minor children present?

(3) Are the differences in the mean amount of time spent in a given household task statistically significant when women who are employed are considered as opposed to women who are not employed?

This is the analysis of main effects.

Analysis of variance will also reveal whether or not any interaction exists between any combination of the independent variables. In particular:

(1) Is there interaction between marital status and presence or absence of minor children?

(2) Is there interaction between marital status and employment status?

(3) Is there interaction between presence or absence of minor children and employment status.

(4) Is there interaction among marital status, presence or absence of minor children, and employment status taken together?

The analysis of two-way interaction answers the first, second, and third question. The analysis of three-way interaction answers the fourth question. Results of ANOVA analysis are presented in Table 2 through Table 9.

In all cases, significance was measured at the .05 level. There was no interaction. Only main effects were significant. In the analysis of variance in meal provision, only employment status and marital status were significant. Employment status alone was significant with respect to care of the house. No single item was significant relative to care of grounds. Presence or absence of minor children in the home was significant with respect to care of household durables. Both employment status and presence or absence of minor children in the home were significant in care of clothing. Marital status was significant in care of adult family members while employment status and presence or absence of minor children in the home was significant in care of child family members. No variable was significant with respect to marketing and management.

Summary of the Descriptive Analysis

The results of the descriptive analysis suggest that marital status, presence or absence of minor children in the home and employment status do influence the amount of time that women spent in meal preparation, care of the house, care of grounds, care of clothing, care of adult family members, care of child family members, marketing and management. It is useful to categorize women according to these variables when time is used as a unit of measure of work effort within the household.

More studies of the time use of single women, both with and without children is needed. This is especially true as the proportion of divorced women with children and the proportion of single mothers increases with respect to the general population. Limited numbers of women in some of the family type categories precluded some of the more interesting analysis. For example, it was not possible to ascertain whether part-time employment had a different effect than full time employment or no employment. A larger sample would allow finer distinctions to be made in such categories as age of youngest child and employment status of the woman.

Note, too, that descriptive analysis, while informative and useful in its own right, is limited in explanatory power. An alternative method of analysis is available which is not as limited as descriptive analysis. In the next chapter, regression analysis is used to estimate the mean amount of time women spend on all household related work. The same data set is used.

CHAPTER IV: REGRESSION ANALYSIS

The regression analysis will focus on four models of the relationship between the amount of time that women spend in household task performance and the exogenous factors which can influence that amount of time. Discussion of the regression analysis will proceed as follows. First, the variables will be described. Second, problem of selection bias and the steps taken to decrease its effect are explained. Third, the equations for estimating the amount of time that women spend in household work for each of the four models are presented. Empirical results of the regression analysis for each model are presented, compared and contrasted in Chapter V.

Variables

The variables used in the regression analysis are classified as endogenous or exogenous and listed in Table 10. The unit of measure is reported for each variable. Where appropriate, the method used to calculate the variable is also described. The mean and standard deviation of each variable is given in Table 11.

Selection Bias

The problem of selection bias

In recent years, economists have become increasingly aware of the empirical problems that arise when the data which are used to test an economic model are not completely random in nature (Heckman, 1974; Gronau, 1974; Lee, 1982). This difficulty occurs when values for the endogenous variable are observed for only a portion of the sample. Estimates of population parameters which are based only on data obtained from sample participants who do report a value for the endogenous variable are inaccurate. This is the problem of selection bias.

Selection bias may occur whenever data from a sample are used to estimate a causal relationship between variables which exist in the population. If sample participants are randomly chosen, each individual in the population has an equal chance of being included in the sample. Bias is unlikely to occur. The expected value of the parameter estimates obtained from the sample data using ordinary least squares regression (OLS) will equal the true population parameter. If, however, sample participants are not randomly chosen, the chances of being drawn from the population are no longer equal across individuals. Some groups of individuals are over-represented, some are under-represented in the sample as compared with the population. Bias exists. Parameter estimates obtained by ordinary least squares regression are also biased. The measured values are influenced by a factor which has not been measured: the probability of being included in the sample.

The analysis of the wages received by women is a case in point. Wages are observed for women who work in the market. Wages are not observed for women who do not work in the market. Labor force participation is the basis for selection into the sample when the dollar wage is the endogenous variable. If labor force participation were a random variable, no bias would exist. But, it is not random. A woman may choose to be employed outside of the home full-time or part-time or she may choose to be a full-time homemaker. She selects labor force participation or non-labor force participation. According to accepted economic theory, a woman will choose to participate in the labor force when the market wage that she can command exceeds her reservation wage. Conversely, she will choose not to participate in the labor force when her reservation wage exceeds the market wage that she could receive. Thus, the probability of being included in the sample of wage earners is related to an unobserved variable: the reservation wage. A wage function estimated on a sample of working women would not accurately reflect the wages of women in the population as a whole since selection bias is present.

Labor force participation of women also presents an example. Women who choose to work are different from those women who do not choose to work. Truncation of the sample on the basis of labor force participation causes selection bias. In this instance, the bias arises because the differences between women who participate in the labor force and women who do not participate in the labor force are not controlled.

A correction for selection bias explained

Heckman (1974) analyzes selection bias as a form of specification bias. A model based on sample data alone will not correctly specify the true relationship among variables because data from those individuals who selected themselves out of the sample are missing. He suggests:

> . . . it is sometimes possible to estimate the variables which when omitted from a regression analysis give rise to the specification error. The estimated values of the omitted variables can be used as regressors so that it is possible to estimate the behavioral functions of interest by simple methods (Heckman, 1974, p. 153).

Stated simply, his method consists of two interrelated parts. First, a numerical estimate of the bias (which the selection criterion introduced) is obtained. Second, the estimate of the bias is included as a control in the equation which represents the relationship between the endogenous variable and the exogenous variable(s). OLS may then be used to obtain parameter estimates which will be unbiased.

Recall that in the previously mentioned example of the analysis of wages received by women, bias is introduced because data on earned wages is available only for those women who selected labor force participation. The probability that a given woman will participate in the labor force is a function of her reservation wage. Her reservation wage is not observed, but her decision to participate or to not participate in the labor force can be observed. The probability of labor force participation may be estimated. This estimated probability can then, in turn, be used to obtain an estimate of the sample selection bias. If the estimate of the sample selection bias is included in a set of exogenous variables which are thought to influence the dollar wage received by a woman, OLS regression can be used to obtain unbiased parameter estimates. If the estimate of the sample selection bias is excluded from the set of exogenous variables, OLS regression methods will not yield reliable parameter estimates.

In more general terms, the proceedure used to estimate the value of the missing variables may be illustrated following Heckman (1974). Consider a two equation model. Given a random sample of J observations:

$$Y_{1j} = X_{1j} B_1 + U_{1j} \tag{4.1}$$

$$Y_{2j} = X_{2j} B_2 + U_{2j} \tag{4.2}$$

where Y_{ij} is a column vector of observations on the dependent variable

X_{ij} is a matrix of observations on the exogenous regressor variables

B_{ij} is a column vector of parameters

U_{ij} is a column vector of residuals

and $i = 1, 2$

$j = 1, \ldots, J.$

Y_{1j} could refer to the number of hours worked in the market by employed women and Y_{2j} could represent the labor force participation decision, for example.

If a random sample of observations is selected, $E(U_{ij}) = 0$. Given a sample which contains both women who are employed and who are not employed, suppose an estimate of Y_{1j} is desired. But, the distribution of Y_{1j} is truncated such that Y_{1j} is observed only for those women who are employed. The regression function for the <u>population</u> is

$$E(Y_{1j} | X_{1j}) = X_{1j} \beta_1 . \qquad (4.3)$$

But, for the subsample of available data, the function becomes

$$E(Y_{1j} \mid X_{1j}, \text{ sample selection rule}) = X_{1j}\beta_1 + E(U_{1j} \mid \text{sample selection rule}). \quad (4.4)$$

Let Y_{2j} define the sample selection rule such that

Y_{1j} is observed when $Y_{2j} \geq 0$

Y_{1j} is not observed when $Y_{2j} < 0$.

Because the distribution of Y_{1j} is truncated, the $E(U_{1j})$ no longer equals zero. With the presence of selection bias,

$$E(U_{1j} \mid X_{1j}, \text{ sample selection rule})$$

$$= E(U_{1j} \mid X_{1j}, Y_{2j} \geq 0)$$

$$= E(X_{1j} \mid U_{2j} \geq -X_{2j}\beta_2). \quad (4.5)$$

And

$$E(Y_{1j} \mid X_{1j}, \text{ sample selection rule})$$

$$= E(Y_{1j} \mid X_{1j}, Y_{2j} \geq 0)$$

$$= X_{1j}\beta_{1j} + E(U_{1j} \mid U_{2j} \geq -X_{2j}\beta_2). \quad (4.6)$$

The numerical estimation of the term $E(U_{1j} \mid U_{2j} \geq -X_{2j}\beta_2)$ depends on the assumption made regarding the form of the distribution function pertaining to U_{1j} and U_{2j}. If, for example, it is assumed that $g(U_{1j}, U_{2j})$ is a bivariate normal density,

$$E(U_{1j} | U_{2j} \geq -X_{2j}\beta_2) = \frac{\sigma_{12}}{\left(\sigma_{22}\right)^{1/2}} \cdot \lambda_j \tag{4.7}$$

And, to continue the example, the regression function for those who are employed (the subsample for whom data are available) becomes:

$$E(Y_{1j} | X_{1j}, Y_{2j} \geq 0) = X_{1j}\beta_1 + \frac{\sigma_{12}}{\left(\sigma_{22}\right)^{1/2}} \cdot \lambda_j \tag{4.8}$$

where

$$\lambda = \frac{\phi\left(z_j\right)}{1 - \Phi\left(z_j\right)} = \frac{\phi\left(z_j\right)}{\Phi\left(-z_j\right)} \tag{4.9}$$

The density function and the distribution function for a standard normal variable are represented by ϕ and Φ, respectively, and

$$Z_j = - \frac{X_{2j}\beta_2}{\left(\sigma_{22}\right)^{1/2}} \qquad (4.10)$$

(Heckman, 1979, pp. 154-159).

Note, an appropriate correction for sample selection bias may also be developed for the case of the normal distribution for those women who are not employed. For this group, the sample selection rule is $Y_{2j} < 0$. Those interested in the development of this correction are referred to Maddala (1983, p. 367).

Heckman's estimation method requires two steps. First, consistent estimates for the parameters in Z are obtained using probit analysis. Second, equation (4.8) is estimated by ordinary least squares regression, using the estimated values of Z.

<u>A correction for selection bias applied</u>

Heckman's two step adjustment method is adopted in this thesis. The following procedure was used to implement his method to estimate the values of the omitted variables. A dichotomous variable, Y, was defined to be:

1 if a woman was in the labor force

0 otherwise.

A woman was classified as in the labor force if she received wages in 1980.

The dichotomous nature of the endogenous variable, Y, precludes estimation by OLS regression. For the OLS estimates to be unbiased, it is necessary for the expected value of the residual to be equal to zero. It can be shown that when the dependent variable is dichotomous, the residual will be correlated with the independent variable(s) in the model. The expected value of the residual is then not equal to zero and OLS estimates are biased (Maddala, 1983, p. 2).

Probit analysis has been suggested as an estimation method (Heckman, 1974; Maddala, 1983). In this thesis, logit analysis is used as a substitute for probit analysis. This substitution was made because the available probit programs would require a much larger time investment than that required by the logit programs. The substitution does not present a serious problem since the logistic distribution very closely approximates the probit distribution. The tails of each distribution are not quite the same, but the difference is slight. Thus, unless the sample considered is large enough to place several observations in the tail of the distribution, the two distributions are, for all practical purposes, quite acceptable substitutes (Hanushek and Jackson, 1977, pp. 187-189).

When one uses logistic regression, one assumes the values of the dependent variable can be stated as probabilities:

> $$P_t = \text{Prob}(Y_t = 1) = F(X_t\beta) \qquad (4.11)$$
>
> $$(1 - P_t) = \text{Prob}(Y_t = 0) = 1 - F(X_t\beta), \qquad (4.12)$$
>
> where $F(X_t\beta)$ is simply the cumulative distribution function that describes how the probabilities are related to the exogenous variables.
>
> (Hanushek and Jackson, 1977, p. 187).

One further assumes the relationship between the exogonous variables and the probabilities (P_t and $(1 - P_t)$) is accurately represented by the logistic distribution function:

$$P = 1/(1 + e^{-X\beta}). \qquad (4.13)$$

As XB ranges from minus infinity to plus infinity, the logistic distribution ranges from 0 to 1.

Define a ratio of odds as:

$$P/(1-P). \qquad (4.14)$$

The log of the odds ratio or the logit is then:

$$\text{Log } [P/(1-P)]. \qquad (4.15)$$

P may be replaced with the logistic distribution function:

$$\text{Log } \frac{(1/e^{-X\beta})}{[1/(1 + e^{X\beta})]}. \qquad (4.16)$$

Equation (4.16) is the endogenous variable in logistic regression. It can be shown that the evaluation of this log function will yield XB (Hanushek and Jackson, 1977, p. 188). Thus, unbiased estimators are obtained.

In the sample used for the regression analysis in this thesis, selection bias is present because data on wages are available only for those women in the sample who are labor force participants. Numerical estimation of this bias required several steps. First, logistic regression was used to obtain an estimate of the log of the odds ratio. As an example, let

Y = f(AGEW, AGEW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD)

(4.17)

where Y is the log of the odds ratio and the exogenous variables listed are among those described in Table 10.

The estimated value of Y (equation (4.17)) was used to calculate the probability that a woman would be in the labor force. This was the second step. To calculate this probability, it was necessary to recognize that:

$$PROB = e^{Y} / (1 + e^{Y}) \tag{4.18}$$

where PROB is the probability that a woman will be in the labor force and Y is the endogenous variable in the logistic regression. The Y in equation 4.18 is comparable to the XB in equation 4.13.

Third, both PROB and Y were used to calculate the statistic which estimates the value of the omitted variables. One could think of the statistic PROB as representing the area under the probability density function which pertained to the portion of the sample selected or not selected according to a given criterion. The selection criterion demarcates the point at which truncation takes place. The area below the point of demarcation pertains to the probability of being in one group, for example, the probability of a woman in the sample being employed. The area above the point of demarcation pertains to the probability of being in the other group, for example, the probability of a woman in the sample not being employed.

For the employed women, the statistic that estimates the value of the omitted variables is $LAMBDA_E$ and is calculated as:

$$LAMBDA_E = Y + ((\log(1 - Prob)/Prob). \qquad (4.19)$$

For the derivation of $LAMBDA_E$, see Maddala (1983, p. 369).

For the women who are not employed, the statistic that estimates the value of the omitted variables is $LAMBDA_{NE}$ and is calculated as:

$$LAMBDA_{NE} = -(Y + (\log(1 - Prob)))/(1 - Prob). \qquad (4.20)$$

The derivation of $LAMBDA_{NE}$ is given in Appendix B.

Model Equations

Given the estimate of selection bias for both the women who are employed and the women who are not employed, the equations which estimate the amount of time that women spend in household task performance can now be presented for each of the four models. (A formal proof of the fact that separate estimates of the amount of time devoted to household work is needed for employed women as opposed to not employed women is given in Appendix C.) This presentation can be made more efficient by first noting the similarities that exist among the models.

First, in all four models, time spent in household task performance is calculated for three groups of women: (1) all women in the sample who are employed, (2) all women in the sample who are not employed, (3) all women in the sample taken as a group. Clearly, the first and the second group are mutually exclusive and exhaustive subsets of the third group. Second, all of the models contain a correction for selection bias for the equations which pertain to all women who are employed and to all women who are not employed. (Note, no correction for selection bias is necessary for the equations which pertain to all women taken as a group.) Third, the set of exogenous variables which characterize a woman's household is held constant across all four models. The members of this set are the variables DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD. Each of these variables have been described in Table 10. Fourth, in two of the models, an estimate of the wage received by the women in the sample who are employed is explicitly calculated while, in the remaining two models this explicit calculation is omitted and the effect of the wage is implicit in the exogenous variables which are used. Also, in two of the models, the age of the woman is included explicitly as AGEW. In the other two models, the variable AGEW is replaced by the three variables HOMEYRS, EDUCW, and EXPRNW. The four models, then, consist of the set of exogenous variables which are held constant across all four models and the possible combinations of the two measures of the wage of the employed women and of the two measures of the age of each woman in the sample.

To avoid undue repetition, model I will be described in detail. The remaining models will then be described in terms of the differences that exist between model I and the paticular model of interest. The equations used for each model are listed in Appendix D.

As an initial step in the building of model I, the selection bias correction factors, $LAMBDA_{E}$ and $LAMBDA_{NE}$, are calculated using equations 4.17, 4.18, 4.19 and 4.20 which have been described in a previous section. Then, the sample of women is subdivided according to employment status (employed or not employed). Division of the sample into those women who are employed and those women who are not employed introduces selection bias. Thus, it becomes necessary to include a correction factor for this selection bias in any equation which pertains to women who are employed and women who are not employed.

Computation of the amount of time that employed women spend in household task performance requires two steps. One, to reduce the potential for measurement bias, an employed woman's wage is estimated. Two, the estimated wage becomes a part of the set of exogenous factors that influence the amount of time that these women spend in household task performance.

Estimation of the wage for employed women in the sample requires two equations. The first equation contains the factors thought to influence the amount of the wage received and the control factor for selection bias. This equation is:

$$WAGE = f(EXPRNW, EXPRNW2, EDUCW, EDUCW2, LAMBDA_E). \quad (4.21)$$

The woman's labor force experience (EXPRNW) and her education (EDUCW) are chosen as exogenous variables because labor force experience and education are both forms of investment in human capital. A positive payoff in the form of increased wages is expected to be realized when either labor force experience or education are increased.

$LAMBDA_E$ serves as an exogenous control factor that provides a correction for selection bias. It is a shift parameter. When an equation which includes $LAMBDA_E$ as an exgenous control variable is used to obtain an estimate of the endogenous variable for a <u>specific case</u>, the parameter estimate associated with $LAMBDA_E$ may be multiplied times the mean value of $LAMBDA_E$ over the sample and added to the constant term in the estimation equation. With $LAMBDA_E$

present in equation 4.21, the parameter estimates of EXPRNW, EXPRNW2, EDUCW, EDUCW2 are unbiased.

These unbiased parameter estimates are then used to obtain the expected wage, ESTWAGE.

$$\text{ESTWAGE} = f(\text{EXPRNW, EXPRNW2, EDUCW, EDUCW2}) \tag{4.22}$$

This estimated wage for employed women is included in the equation which estimates the amount of time that these women spend in household task performance:

$$\text{HHTIME}_E = f(\text{AGEW, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, LAMBDA}_E). \tag{4.23}$$

Justification of the choice of exogeneous variables follows Gronau (1980, p. 410). Age of the woman (AGEW) is a proxy for "on the job experience" within the household. An increase in age (AGEW) is expected to increase the woman's marginal productivity in work at home. The presence of young children (CLD and AGEYC) is expected to increase the value of the services the woman provides in the home, thus, the value of her marginal productivity at home is expected to increase as well. This increase may diminish as the children mature. The smaller the birth interval (BINT), the greater the value of the woman's services in the home. The larger the birth interval, the lesser the value of the woman's services in the home. This inverse relationship is proposed on the assumption that older children can help with care of the household and with care of younger siblings. The size of the home, represented by ownership of a single family dwelling (OWNSFD) may also increase the woman's marginal productivity at home. Control for the effects of marriage is provided by the dummy variable, DMAR. Husband's wage (WAGEH), and other family income (OTHINC) serve as proxy for other inputs into the home production process and general sources of wealth that allow more leisure and less work of all types. The woman's expected wage (ESTWAGE) will likely vary inversely with the time that she spends in household work since higher market wages increase the opportunity cost of remaining in the home. $Lambda_E$ is included in the equation to permit OLS regression of the parameters of the exogenous variables.

For the women who are not employed, only one equation is necessary to obtain an estimate of the amount of time that these women spend on household task performance:

$$HHTIME_{NE} = f(AGEW, DMAR, EDUCH, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, LAMBDA_{NE}). \qquad (4.24)$$

This equation differs from (4.23) only in the deletion of ESTWAGE and substitution of the appropriate sample selection bias adjustment factor. No market wage is observed for women who are not in the labor force. On the basis of accepted economic theory, the reservation wage of a woman who is not in the labor force exceeds her market wage. This implies that her market wage rate would provide little information about optimal hours of household work and, hence, the deletion of ESTWAGE. The choice of the appropriate sample selection bias adjustment factor has been discussed in a previous section.

The equation which represents the amount of time spent in household task performance by all women in the sample is:

$$HHTIME_T = f(AGEW, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, EMPWAGE) \quad (4.25)$$

As mentioned in a previous section, when all women are included in the same group, no correction for selection bias is necessary, as no selection took place. The variable EMPWAGE is the value of the estimated wage received by employed women in the sample. It is calculated by multiplying ESTWAGE times a dummy variable which was set equal to one if a woman was employed and set equal to zero if she was not employed. The description of model I is now complete. Attention may now be focused on the other three models which are used in this thesis.

Recall that all four models share the same set of variables which pertain to the characteristics of a woman's household. The three remaining models differ from model I in only one aspect: the measurement of the two exogenous variables which pertain to characteristics of the woman, herself. These two variables are the age of the woman and, if she is employed, the expected wage of the woman. Inclusion of these two variables in the empirical estimate of the amount of time a given group of women spend in household task performance may be explicit or implicit. In model I, an explicit measure of age and and explicit measure of expected wage (ESTWAGE, equation 4.22) is used. Model II retains the explicit measure of age, but uses AGEW and AGEW2 as an implicit measure of expected wage. Empirical results indicated that use of AGEW and AGEW2 in the place of an explicit measure of the expected wage did not make much difference in the estimated coefficients. Further, AGEW and AGEW2 are highly colinear with EXPRNW, EXPRNW2, EDUCW, and EDUCW2, the variables upon which ESTWAGE depend.

Model III replaces the explicit measure of age with three variables: HOMEYRS, EDUCW, and EXPRNW. HOMEYRS is the number of full-time equivalent years that a woman spends at home, exclusive of her education and preschool years.

EDUCW is the number of years that a woman spends in school. EXPRNW is the number of full-time equivalent years that a woman spends in the labor force. The sum of these three variables is approximately equal to AGEW. Two of these variables, EDUCW and EXPRNW, are also used to calculate a woman's expected wage (ESTWAGE), if she is employed. Explicit calculation of ESTWAGE may still be made, however, since the terms EDUCW2 and EXPRNW2 are not included in the equation which estimates the amount of time spent on household work. In model IV, both age and estimated wage are measured implicitly. The linear terms HOMEYRS, EDUCW, EXPRNW, replace AGEW. These linear terms, in combination with the quadratic terms HOMEYRS2, EDUCW2, and EXPRNW2, provide an implicit measure of the wage received by an employed woman.

Having discussed the models and variables used in this analysis, the empirical results of the regression analysis of these models will now be presented.

CHAPTER V: EMPIRICAL RESULTS

In this chapter, the statistical procedures employed to estimate the parameters of each of the four models that are presented in this thesis are named and the results of those proceedures are reported. Two comparisons are based on this report. First, selected aspects of each of the four models themselves are compared. Second, the empirical results which pertain to employed women are compared against the results of a similar previous study. Following the comparisons, examples of how the empirical results can be used to estimate the time use for an individual woman are given.

Statistical Procedures

The statistical procedures catagorical modification (CATMOD), and regression (REG) in the Statistical Analysis Systems Version 5 (SAS) package were used to obtain the empirical estimates of the parameters in each of the four models (see Appendix D for a detailed listing of these models). The regression coefficients for the two logistic regressions or logit equations (equations (D.1) and (D.11)) were generated using the CATMOD proceedure. The REG proceedure was used with all remaining model equations.

Model I and model III incorporate explicit estimates of the hourly wage of the women who are employed. These estimates are given in Table 12. All four models contain estimates of the amount of time that women, classified as employed or not employed or considered as a group, spend on household work. Empirical estimates of household work time for each classification of women for model I though model IV are reported in Tables 13 through 16, respectively.

The Four Models Compared

In this section, the similarities and differences of several aspects of the four models themselves are discussed. This comparison reveals which patterns, if any, are consistent among the models and which of the four models has the greatest explanatory power.

To facilitate comparison among the four models, recall that the equations which constitute these models are identical except for the method used to measure the age of the woman (AGEW) and the wage received by the employed woman (ESTWAGE). The age of the woman and her wage, if she is employed, are explicitly measured in model I. The explicit measure of age is retained in model II. The explicit measure of wage is deleted and the effect of the wage of the employed woman in her household work time is measured implicitly. In model III, the explicit measure of age is disaggregated into the three variables HOMEYRS, EXPRNW, and EDUCW. The wage is measured explicitly. In model IV, the disaggregate measure of age is used while the measure of wage is, once again, implicit.

Two general similarities may be noted. First, all four models rely on the same data set for empirical estimation of the regression coefficients. This data set is the same one that was used for the descriptive analysis (see chapter III). Recall, this data set consists of 426 women. In this total group, 256 of the women are employed and 170 of the women are not employed.

Second, the signs of several regression coefficients are consistent across the four models. Comparing the two equations from model I and model III that explicitly estimate the wage received by the employed women, similar signs are found for every regression coefficient (see Table 12). Comparing the equations which pertain to the amount of time that each group of women devote to household work, these similarities are found. Across all four models, those women who are married (DMAR) and own a home (OWNSFD) spend more time in household work than do those who are single and do not own a home. In addition, those women who have non-wage sources of family income (OTHINC) spend less time in household work as their non-wage income rises. It is interesting to note in this context that an increase in the wage of the husband (WAGEH) of those women who are married can be associated with either an increase or a decrease in household work time. The result depends both on the model and on the group of women considered. No consistent patterns emerge for this variable. In contrast to the uncertain effect of the wage of the husband, when the wage of the employed woman is explicitly estimated and included in the estimate of household work time, the woman's estimated wage (ESTWAGE in the equation for employed women and EMPWAGE in the equation for all women combined) and her household time are consistently inversely related. The presence of minor children in the home also produces a consistent effect across all groups of women and all models. As the number of children (CLD) increases, a woman's household work time increases at a decreasing rate. An increase in the age of the youngest child (AGEYC) or the birth interval (BINT) between the oldest and the youngest child is associated with a decrease in a woman's household work time which occurs at an increasing rate.

A number of comparisons among the four models could be made. These comparisons were selected: (1) the household work time regressions which include an explicit measure of the wage versus the regressions of this type which exclude an explicit measure of the wage, (2) the equations which pertain to the amount of time devoted to household work by women who are employed versus women who are not employed versus all women grouped together, (3) the impact of the age of the woman (AGEW) versus the impact of prior household experience (HOMEYRS), education (EDUCW), and prior market experience (EXPRNW) on the amount of time that each group of women spend in household work, (4) the impact of the presence of a spouse (DMAR) on the amount of time that each group of women spend in household work, and (5) the impact that children have on the amount of time that each group of women spend in household work as measured by the number of children (CLD), the age of the youngest child (AGEYC) and the birth interval between the oldest and the youngest child (BINT). Each comparison will be considered in turn.

Wage versus no wage

An explicit estimate of the market wage received by employed women is included in models I and III (see Tables 12, 13, and 15). In both models, the variables EXPWAGE (the expected wage estimated for all women who are employed) and EMPWAGE (the expected wage estimated for all women who are employed as a part of the group of all women) are negative and significant at the 5% level or higher. This result is reasonable as it suggests that as the wage a woman receives increases, her opportunity cost of spending time in household work increases and she responds by decreasing the number of hours that she works at home.

This explicit estimate of the market wage received by the employed women is excluded in models II and IV (see

Tables 14 and 16). Exclusion of the wage estimate in these two models yielded no change in the sign and little to no change in the significance levels of the comparable variables in models I and III, respectively.

Comparison of model I against model II reveals that, for these two models which measure the age of the woman directly as AGEW, a higher R^2 and adjusted R^2 is obtained when the estimate of the wage is explicitly included in the model. This difference is greatest for the household time equations which pertain to all women considered as a group. Comparison of model III against model IV reveals that, for these two models which replace the variable AGEW with the variables HOMEYRS, EDUCW, and EXPRNW, a slightly higher R^2 and adjusted R^2 is obtained when the explicit estimate of the wage is _excluded_, with one exception. For the equations which pertain to all women considered as a group, the R^2 statistics are slightly higher in model III, the model which does include the explicit estimate of the wage. It is of interest to note that, although model IV does not include an explicit estimate of the market wage received by the employed women, this model does include all of the components of the estimated wage equation (EDUCW, EDUCW2, EXPRNW, EXPRNW2, $LAMBDA_E$).

These results suggest that the explanatory power of a given model may be improved when the variables that influence the estimated wage received by employed women are included in the model. This inclusion may take the form of an explicit estimate of the wage, as in model I, or the wage estimate may be implicit, as in model IV.

<u>Employed versus not employed versus total</u>

In each model, regression analysis is used to estimate the amount of houshold work time of three groups of women: the employed, the not employed, and all women combined. Comparison of the regression equations which pertain to each group of women may be made at several points. First, the lowest number of statistically significant parameter estimates is consistently found in the household time regressions which pertain to not employed women. For this group of women, only the number of children (as measured by CLD and CLD2) and the age of the youngest child (as measured by AGEYC and AGEYC2) proved to be statistically significant indicators of the amount of time spent in household work, as indicated by the joint F test.

For women who are employed and for the total group of women, a greater number of statistically significant parameter estimates are found. For these two groups of women, as with the group of not employed women, the number of children and the age of the youngest child are jointly significant in each of the four models. But, for the employed and for the total group, the birth interval between children (as measured by BINT and BINT2) is also jointly significant across all models. In addition, marital status (DMAR) for all women combined and the estimated market wage for both employed women (ESTWAGE) and for all women combined (EMPWAGE) exert a statistically significant influence on the amount of time these women spend in household work. (Note that in model III and model IV, marital status just misses being a statistically significant factor for the group of employed women.)

Second, the R^2 and the adjusted R^2 may be used to evaluate overall performance of the household work equations for each group of women. The household time regression for all women grouped together performs better than the household time regressions for the groups of women partitioned by employment status when an estimate of the wage received by the employed women is explicitly included in the model (see models I and III). When the wage estimate is excluded from explicit consideration, a different pattern is observed. In the models that exclude an explicit estimate of the wage, the household time regressions for the groups of women partitioned by employment status perform as well as or better than the household time regressions for all women grouped together. In addition, the household time regression for the group of not employed women has the highest R^2, while the adjusted R^2 remains virtually equal to or greater than the adjusted R^2 achieved with the household time regressions which pertain to the other two groups of women (see models II and IV).

Comparing the household time regressions for each group of women across all four models, these results are found. The household time regression for the group of employed women attains the highest R^2 statistics in model IV. This is also true of the household time regression for the group of not employed women. But, for the household time regression for the total group of women, the R^2s obtained in models I and III are virtually identical and are greater than those obtained for similar regressions in models II or IV. Interestingly, this difference in R^2s is relatively large when model II is compared against model I or model III, but relatively small when model IV is compared against model I or model III. Given this small difference in R^2s, if choice of one model out of the four is necessary or desirable for further empirical work, model IV is the best overall choice.

<u>Age of the woman versus her household experience, educational experience, and market experience</u>

In models I and II, the age of the woman is included in the set of exogenous variables thought to influence the amount of time that women, whether grouped by employment status or treated as one group, spend on household work.

Models I and II present a linear form and a quadratic form of the variable AGEW, respectively. In neither model is the variable AGEW significant, whether individual or joint significance of the variable is considered.

The age of the woman is disagregated into her previous experience in the home (HOMEYRS), in education (EDUCW), and in the labor market (EXPRNW) in models III and IV. In model III, the variables HOMEYRS, EDUCW, and EXPRNW are linear, consequently, model III is directly comparable to model I.

In this linear form, only the variables HOMEYRS and EXPRNW are statistically significant at the 10% level or better and that is only true for the employed women in the sample. As work experience in the home (HOMEYRS) increases, household work time decreases for not employed women but increases for employed women and for all women grouped together. Education (EDUCW) exerts a positive influence on household work time for each group of women. Labor force experience (EXPRNW) is associated with an increase in houshold work time for employed women and with a decrease in houshold work time for not employed women and for all women grouped together. In general, the t values for the variables HOMEYRS, EDUCW, and EXPRNW in model III are the largest for the group of women who are employed.

As a point of comparison, in model I, as the age of the woman (AGEW) increases, household work time increases for employed women but decreases for not employed women. The variable AGEW for employed women has the larger t value. Apparently, when all women are considered as a group, this effect dominates as the coefficient for the variable AGEW is positive for this group as well.

A quadratic form of the variables HOMEYRS, EDUCW, and EXPRNW is used in model IV. This model corresponds to model II. In model IV, the linear form of the variable HOMEYRS is positive and the quadratic form of the variable is negative across all groups of women. However, plots of the relationship between the women's home years and their household work time reveal a positively sloped linear path over the relevant range of home years. The quadratic form of the variable is statistically significant both individually and jointly for employed women and for all women combined, at or above the 5% level. Statistical significance is not obtained for the home years of not employed women, for either the linear or the quadratic form of the variable HOMEYRS.

As the education of employed women increases, their household work time decreases at an decreasing rate. For the other two groups of women, household work time increases at a decreasing rate. The education variable is individually significant (at the 10% level) only for not employed women. It is not jointly statistically significant for any group of women.

For all groups of women, household work time decreases at a decreasing rate as a woman's labor force experience (EXPRNW) increases. The variable EXPRNW is individually significant (at the 10% level or above) both for employed women and for all women combined. It is jointly significant (at the 5% level) only for all women combined.

Referring to model II as a comparison, it is found that the relationship between the age of the woman and her household work time exhibits no consistent pattern across the three groups of women. For those women who are employed, household work time decreases at a decreasing rate as their age advances. Women who are not employed devote less time to household work at a decreasing rate as they age. When women are all placed in the same group, the time the women spend in household work increases at a decreasing rate as they grow older.

Plots of the age of the woman against the amount of time spent in household work reveal the same inconsistency. The plot pertaining to the employed women reveals a decline in the amount of time spent on household work until the women are between 30 and 35 years of age. After that time, household work time steadily increases. The plot pertaining to not employed women is essentially a line with a negative slope. Conversely, the plot pertaining to a women in the combined group is essentially a line with a positive slope. The variable AGEW is statistically significant only when the linear and the quadratic terms are considered jointly and only for the group of all women combined (significance level is 1%).

Married versus single

In general, those women who are married, regardless of the group into which they are placed, spend more time in household work than their single counterparts. The statistical significance of the presence of a spouse in the home on a woman's household work time depends on the model under consideration. In the two models which include the age of the woman, marital status is statistically significant at the 10% level or better for women who are employed and for all women grouped together (see models I and II). In the two models which replace the measure of the woman's age with the variables HOMEYRS, EDUCW, and EXPRNW, marital status is statistically significant at the 5% level or better in the regression equations which pertain to the group of all women together.

Presence of children

The effect of the presence of minor children in the household on the amount of time that women spend in household work is measured in three ways: the number of children (CLD), the age of the youngest child (AGEYC), and the birth interval between the oldest minor child and the youngest minor child in the household (BINT). The correlation between the three variables, CLD, AGEYC, BINT, and the amount of time women devote to household work (HHTIME), the age of the woman (AGEW), and her household work experience (HOMEYRS) is reported in Table 17.

In all models and for each group of women, the number of children proved to have a statistically significant impact on the amount of time that women spend in household work. At a minimum, the level of significance is 10%. In most instances, a significance level of 1% is obtained both for the individual linear and quadratic terms and for the pair of terms considered jointly. Plots of the non-linear relationship between the number of children and the amount of time that women spend in household work reveal a consistent pattern. As the number of children increases, the amount of time that women devote to household work also increases until four children are in the family. When the fifth child is added to the family, the amount of time that women devote to household work begins to decline and remains on a steady downward path. (The actual turning point of the function occurs between four and five, but children come in discrete, not continuous numbers.) These results are invariant with respect to the model used or to the group of women considered. This pattern of time use suggests that, perhaps, the older children are able to assist the woman with both care of the house and care of younger siblings. The age of the youngest child performed best as a linear term in all models and for all groups of women. At no time did the quadratic term, taken as an individual variable, achieve statistical significance. Note, however, that the linear and the quadratic term, taken jointly, did prove to be statistically significant at or above the 10% level for all groups of women across all models. Plots of the non-linear relationship between the age of the youngest child and the amount of time that women spend in household work reveal, in general, a steady decline in the amount of time that employed women devote to household work as the child ages. For the not employed women, a slight increase in the amount of time devoted to household work is noted as the child enters adolescence (between the ages of 12 to 14). When both employed women and not employed women are considered as a group, the amount of time that the women spend in household work steadily declines until the child reaches late adolescence (between the ages of 16 to 17).

The birth interval between the youngest and the oldest minor child in the household exerts a consistent, statistically significant influence on the amount of time that all women, taken as a group, spend on household work. For the linear term, the level of significance obtained is 1%, and for the quadratic term, it is 5%. Considered jointly, the level of significance is at or above 5%. These results are observed across all four models. When the total group of women is partitioned according to employment status, a different pattern emerges.

The birth interval between the youngest and the oldest minor child in the household never attains statistical significance for those women who are not employed in any of the four models. This is true regardless of whether the linear and the quadratic terms are considered individually or jointly. For those women who are employed, the linear term itself and the linear and quadratic term combined does make a difference (at the 5% level or above) in the amount of time that these women devote to household work.

For each group of women, across all models, the signs of the linear and the quadratic term are consistent. Plots of the non-linear relationship between the birth interval between the oldest child and the youngest child and the amount of time that women spend in household work indicate that, as the birth interval increases, women's household work time decreases until the birth interval spans approximately 10 years. Beyond this point, further increases in the birth interval are associated with an increase in the amount of time that women devote to household work. It is interesting that this turning point is reached first by those women who are not employed. For this group the turning point is 8 years, across all models. A delay in this turn around is associated with the employed women. For this group, the turning point is 10 to 13 years, depending on the model. This suggests that, to a point, older children may take on some household responsibilities and thus decrease the amount of time that the women must allocate to household work. However, as these older children age, they either leave home or they acquire interests and activities outside the home that decrease the amount of time that they are willing and able to devote to household tasks. Performance of these tasks may then be resumed by the women.

Summary of comparisons

Each comparison in this section has either examined selected aspects of the composition of the four models or has assessed the impact that selected variables have on women's household work time. The first comparison examined the difference between the models that included an explict estimate of the market wage received by women who are employed and the models that excluded such a estimate. It was found that the components of the equation which estimates the market wage received by women who are employed does tend to have an impact on the amount of time that women devote to household work. This impact may be measured directly by including an estimate of the market wage in the household time regression of those women who are employed (whether considered as a separate group or as a part of the total group of women). Models I and III exemplify this approach. Or, this impact may be measured indirectly by including the components of the estimated wage equation in the household time regression for each group of women considered. Model IV exemplifies this approach.

The second comparison examined the differences that exist among the three groupings of women in each of the four models. This comparison revealed an interesting pattern. In both models which include an explicit estimate of the wage (models I and III), higher R^2 statistics are associated with the household time equations for the total group of women. But, in the two models which exclude the explicit estimate of the wage from the set of variables (models II and IV), the higher R^2 statistics are associated with the household time equations for the not employed group of women.

Two approaches to the measure of the age of the woman are examined in the third comparison. In models I and II, the age of the woman is measured in years as the variable AGEW. In models III and IV, the years of a woman's life are disaggregated into the years spent in the home (HOMEYRS), the years spent in education (EDUCW) and the years spent in the labor force (EXPRNW). (Note that steps were taken to minimize the possibility of double counting among these variables. See Table 10 for further information regarding the construction of these variables.) Judging from the individual and joint statistical significance of the relevant variables and from the model R^2 statistics, the disaggregated measure of age is the better performer.

The fourth and fifth comparison reveal that, for all groups of women considered, household work time increases when a spouse is present, and/or when the number of minor children at home increases, and/or the younger the age of the youngest child, and/or the smaller the birth interal between the oldest and the youngest child.

Gronau Revisited

In this section, the empirical results obtained by Gronau (1980), are compared against the empirical results obtained for the group of employed women in the four models in this thesis. This comparison is of interest because the models used in this thesis have evolved from and are quite similar to the model which Gronau developed and estimated. Further, the comparison of the results obtained in this thesis against prior work of similar nature and content provides a basis for confirming or disaffirming this prior work.

The Gronau model consists of two equations. The first equation estimates the wage received by white, married, employed women. The second equation estimates the amount of time that these women spend in household related work.

Two of the four models presented in this thesis contain an explicit estimate of the wage received by employed women. All of the four models contain an estimate of the household work time of employed women. (Data limitations precluded any consideration of the race of the women.)

The results of the estimated wage equations are compared first. Then, using the results which Gronau obtained for the household work time of white, employed, married women as a basis for comparison, the results obtained for the household work time regressions for employed women are examined.

The estimated wage regressions

Gronau chose to estimate the wage received by the employed woman rather than use the woman's self report of this statistic. His justification for this choice is that this estimation will reduce the effect of measurement bias (Gronau, 1980, p. 410). His estimation equation, recall, is of the semi-log form:

$$\ln W = -.4237 + .0827EDUCW + .0186EDUCH + .0331EXPRNW - .0006(EXPRNW)^2 \quad (5.1)$$
$$\qquad (3.83) \quad (8.34) \quad (2.25) \quad (5.48) \quad (3.39)$$

(Gronau, 1980, p. 410)

In this thesis, both model I and model III contain an explicit estimate the the wage of the employed woman. The equation used in this thesis for this estimate is similar to the equation which Gronau used with these exceptions: (1) the variable EDUCW2, the square of the education variable, is added to ascertain the non-linear effects of this variable, (2) the variable EDUCH is deleated as irrelevant to estimation of the wage of the women, (3) no logs are used. The regression coefficients and their corresponding t values are listed in Table 12. The R^2 statistic and the joint F test of the non-linear terms are also given in this table. Note, the estimated wage regression for models I and III use the same set of exogenous variables and rely on data from the same group of women for empirical estimation. The estimated coefficients have identical signs. Similar R^2s and adjusted R^2s are obtained. The difference between the two equations results from the difference between the selection bias correction factor, $LAMBDA_E$, used in each equation. The set of exogenous variables used to estimate $LABMDA_E$ for model I differs from the set of variables used to estimated $LAMBDA_E$ for model III. (See Appendix D for greater detail on these differences.)

Gronau found a positive relationship between an employed woman's years of education and her estimated wage. This result appeals to reason as it suggests that as her educational level increases, her estimated wage also increases. This result is replicated in the wage equations which are estimated in models I and III. Although the relationship between the employed woman's educational level and the time that she devotes to household work begins to decrease at a decreasing rate, the function reaches a minimum between approximately four to five years of education. Over the relevant range of educational level, the function increases at an increasing rate. Note that neither the linear nor the quadratic form of the variable EDUCW is statistically significant when considered alone. However, joint significance is achieved at the 1% level.

Gronau found that increasing the employed woman's labor force experience increases her estimated wage, at a decreasing rate. Both the linear and the quadratic form of the variable EXPRNW are individually significant. No joint F test was performed by Gronau. Similar results are obtained in models I and III. Statistical significance is achieved for the linear and the quadratic form of the variable, both individually and jointly, at the 1% level.

The variables in the estimated wage regression of model I and model III explain a larger percentage of the variance in the estimated wage of the employed women than that explained in the Gronau model. Both the R^2 statistic and the adjusted R^2 statistic for both models are approximately 0.24. In contrast, the R^2 reported by Gronau for the estimated wage equation is 0.16. This difference in R^2 could be due to the use of a different data set and/or to the fact that a semi-log form was not used in the wage equations in this thesis.

<u>The estimated household work time regressions</u>

Four models are used in this thesis. These models and the equations which constitute them are listed in Appendix D. Each model contains an estimate of the amount of the that women, classified by employment status or considered as a group, spend on household related work. The regression coefficients and the related statistics which pertain to these estimates are reported in Tables 13 through 16. Since Gronau did not include women who were not employed in his analysis, only the empirical results which pertain to employed women will be contrasted against the empirical results reported by Gronau.

According to Gronau, the estimated household work time of white, married, employed women is:

$$H = \underset{(4.63)}{852.51} + \underset{(3.35)}{7.526}\ AGEW + \underset{(2.25)}{46.168}\ EDUCW + \underset{(2.58)}{25.813}\ EDUCH$$

$$- \underset{(0.56)}{4.614}\ WAGEH - \underset{(1.22)}{1.879}\ OTHINC + \underset{(9.58)}{190.080}\ CLD$$

$$- \underset{(3.56)}{17.494}\ AGEYC + \underset{(1.80)}{30.617}\ ROOMS - \underset{(5.18)}{1009.743}\ EXPWAGE \qquad (5.2)$$

(Gronau, 1980, p. 410)

A general similarity between this regression equation and the regression equations estimated for the group of employed women across all models may be noted at this point. All of the exogenous regressors chosen by Gronau are included in all of the household work time regressions used in this thesis, with these exceptions. First, the variable AGEW appears only in models I and III. It is disaggregated into the three variables HOMEYRS, EDUCW, and EXPRNW in models II and IV. Second, the variable EDUCH, the educational level of the husband, is excluded from analysis in this thesis because preliminary analysis revealed this variable explained little of the variance in household work time for any group of women. Also, the educational level of the husband (EDUCH) is highly correlated with the wage that he receives (WAGEH). Third, data limitation precluded replication of the continuous variable ROOMS (the number of rooms). As a proxy for the size of the dwelling, a dummy variable representing ownership of a single family dwelling (OWNSFD) is used.

The sign associated with the intercept and with the variables CLD, AGEYC, OTHINC in the Gronau model are replicated in all of the household time regressions estimated in this thesis, regardless of the group of women or the model considered. This is also true of the variables ROOMS and EXPWAGE in the Gronau model and their counterparts in the household time regressions estimated in this thesis. Attention will now be focused on specific similarities and differences between the estimated household time regression in the Gronau model and the household time regressions estimated for employed women across all models.

Gronau found a positive, statistically significant relationship between the age of a white, married, employed woman (AGEW) and the amount of time that she spends in household work. He finds similar results with respect to her level of education (EDUCW). He does not include her labor force experience (EXPRNW) in the set of exogenous variables thought to influence household work time.

For the employed women in model I, the relationship between the age of the woman and her household time is positive, but not statistically significant. The results for model II indicate that as an employed woman ages, her household work time decreases at a decreasing rate. But, no individual or joint significance is found for the linear or quadratic measure of the variable AGEW.

Work experience in the home (HOMEYRS), educational level (EDUCW), and work experience in the market (EXPRNW) replace the age of the woman (AGEW) in models III and IV. For the employed woman, model III shows a positive relationship between the woman's home experience, education, work experience and her household work time. This relationship is statistically significant for the variables HOMEYRS and EXPRNW at the 5% and 10% level, respectively. The non-linear measure of HOMEYRS included in the regression equation in model IV, reveals that, as HOMEYRS increase, the amount of time an employed woman devotes to work related to the household increases at a decreasing rate. Both the linear and the quadratic term are individually and jointly significant at or above the 10% level. This result is not greatly different from that obtained in model III, when a linear form of the variable is used. However, a reversal of signs appear when non-linear measures of the variables EDUCW and EXPRNW are used. Household work time for the employed woman decreases at a decreasing rate as either her educational level or her labor force experience increases. Note, however, that only the individual linear and quadratic terms for EXPRNW are statistically significant, and that only at the 10% level.

Gronau controlled for the marital status of the woman by only including those women who were married in the empirical estimation of his model. In this thesis, both single women and married women were included in the empirical estimation of the models considered. Thus, to ascertain the effects of marriage on household work time, it was necessary to include a dummy variable in the equations which estimated household work time, DMAR. It was found that, for employed women, the presence of a spouse in the home was positively associated with household work time. In fact, this same result was found for all groups of women across all four models.

Gronau found that the wage of the husband had a negative effect on the amount of time the employed wife spent in household work. In the household time regressions in this thesis which pertain to employed women, this sign was replicated in model IV only. In all other household time regressions which pertain to employed women, this variable had a positive coefficient. In both the Gronau model and in the models in this thesis, a very low t ratio was obtained for the variable WAGEH.

As mentioned earlier, Gronau found that the household work time of white, married, employed women increased as the number of children increased and decreased as the youngest child aged. For the employed women considered in the models in this thesis, the same results are obtained for the linear variables CLD and AGEYC. Further, it was found that the effect of the presence of minor children in the home on the amount of time employed women spend on household work, as measured by the number of minor children, the age of the youngest minor child, and the birth interval between the oldest and the youngest minor children in the household was consistent across all four models.

In contrast to Gronau, non-linear measures of the variables related to the presence of minor children in the home were used in the models in this thesis. It was found that, as the number of minor children in the household increased, household work time increased for these women at an increasing rate until approximately four children were in the family. Further additions of children were associated with a downward turn of the function and, after this point, household work time decreases at a decreasing rate. Both the linear and the quadratic measures of the number of minor children in the home are statistically significant, individually and jointly, at the 1% level. As the youngest minor child in the household ages, the time required for household work declines at a decreasing rate. The relationship between the age of the youngest child and the household work time of women depended, to some extent, on the group of women considered. For employed women, the relationship is essentially linear for the relevant range of the variable AGEYC (0 through 17 years of age) across all models. For not employed women, the function begins to increase at an increasing rate when the age of the youngest child is between 12 to 14 years of age, depending on the model considered. When all women are considered together, a combination of these effects may be seen. As the age of the youngest child increases, over the greater part of the relevant range, the function decreases at a decreasing rate. The upturn in the function occurs at a later point for this group of women than it did for the group of not employed women (when the youngest child is 16 to 17 years of age).

The linear term AGEYC is statistically significant at the 10% or the 5% level, depending on the model considered. The quadratic variable, AGEYC2 is never significant. But, the joint effect of the linear and the quadratic measures is statistically significant at the 1% level across all models.

Gronau did not measure the effect of the birth interval between the oldest and the youngest child on the amount of time spent in household work by employed women. Work by Zick and Bryant (1983) suggested that this measure could contribute to the explanatory power of the equation. This did prove to be true for the models used in this thesis. In each household work time regression which pertained to employed women, the birth interval (BINT) is negative and significant at the 5% level or above. The squared term (BINT2) did not fare as well. It was positive in each model, but not significant. However, in the household time regressions which pertain to employed women, the birth interval is jointly significant at the 5% level or above in each of the four models.

Gronau does not address the problem of selection bias. In this thesis, however, selection bias correction factors are calculated and used to decrease the effect of selection bias in the regression equations which pertain either to employed women or to not employed women. The selection bias correction factor for the household work time regressions for employed women is positive across all models. Statistical significance is never attained. The t value for the correction factor for employed women ranges from a low of 0.22 in model I to a high of 1.06 in model III. It is interesting that the only significant difference between model I and model III is the method used to measure the age of the woman. In model I, the linear variable AGEW is used. In model III, the linear variables HOMEYRS, EDUCW, and EXPRNW replace AGEW.

The R^2 for the equations in this thesis which estimate the amount of time that employed women devote to household related work range from a low of 0.296 for model II to a high of 0.334 for model IV. Gronau reports an R^2 of 0.158 for the equation which estimates the amount of time that employed women spend in household work (Gronau, 1980, p. 410; see also equations (2.14) and (5.2) in this thesis).

Note that the equations used in this thesis which pertain to the employed women contain a greater number of independent variables than the equations used by Gronau (see Appendix D, equations (D.4), (D.8), (D.14), (D.18)). In general, the greater the number of independent variables in a regression equation, the smaller the variation in the dependent variable that remains unexplained. Since R^2 measures the proportion of the variability in the dependent variable which has been explained by the regression equation, additional independent variables will never decrease R^2 and, in the usual case, will increase it (Pindyck and Rubinfeld, 1976, p. 58). The adjusted R^2 statistic takes the number of independent variables present in the regression equation into account. Thus, it measures the proportion of variation which has been explained by the independent variables, given the number of independent variables in the model. The adjusted R^2 for the estimated wage regression is 0.233 for model I and 0.228 for model III. This still exceeds the R^2 of 0.16 which Gronau obtained. The adjusted R^2 for the estimated household work time regressions range from a low of 0.247 for model II to a high of 0.287 for model IV. These figures, too, exceed the R^2 of 0.158 which was reported by Gronau.

The larger R^2 terms obtained in this thesis may be due to the fact that different data sets were used. Or, it may be that the presence of the dummy variable for marriage (DMAR) and the non-linear terms do, in fact, increase the proportion of explained variation in expected wages and the amount of time that employed women spend in household work.

In general, then, the household work time equations in this thesis which pertain to employed women confirm and support several of the results achieved by Gronau.

Examples

The regression equations which pertain to the amount of time devoted to household work by women who are employed, by women who are not employed and by all women combined in one group ($HHTIME_E$, $HHTIME_{NE}$, $HHTIME_T$) can be used to generate case specific examples which estimate the amount of time that a particular woman spends on household tasks.

A computer spreadsheet program such as Lotus 1-2-3 or Visi-Calc may be used to perform the estimation. Depending on the application of the result, a decision is made as to what is to be allowed to vary and what is to be held constant. The items that are allowed to vary are multiplied by the appropriate regression coefficient. The mean of each of the items that are to be held constant are multiplied by the appropriate regression coefficient and added to the constant intercept term. The result of these two procedures is then added together to yield the estimate of the amount of time spent in household work. In the original data set, the unit of measure for time is the number of minutes per week. Dividing the household time in minutes per week by sixty will easily convert the unit of measure to number of hours per week, which is a more common measure of time spent in productive activity.

Four specific examples are presented here. Each example estimates the amount of time that a particular woman spends in household work per week. These characteristics are assumed to be constant in each example:

- she has a high school education (EDUCW = 12)
- she is married (DMAR = 1)
- her husband earns $10.00 per hour (WAGEH = $10)
- her family's non-wage income is $7000 per year (OTHINC = $7000)
- her family lives in a single family dwelling, which they own (OWNSFD = 1)

To highlight the effect of employment and the presence of minor children in the home on the amount of time that women spend in household work, the variables which pertain to employment of the woman and to the presence of minor children in the home are allowed to vary from woman to woman. All of the examples generated use the coefficients from model IV. This model was chosen because, of all the models, it performs well both in terms of the R^2 statistics and the significance levels of the variables included in the model. Further, it often happens in practice that data is not available on the wages that the woman may have earned during her life. An advantage of model IV is that the wage of the woman is included implicitly rather than explicitly in the relevent household work time regression equations.

The first example illustrates the case of a woman who never worked outside the home. She has a husband, but no children. For this example the coefficients of the regression equation which pertains to the women who are not employed are used. The second example focuses on a career woman who, like the woman in the first example, has a husband and no children. For this example, the coefficients of the regression equation which pertains to the women who are employed are used. The woman in the third example worked outside the home from the time that she was twenty until she was twenty-four. At age twenty-five, her first child is born. When this child is three years of age, her second child is born. When this child is two years of age, her third child is born. During the time that the children are at home, she is not in the work force. Each child leaves the home at age 18. The last child leaves home when the woman is 48 years old. The woman then re-enters the work force and remains there until she retires at age 65. Since this woman spends some of her years in the home and some of her years in the market, the coefficients for all women is used. The final example focuses on a woman who is employed from the time that she is twenty years old until she is twenty-four. When she is twenty-five, her first child is born. At this time, she leaves market work and works in the home from the time the child is born until the child is three years old. She then re-enters the labor market and works until she retires at age 65. Like the woman in the third example, this woman spends some years in the labor force and some years at home. Thus, for this example, too, the coefficients for the equation which estimates the amount of time that all women in the sample taken as a group spend in household work is used. The results of all four examples are presented in table 18.

Some general patterns may be noted across these examples. The woman who works outside the home and has no children at home allocates the least amount of time to household work. From the time that she is 20 until she is 64, she spends an average of approximately 994 hours per year doing household related work. She spends the least amount of time in household work during her middle years (approximately 884 hours per year each year between age 30 to age 40). Interestingly, it is the women who has neither work outside the home nor children at home who devotes the greatest amount of time to household work. For this woman, the amount of time devoted to household work, on average, from the time that she is 20 until she is 64, is 2050 hours per year. This figure is essentially equivalent to the amount of time that she would spend on a full time job. In this thesis, this difference arises, at least in part, because the parameter estimates which pertain to the not employed women differ from the estimates which pertain to women who are employed (see Appendix D, equations (D.18) and (D.19), and Table 16). Also, it is reasonable to expect that the employed woman faces demands on her time that decrease both the time and the energy that she has available to devote to household work. As a consequence, compared to her not employed counterpart the employed woman may have lower performance standards and/or rely more frequently on capital-intensive rather than labor-intensive methods of completing her household work. Both of these adaptive strategies would decrease the amount of time that an employed women devotes to household work.

The addition of minor children to the family unit is consistently associated with an increase in household work time. This result is not surprising, given the statistical signficance associated with the variables pertaining to the presence of minor children in the home in the equations which pertain to household work time. It is assumed that children are born to the women portrayed in examples III and IV. The woman in example III has three children and does not work outside the home while her children are under 18 years of age. Her household work time increases to 676 hours per year the year the first child is born. As this child grows older, the additional amount of time devoted to household work declines until additional children are born into the family unit. With each additional child, the same pattern of an initial increase in household work time followed by a steady decline is noted. It is interesting that the birth of each additional child is associated with a slightly smaller increase in the amount of time the mother devotes to household work. The birth of the second and third child is associated with an increase of 364 and 260 hours of household work per year, respectively. Perhaps some economies of scale are being realized. The woman in example IV is assumed to have one child and to be out of the labor force for only the first few years of her child's life. As with her counterpart in example III, this woman finds the birth of her child associated with an initial increase in time devoted to household work, followed by a decline in such time as the child matures.

CHAPTER VI: SUMMARY

This thesis presented two separate analysis of the same dependent variable: the amount of time women spend in household work. One analysis used simple statistical procedures to describe the impact that marriage, children and employment had on the amount of time that women spend on household work. The other analysis used more sophisticated statistical procedures to explain the variation in and to obtain an estimate of the amount of time that women spend on household work. For the descriptive analysis, women were classified according to their marital status, their employment status, and the presence or absence of minor children in the home. Eight family types were thus represented, each one specifying a particular combination of the three classification criterion. Histograms were used to visually portray the mean number of minutes per week women in each family types spent in each of eight mutually exclusive household tasks: meal preparation, care of the household, care of the grounds, care of household durables, care of clothing, care of child family members, care of adult family members, and marketing and management.

Analysis of variance was used to learn whether the differences across family type for each of the eight household activities were statistically significant. It was found that, for all eight activities, there was no interaction among marital status, employment status, and presence or absence of minor children in the home. The amount of time that married women spent on meal preparation and on care of adult family members was significantly different from the amount of time that single women spent on the same activities. The amount of time that women with minor children at home spent on care of household durables, care of clothing and care of child family members was significantly different from the amount of time spent in these areas by women without minor children at home. Employment status was significant influence on the amount of time that women spent on meal provision, care of the house, care of clothing and care of child family members.

For the regression analysis, the total group of women was divided according to employment status. Three groups of women were then used: employed women, not employed women and all women considered as one group. Steps were taken to decrease the effect of both measurement error and selection bias. Four models were presented. These four models had several exogenous variables in common. The four models differed in essentially two respects: the way the age of the woman and the way the wage of the employed woman was included in the household time regression equations. Each model contains an estimate of household work time for the three groups of women previously mentioned. Selected characteristics of these household work time regressions were compared across all models. It was found that the results are, in general, similar across all models. Overall, the household regression equations which pertain to the total group of women performed the best when the R^2, the adjusted R^2, and the occurrence and degree of statistical significance among the set of exogenous variables are used as the basis for this judgment. Also, the regressions in each model which pertain to women who are employed are compared against the regression equations which Gronau (1980) developed and estimated for a similar group of women. It was found that the results of the regression equations in this thesis which pertain to women who are employed tend to confirm and support the results which Gronau obtained. the estimated wage regression the result of the regressions which pertain to women who are employed are compared against the results obtained by Gronau (1980). Four examples were developed to illustrate how the estimated regression equations could be used to assess the amount of time that a paticular woman would spend on household work. Model IV was used as the basis for these examples as it had several desirable characteristics. The employment status and the labor force participation history of the woman exemplified dictated the which household work time regression equation was to be used.

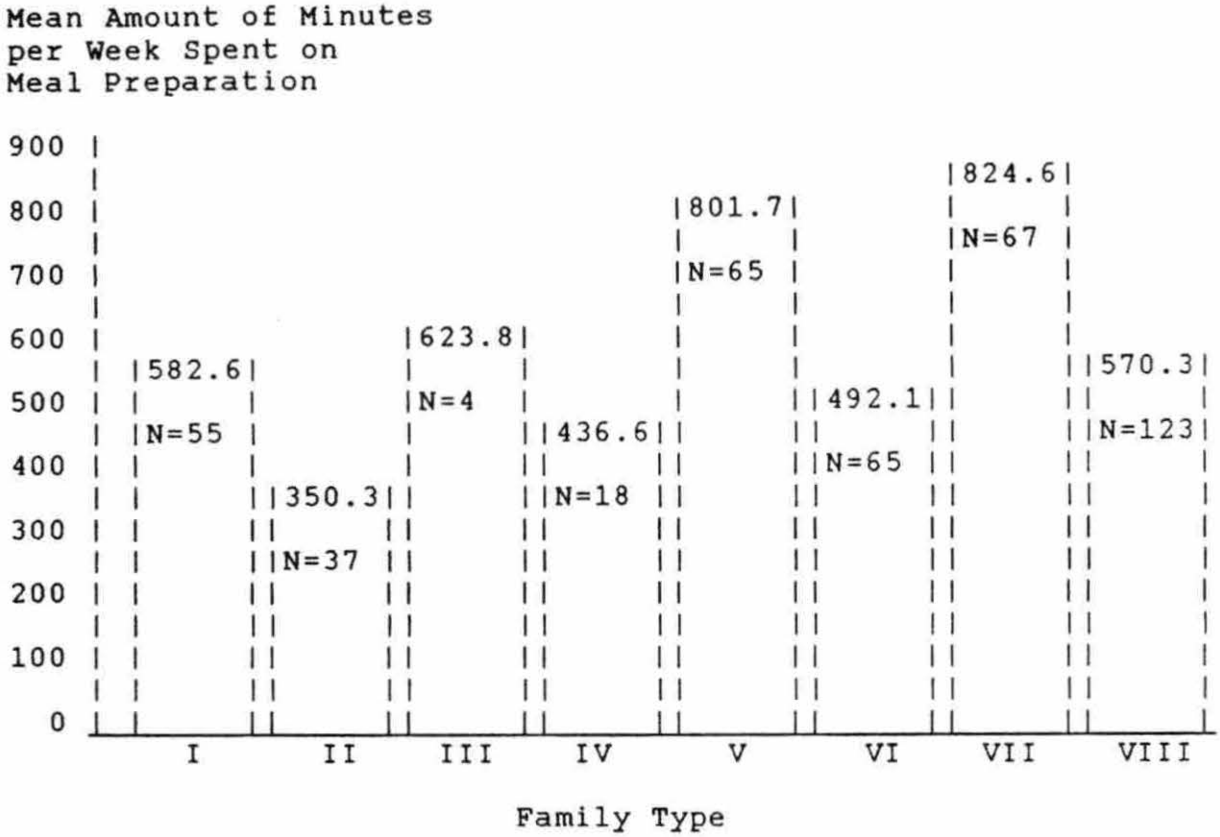

Figure 1. Histogram of the mean amount of minutes per week that women spend on meal preparation grouped by family type

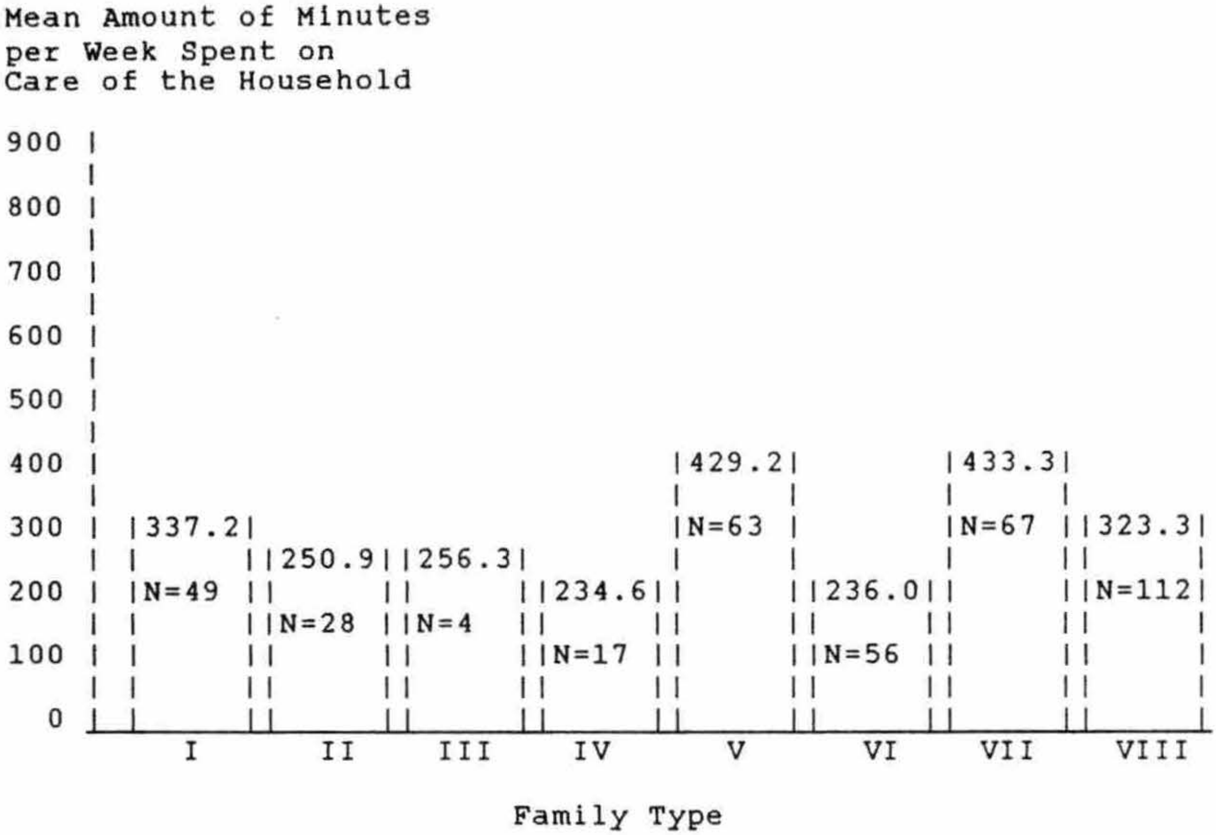

Figure 2. Histogram of the mean amount of minutes per week that women spend on care of the household grouped by family type

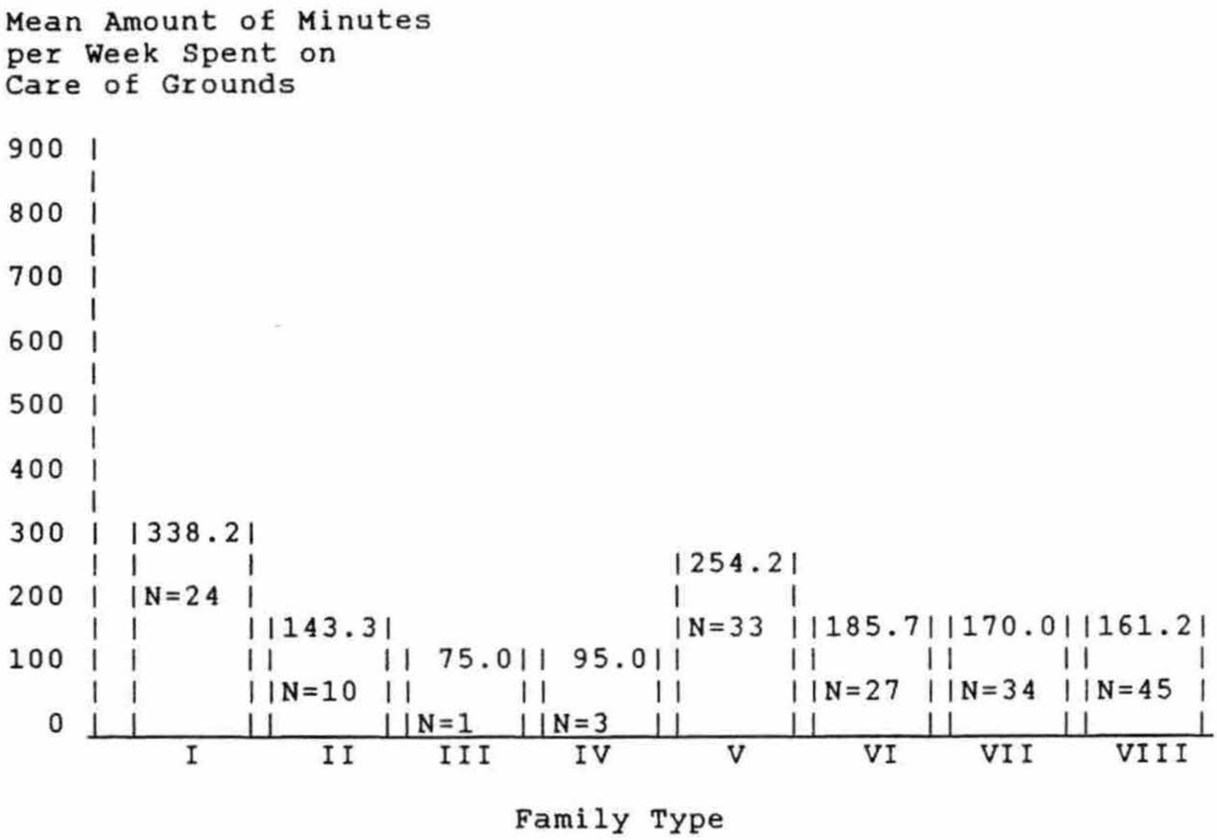

Figure 3. Histogram of the mean amount of minutes per week that women spend on care of grounds grouped by family type

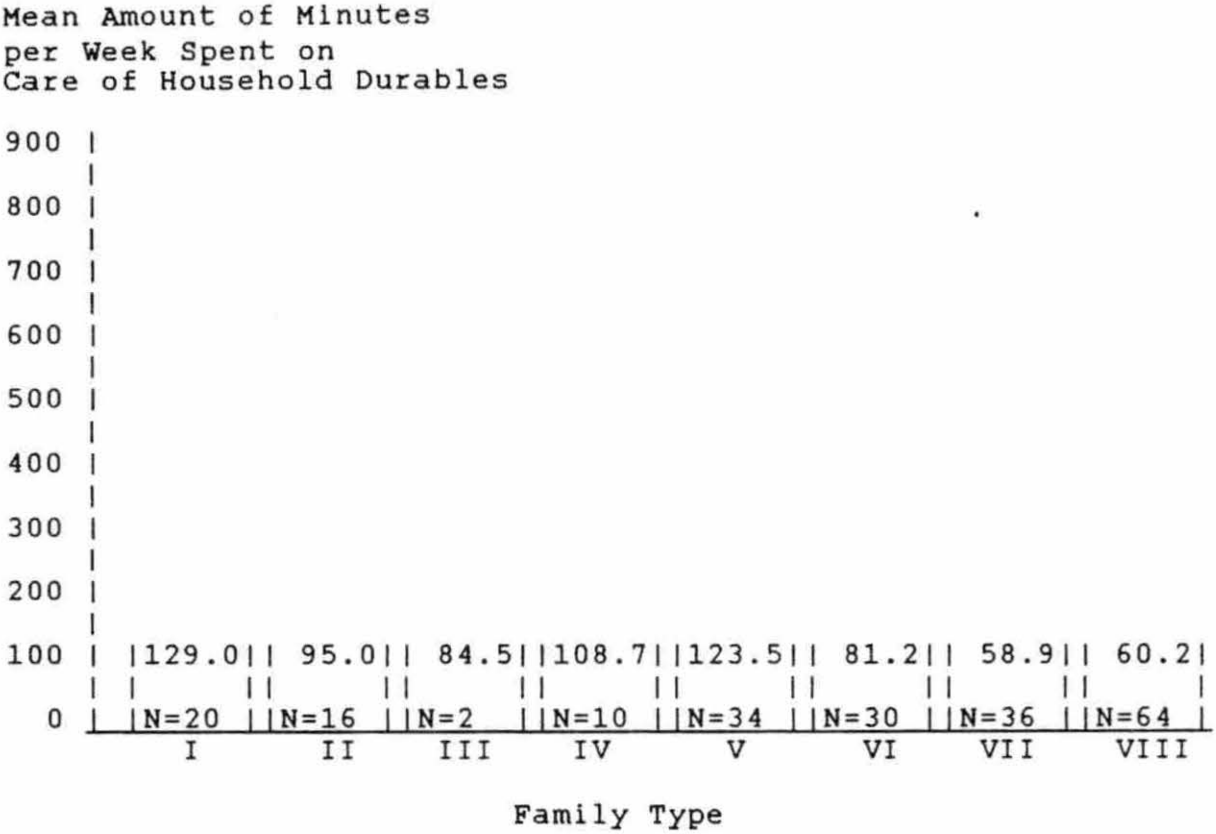

Figure 4. Histogram of the mean amount of minutes per week that women spend on care of household durables grouped by family type

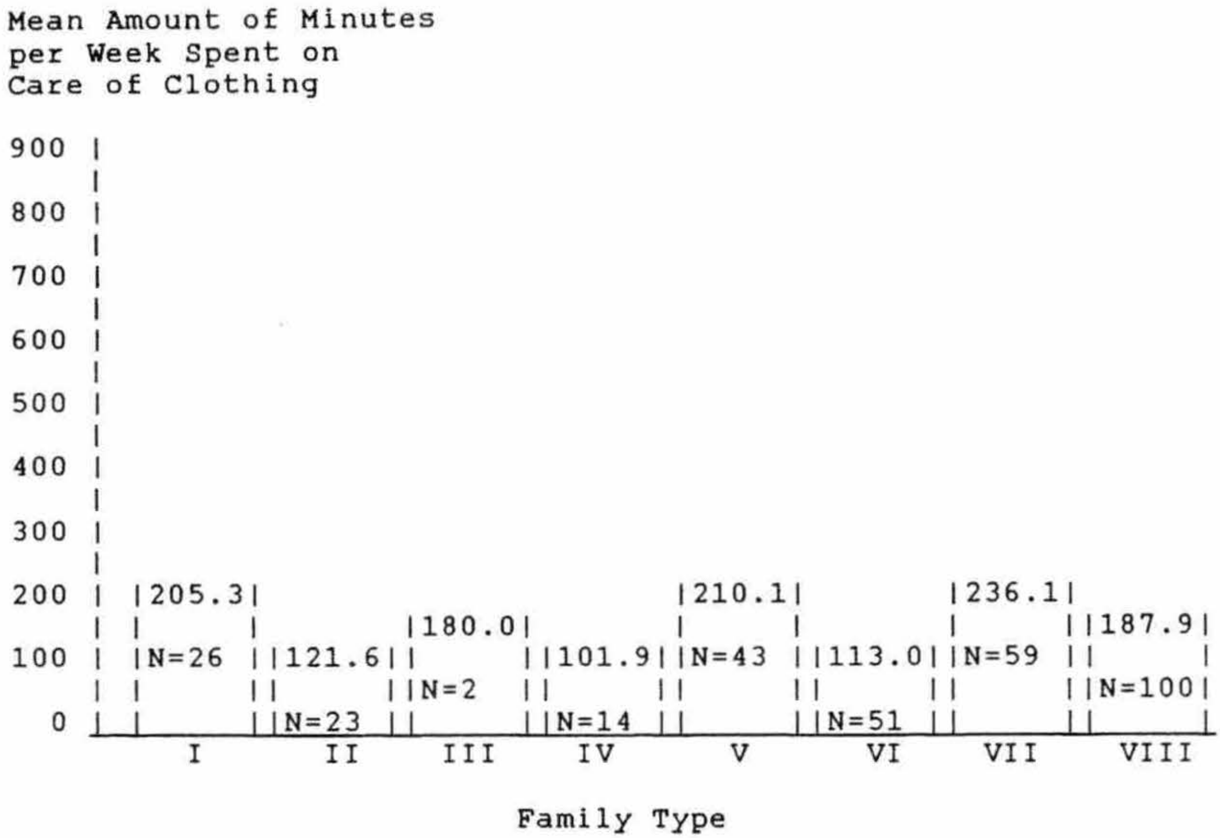

Figure 5. Histogram of the mean amount of minutes per week that women spend on care of clothing grouped by family type

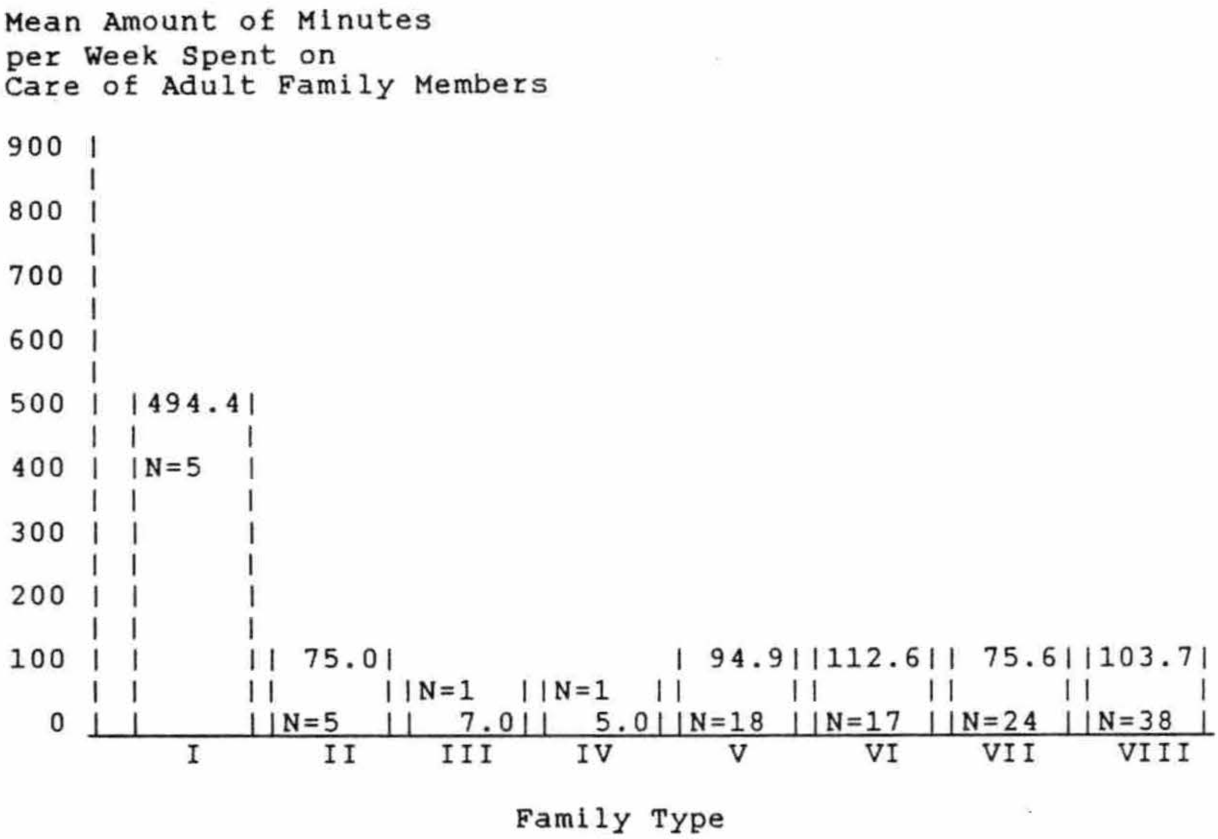

Figure 6. Histogram of the mean amount of minutes per week that women spend on care of adult family members grouped by family type

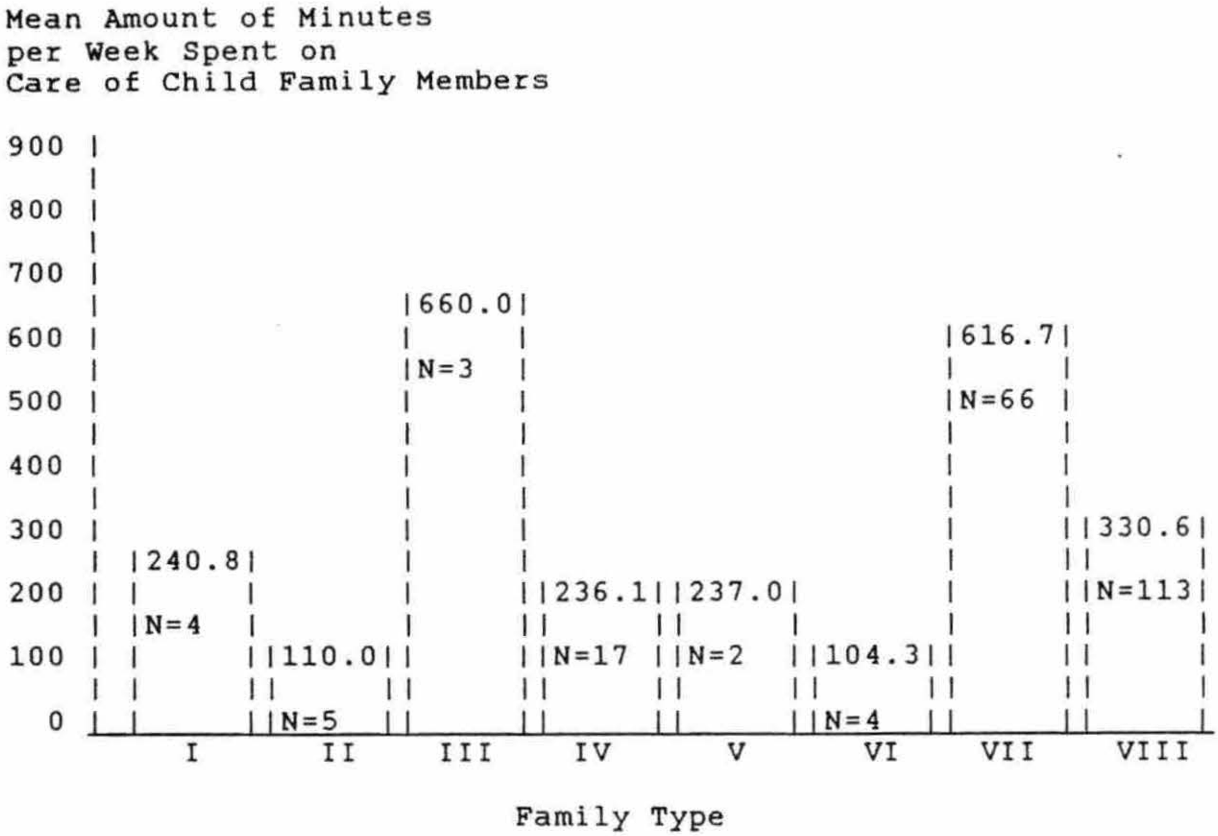

Figure 7. Histogram of the mean amount of minutes per week that women spend on care of child family members grouped by family type

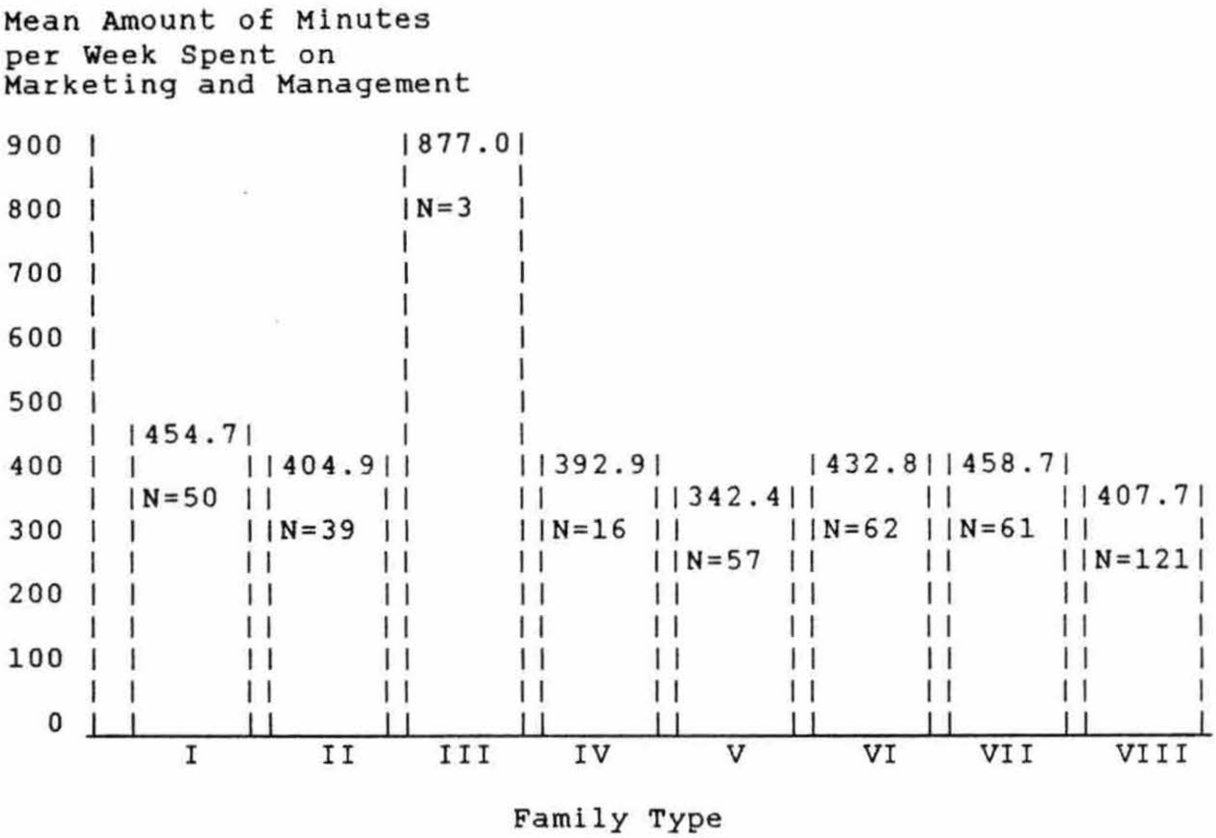

Figure 8. Histogram of the mean amount of minutes per week that women spend on marketing and management grouped by family type

Table 1. Proportion of women grouped by family type that did not spent any time in the given household activity

	Family Type							
	I	II	III	IV	V	VI	VII	VIII
Meal Provision	0.0	5.1*	0.0	0.0	0.0	0.0	0.0	0.8*
Care of House	10.9	28.2	0.0	5.6*	3.1*	13.8	0.0	9.7
Care of Grounds	56.4	74.4	75.0*	83.3	49.2	58.5	49.3	63.7
Care of Household Durables	63.6	59.0	50.0*	44.4	47.7	53.8	46.3	48.4
Care of Clothing	52.7	41.0	50.0*	22.2*	33.8	21.5	11.9	19.4
Care of Adult Family Members	90.9	97.4	75.0*	94.4	72.3	73.8	64.2	69.4
Care of Child Family Members	92.7	87.2	25.0*	5.6*	96.9	93.8	1.5*	8.9
Marketing and Management	9.1*	0.0	25.0*	11.1*	12.3	4.6*	9.0	2.4*

*Indicates cases where $n \leq 5$.

Table 2. Analysis of variance in meal provision by work status, presence or absence of minor children in the home, marital status [N = 434]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	9514534.0	3	3171511.4	29.0*
Work Status	7106693.5	1	7106693.6	65.1*
Children	322285.9	1	322285.9	3.0
Marital Status	2201259.6	1	2201259.6	20.2*
2-Way Interaction	135013.3	3	45004.5	0.4
Work Status Children	62391.1	1	62391.1	0.5
Work Status Marital Status	91963.8	1	91963.8	0.8
Children Marital Status	1457.5	1	1457.5	0.9
3-Way Interaction	252.2	1	252.2	0.0
Work Status Children Marital Status	252.2	1	252.2	0.0
Explained	9649799.6	7	1378542.8	12.6
Residual	46540825.7	426	109250.8	
Total	56190625.3	433	129770.5	

* $p < .05$

Table 3. Analysis of variance in care of house by work status, presence or absence of minor children in the home, marital status [N = 396]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	1911316.4	3	637105.5	6.8*
Work Status	1616321.1	1	1616321.1	17.5*
Children	110794.3	1	110794.3	1.2
Marital Status	254052.2	1	254052.2	2.8
2-Way Interaction	247471.1	3	82490.4	0.8
Work Status Children	130786.1	1	130786.1	1.4
Work Status Marital Status	149726.5	1	149726.5	1.7
Children Marital Status	111743.7	1	111743.7	1.2
3-Way Interaction	811.9	1	811.9	0.0
Work Status Children Marital Status	811.9	1	811.9	0.0
Explained	2159599.4	7	308514.2	3.3
Residual	35755015.3	388	92152.1	
Total	37914614.7	395	96986.4	

* $p < .05$

Table 4. Analysis of variance in care of grounds by work status, presence or absence of minor children in the home, marital status [N = 177]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	504754.0	3	168251.3	3.5*
Work Status	167983.6	1	167983.6	3.5
Children	138333.5	1	138333.5	3.0
Marital Status	24430.1	1	24430.1	0.5
2-Way Interaction	213270.0	3	71090.0	1.5
Work Status Children	47492.9	1	47492.9	1.0
Work Status Marital Status	62212.5	1	62212.5	1.3
Children Marital Status	15288.9	1	15288.9	0.3
3-Way Interaction	14898.0	1	14898.0	0.3
Work Status Children Marital Status	14898.0	1	14898.0	0.3
Explained	732922.1	7	104703.2	2.2
Residual	7916503.8	169	46846.2	
Total	8649425.8	176	49144.5	

* $p < .05$

Table 5. Analysis of variance in care of household durables by work status, presence or absence of minor children in the home, marital status [N = 212]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	126383.3	3	42127.8	3.2*
Work Status	14502.8	1	14502.8	1.1
Children	52617.4	1	52617.4	4.0*
Marital Status	16260.6	1	16260.6	1.2
2-Way Interaction	33987.9	3	11329.3	0.8
Work Status Children	22507.2	1	22507.2	1.7
Work Status Marital Status	952.3	1	952.3	0.1
Children Marital Status	6114.3	1	6114.3	0.4
3-Way Interaction	256.6	1	256.6	0.0
Work Status Children Marital Status	256.6	1	256.6	0.0
Explained	160627.7	7	22946.8	1.8
Residual	2622906.4	204	12857.4	
Total	2783534.1	211	13192.1	

* $p < .05$

Table 6. Analysis of variance in care of clothing by work status, presence or absence of minor children in the home, marital status [N = 318]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	539578.3	3	179859.4	6.4*
Work Status	407443.6	1	407443.6	14.6*
Children	118940.3	1	118940.3	4.2*
Marital Status	21478.8	1	21478.8	0.8
2-Way Interaction	98312.7	3	32770.9	1.2
Work Status Children	31702.1	1	31702.1	1.1
Work Status Marital Status	335.7	1	335.7	0.0
Children Marital Status	63794.8	1	63794.8	2.2
3-Way Interaction	2577.6	1	2577.6	0.0
Work Status Children Marital Status	2577.6	1	2577.6	0.0
Explained	640468.7	7	91495.5	3.2
Residual	8643454.5	310	27882.1	
Total	9283923.1	317	29286.8	

* $p < .05$

Table 7. Analysis of variance in care of adult family members by work status, presence or absence of minor children in the home, marital status [N = 105]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	504658.0	3	168219.3	3.7*
Work Status	7774.8	1	7774.8	0.2
Children	71223.8	1	71223.8	1.5
Marital Status	307252.6	1	307252.6	6.8*
2-Way Interaction	292881.2	3	97627.1	2.1
Work Status Children	40.9	1	40.9	0.0
Work Status Marital Status	87062.3	1	87062.3	1.9
Children Marital Status	110863.7	1	110863.7	2.4
3-Way Interaction	58282.4	1	58282.4	1.2
Work Status Children Marital Status	58282.4	1	58282.4	1.2
Explained	855821.6	7	122260.2	2.7
Residual	4361474.9	97	44963.7	
Total	5217296.5	104	50166.3	

* $p < .05$

Table 8. Analysis of variance in care of child family members by work status, presence or absence of minor children in the home, marital status [N = 214]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	5080145.0	3	1693381.7	12.6*
Work Status	3857291.1	1	3857291.1	28.7*
Children	719660.8	1	719660.8	5.4*
Marital Status	87670.3	1	87670.3	0.6
2-Way Interaction	132048.3	3	44016.1	0.8
Work Status Children	120100.8	1	120100.8	0.8
Work Status Marital Status	33666.3	1	33666.3	0.3
Children Marital Status	8674.7	1	8674.7	0.1
3-Way Interaction	12044.6	1	12044.6	0.1
Work Status Children Marital Status	12044.6	1	12044.6	0.1
Explained	5224237.8	7	746319.7	5.6
Residual	27711928.2	206	134523.9	
Total	32936166.0	213	154629.9	

* $p < .05$

Table 9. Analysis of variance in marketing and management by work status, presence or absence of minor children in the home, marital status [N = 409]

Source of Variation	Sum of Squares	DF	Mean Square	F
Main Effects	459460.0	3	153153.3	1.4
Work Status	395915.2	1	395915.2	3.6
Children	18166.2	1	18166.2	0.1
Marital Status	13862.1	1	13862.1	0.1
2-Way Interaction	162559.8	3	54186.6	0.5
Work Status Children	24290.7	1	24290.7	0.2
Work Status Marital Status	42344.7	1	42344.7	0.4
Children Marital Status	150830.3	1	150830.3	1.4
3-Way Interaction	408199.6	1	408199.6	3.8
Work Status Children Marital Status	408199.6	1	408199.6	3.8
Explained	1030219.4	7	147174.2	1.4
Residual	43255086.8	401	107868.1	
Total	44285306.3	408	108542.4	

* $p < .05$

Table 10. The set of variables used for the logistic regressions, and for the ordinary least squares regressions

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ENDOGENOUS VARIABLES

Y: The log of the odds ratio.

$LAMBDA_E$: The empirical estimate of the selection bias which applies to the employed women.

$LAMBDA_{NE}$: The empirical estimate of the selection bias which applies to the women who are not employed.

ESTWAGE: The estimated wage received by women who are employed, measured in terms of dollars per hour.

$HHTIME_E$: The estimated amount of time that employed women spend in household related work. The estimate is calculated as the sum of time spent in each of the following activities: meal preparation, care of the household, care of the grounds, care of household durables, care of clothing, care of adult family members, care of child family members, marketing and management. The calculation of these household activities is given in Appendix A. HHTIME is measured in number of minutes per week.

$HHTIME_{NE}$: The estimated amount of time that women who are not employed spend in household related work. The estimate is calculated as the sum of the amount of time that women who are not employed spend in each of the eight household activities previously listed.

$HHTIME_T$: The estimated amount of time that all women in sample spend in household related work. The estimate is calculated as the sum of the amount of time that women who are not employed spend in each of the eight household activities previously listed.

Table 10 (Continued)

EXOGENOUS VARIABLES

AGEW: The age of the woman, measured in years.

AGEW2: The age of the woman, squared.

HOMEYRS: The household work experience of the woman, measured in years and calculated as:

AGEW - EXPRNW - EDUCW + ADJ - 5

It is assumed that, if a woman attends college, she does so immediately after high school and that, if her work history includes both part time and full time work, the part time years preceeded the full time years. It is possible that a woman both attended college and worked part time and/or full time for all or part of the time that she attended college. When this occurs, the time that she spent in school and the time that she spent working while in school is substracted from her age. This would yield an inaccurate result as the same years are subtracted twice. Thus, for women who worked while attending college, an adjustment factor is added (ADJ) so that the double subtraction does not occur. The adjustment factor is equal to the time spent in work while in college, measured in full-time equivalent years (see the explanation of the variable (EXPRNW)). If a woman did not attend college or did not work during college then the adjustment factor is equal to zero.

HOMEYRS2 = The home years of the woman, squared.

EDUCW: The education of the woman, measured as number of years of schooling completed. This variable ranged from 0 to 19 years. Years of education in excess of 19 years were coded as 19 years.

EDUCW2: The education of the woman, squared.

Table 10 (Continued)

EXPRNW: The labor force experience of the woman, measured as the number of years worked full time since age 18. For the women whose labor force experience included part time work, an estimate of full time equivalent years was calculated:

PTYRS = number of years worked since age 18 - # of years worked full time

PTHRWK = number of part-time hours worked per week * number of part-time weeks worked per year

FT = 1730 hours per year * number of years worked full time

(The figure 1730 was estimated using a Bureau of Labor Statistics publication (U.S. Department of Labor, 1984.))

EXPRNW = ((PTHRWK * PTYRS) + FT) / 1730

EXPRNW2: The labor force experience of the woman, squared.

DMAR: A dummy variable which indicates marital status. It is coded 1 if married, 0 otherwise.

WAGEH: The wage of the woman's husband. If the woman was married, WAGEH was calculated as the sum of his wage or salary for 1980, his bonus or commission for 1980, and any farming income for 1980 divided by number of hours worked in 1980. WAGEH is measured in dollars per hour. If the woman was not married, WAGEH was set equal to zero.

CLD: The number of children present in the home aged 17 years of age or younger.

CLD2: The number of children, squared.

AGEYC: Age of the youngest child in the home. This variable was set equal to zero for "children" 18 years of age or older.

AGEYC2: Age of the youngest child, squared.

Table 10 (Continued)

BINT: The birth interval between the oldest child in the household and the youngest child in the household. It is calculated as the age of the oldest child minus the age of the youngest child.

BINT2: The birth interval between children in the household, squared.

OTHINC: The sum of all income items which were not wage-related, measured in dollars received in the year 1980. Non-wage income may have come from dividends and interest, royality or rent, supplemental security, social security, pension, welfare, aid to dependent children, unemployment paid by the government, unemployment paid by a union, VA, workmen's compensation, relatives, alimony, child support and other.

OWNSFD: A dummy variable which indicates ownership of a single family dwelling. It was coded 1 if a single family dwelling was owned. (A home being purchased through a mortgage was included in this category.) It was coded 0 otherwise.

ESTWAGE: The estimated wage received by women who are employed, measured in terms of dollars per hour. This variable appears as an exogenous variable in the regression equations which estimate the amount of time that employed women spend in household related work.

EMPWAGE: The result of the multiplication of ESTWAGE with a dummy variable which has been set equal to one if the woman is employed (she reported receiving a wage in 1980) and set equal to zero if the woman is not employed. This variable appears as an exogenous variable in the regression equations which estimate the amount of time that all women spend in houshold related work. The use of the dummy variable is necessary because the total group of women contains both employed women and not employed women. For the purpose of obtaining an estimate of the amount of time that all women

Table 10 (Continued)

spend in household related work, an estimate of the wage that a woman receives is relevant only for those women who are employed. For the women who are not employed, the estimate of the wage is set equal to zero.

Table 11. Means and standard deviations for the variables in in the logistic regression and the ordinary least squares regression [employed women, N = 256; not employed women, N = 170; all women, N = 426]

	Employed Women		Not Employed Women	
Variable	Mean	Standard Deviation	Mean	Standard Deviation
HHTIME	1629.5898	775.7687	2061.8647	912.3645
AGEW	40.6641	11.2220	57.6235	15.9730
HOMEYRS	9.5412	9.5648	28.3174	16.8804
EDUCW	13.0469	2.4935	11.9353	2.9111
EXPRNW	13.4087	9.5172	12.3829	11.9230
DMAR	0.7734	0.4194	0.6647	0.4734
WAGEH	6.7156	6.4582	7.8614	20.5621
CLD	1.3867	1.3672	0.7118	1.3164
AGEYC	4.8320	5.591	2.1176	4.3945
BINT	2.4922	3.4528	1.2412	2.9444
OTHINC	1050.5000	2760.9097	3165.9588	5428.0080
OWNSFD	0.7344	0.4425	0.8000	0.4012
ESTWAGE	6.9964	1.8863	----	----
EMPWAGE	----	----	----	----
$LAMBDA_E$	-0.6985	0.6523	----	----
$LAMBDA_{NE}$	----	----	2.0965	1.1672

All Women	
Mean	Standard Deviation
2061.8647	912.3645
47.4319	15.6892
17.0341	15.9042
12.6033	22.7200
13.0000	10.5417
0.7301	0.4445
7.1729	13.9093
1.1174	1.3858
3.7488	5.3106
1.9930	33.3130
1894.6972	4167.1663
0.7606	0.4272
----	----
4.2044	3.7284
----	----
----	----

Table 12. Table of estimated coefficients for the wage regression for model I and model III, and the joint F test of the non-linear variables [employed women N = 256; not employed women, N = 170]

	WAGE	
Variable	MODEL I	MODEL III
EDUCW	-0.3473 (0.59)	-0.3119 (0.52)
EDUCW2	0.0334 (1.54)	0.0321 (1.47)
EXPRNW	0.3232 (4.84)***	0.3352 (4.85)***
EXPRNW2	-0.0052 (3.14)***	-0.0060 (3.72)***
$LAMBDA_E$	0.6606 (1.47)	0.1744 (0.483)
Intercept	3.0929 (0.76)	2.5217 (0.612)
R^2	0.2485	0.2427
Adjusted R^2	0.2334	0.2275

t-values are given in parentheses

Joint F statistic		
EDUCW	21.5476***	20.3013***
EXPRNW	17.9890***	15.2446***

***Significant at 1% level.

Table 13. Regression results using a linear measure of the age of the woman and an explicit measure of the wage received by the employed woman: Model I [employed women, N = 256; not employed women, N = 170; all women, N = 426]

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
AGEW	0.0562 (0.66)	15.1004 (1.60)	-7.7889 (0.61)	0.2120 (0.06)
AGEW2	-0.0017 (1.99)**	---	---	---
DMAR	-0.3422 (0.89)	245.9779 (1.84)*	192.6514 (1.25)	251.0378 (2.67)**
WAGEH	-0.0509 (2.88)***	0.2657 (0.03)	-0.6425 (0.10)	-1.5113 (0.57)
CLD	-1.1388 (2.01)**	958.0070 (5.40)***	978.3272 (2.49)**	903.3712 (6.24)***
CLD2	0.0800 (1.02)	-121.9380 (5.02)***	-129.7006 (2.13)**	-115.4584 (5.18)***
AGEYC	0.0723 (0.58)	-75.7394 (1.95)*	-146.9124 (1.82)*	-100.9936 (2.86)***
AGEYC2	0.0015 (0.19)	2.3304 (0.55)	6.1954 (1.22)	3.4330 (1.60)
BINT	0.4313 (2.12)**	-146.1813 (2.28)**	-173.0617 (1.24)	-143.5623 (2.71)***
BINT2	-0.0236 (1.89)*	6.0362 (1.47)	11.1110 (1.28)	7.5036 (2.13)**

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 13 (Continued)

Variable	LOGIT	HHTIME EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
OTHINC	-0.00004 (1.12)	-0.0173 (1.02)	-0.0050 (0.40)	-0.0126 (1.40)
OWNSFD	-0.3834 (1.08)	44.8606 (0.42)	219.7827 (1.36)	141.0311 (1.62)
ESTWAGE	---	-80.6253 (3.32)**	---	---
EMPWAGE	---	---	---	-80.7210 (7.85)***
$LAMBDA_E$	---	36.4955 (0.22)	---	---
$LAMBDA_{NE}$	---	---	-46.0403 (0.32)	---
Intercept	3.1152 (1.47)	1117.2826 (3.13)**	2179.6633 (3.29)**	1658.6400 (7.09)***
R^2	---	0.3119	0.3146	0.3267
Adjusted R^2	---	0.2749	0.2622	0.3071

t-values are given in parentheses

Joint F statistic				
CLD	---	14.78***	3.19**	19.75***
AGEYC	---	8.20***	3.27**	13.74***
BINT	---	4.13**	0.82	4.15**

Table 14. Regression results using a quadratic measure of the age of the woman and excluding explicit measure of the wage received by the employed woman: Model II [employed women, N = 256; not employed women, N = 170; all women, N = 426]

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
AGEW	0.0562 (0.66)	-54.6429 (1.13)	-7.4989 (0.13)	28.8049 (1.41)
AGEW2	-0.0017 (1.99)*	0.9005 (1.32)	-0.0030 (0.01)	-0.1578 (0.83)
DMAR	-0.3422 (0.89)	368.9397 (2.67)***	192.5244 (1.22)	314.0671 (3.12)***
WAGEH	-0.0509 (2.88)***	5.6363 (0.49)	-0.6822 (0.07)	0.1872 (0.07)
CLD	-1.1388 (2.01)**	1002.3716 (5.20)***	979.2068 (2.28)*	1097.1305 (6.66)***
CLD2	0.0800 (1.02)	-116.5698 (4.72)***	-129.8522 (1.91)*	-131.7743 (5.27)***
AGEYC	0.0723 (0.58)	-72.7446 (1.83)*	-147.0213 (1.76)*	-117.2483 (3.08)**
AGEYC2	0.0015 (0.19)	1.1197 (0.46)	6.2000 (1.20)	3.4007 (1.47)
BINT	0.4313 (2.12)**	-162.2563 (2.18)**	-173.1020 (1.24)	-186.2267 (3.23)***
BINT2	-0.0236 (1.89)*	7.4366 (1.55)	11.1118 (1.28)	9.4220 (2.48)**

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 14 (Continued)

Variable	LOGIT	HHTIME EMPLOYED WOMEN	HHTIME NOT EMPLOYED WOMEN	HHTIME ALL WOMEN
OTHINC	-0.00004 (1.12)	-0.0149 (0.83)	-0.0050 (0.37)	-0.0084 (0.86)
OWNSFD	-0.3834 (1.08)	54.9259 (0.47)	219.5258 (1.29)	116.8553 (1.22)
ESTWAGE	---	---	---	---
EMPWAGE	---	---	---	---
$LAMBDA_E$	---	328.1425 (0.93)	---	---
$LAMBDA_{NE}$	---	---	-45.0896 (0.19)	---
Intercept	3.1152 (1.47)	1770.6156 (1.99)**	2172.4256 (1.38)	243.7158 (0.48)
R^2	---	0.2857	0.3146	0.2276
Adjusted R^2	---	0.2474	0.2575	0.2052

t-values are given in parentheses

Joint F statistic				
AGEW	---	1.23	0.18	6.62***
CLD	___	13.81***	2.77*	23.57***
AGEYC	---	7.00***	2.87*	17.23***
BINT	---	3.55**	0.82	6.03***

Table 15. Regression results using a linear measure of the home years, the education, and the labor force experience of the woman and an explicit measure of the wage received by the employed woman: Model III [employed women, N = 256; not employed women, N = 170; all women, N = 426]

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
HOMEYRS	-0.1909 (5.41)***	33.1965 (2.02)**	-11.2882 (0.82)	0.9452 (0.25)
HOMEYRS2	0.0013 (1.93)*	---	---	---
EDUCW	-0.1516 (0.49)	48.1672 (1.24)	10.9325 (0.42)	22.5334 (1.49)
EDUCW2	0.0045 (0.37)	---	---	---
EXPRNW	0.0430 (0.95)	15.4957 (1.60)*	-13.3459 (1.47)	-0.6637 (0.15)
EXPRNW2	-0.0020 (2.14)**	---	---	---
DMAR	0.1372 (0.34)	220.4694 (1.63)	190.2584 (1.18)	253.7708 (2.68)***
WAGEH	-0.0461 (2.52)**	1.5864 (0.19)	-3.8551 (0.42)	-1.6215 (0.61)
CLD	-1.7879 (3.07)***	1057.6847 (5.38)***	952.1446 (2.52)**	895.0901 (6.19)***

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 15 (Continued)

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
CLD2	0.1795 (2.12)**	-133.6090 (5.06)***	-127.1813 (2.17)**	-115.1076 (5.17)***
AGEYC	0.1739 (1.30)	-84.5788 (2.14)**	-143.9611 (1.78)*	-100.8005 (2.86)***
AGEYC2	-0.00023 (0.03)	1.0941 (0.47)	6.1527 (1.21)	3.4944 (1.62)
BINT	0.6575 (3.01)***	-190.6780 (2.60)***	-179.9376 (1.23)	-142.2702 (2.69)***
BINT2	-0.0337 (2.50)**	8.6249 (1.88)*	11.6632 (1.29)	7.6071 (2.16)**
OTHINC	-0.00005 (1.44)	-0.0148 (0.88)	-0.0092 (0.69)	-0.0145 (1.56)
OWNSFD	-0.2631 (0.72)	46.9206 (0.44)	209.5573 (1.29)	128.4097 (1.47)
ESTWAGE	---	-110.8673 (1.94)**	---	---
EMPWAGE	---	---	---	-89.8660 (7.27)***
$LAMBDA_E$	---	242.4235 (1.06)	---	---
$LAMBDA_{NE}$	---	---	38.1053 (0.18)	---
Intercept	-4.8418 (2.12)	928.8467 (2.55)**	1971.7470 (3.26)***	554.8608 (0.97)

Table 15 (Continued)

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
R^2	---	0.3194	0.3205	0.3321
Adjusted R^2	---	0.2769	0.2592	0.3093

t-values are given in parentheses

Joint F statistic				
CLD	---	14.61***	3.23**	19.42***
AGEYC	---	8.05***	2.75*	13.17***
BINT	---	4.76***	0.83	3.97**

Table 16. Regression results using a quadratic measure of the home years, the education, and the labor force experience of the woman and excluding an explicit measure of the wage received by the employed woman: Model IV [employed women, N = 256; not employed women, N = 170; all women, N = 426]

		HHTIME		
Variable	LOGIT	EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
HOMEYRS	-0.1909 (5.41)***	46.5865 (2.58)***	27.0004 (1.29)	46.0664 (6.44)***
HOMEYRS2	0.0013 (1.93)*	-0.8607 (1.98)**	-0.4392 (1.92)	-0.6817 (5.47)***
EDUCW	-0.1516 (0.49)	-98.0606 (0.79)	222.1045 (1.69)*	104.9553 (1.32)
EDUCW2	0.0045 (0.37)	3.0244 (0.68)	-9.2188 (1.71)*	-4.3209 (1.41)
EXPRNW	0.0430 (0.95)	-25.2348 (1.66)*	-25.2794 (1.22)	-29.8173 (2.52)**
EXPRNW2	-0.0020 (2.14)**	0.6468 (1.74)*	0.4064 (0.85)	0.6611 (2.59)***
DMAR	0.1372 (0.34)	211.1106 (1.56)	173.1811 (1.09)	215.1066 (2.23)**
WAGEH	-0.0461 (2.52)**	-0.5703 (0.07)	1.5500 (0.16)	-1.3921 (0.51)
CLD	-1.7879 (3.07)***	962.8813 (4.82)***	1220.2539 (3.12)***	1090.0182 (7.36)***

*Significant at 10% level.
**Significant at 5% level.
***Significant at 1% level.

Table 16 (Continued)

Variable	LOGIT	HHTIME EMPLOYED WOMEN	HHTIME NOT EMPLOYED WOMEN	HHTIME ALL WOMEN
CLD2	0.1795 (2.12)**	-126.1941 (4.78)***	-163.9374 (2.71)***	-140.1097 (6.13)***
AGEYC	0.1739 (1.30)	-79.2550 (2.01)**	-170.2506 (2.08)**	-121.1720 (3.39)***
AGEYC2	-0.00023 (0.03)	1.3596 (0.58)	6.4071 (1.26)	3.4513 (1.57)
BINT	0.6575 (3.01)***	-163.3175 (2.20)**	-222.6116 (1.53)	-201.8953 (3.74)***
BINT2	-0.0337 (2.50)**	7.3551 (1.59)	13.3294 (1.49)	10.4085 (2.90)***
OTHINC	-0.00005 (1.44)	-0.0167 (1.00)	-0.0023 (0.17)	-0.0078 (0.82)
OWNSFD	-0.2631 (0.72)	71.4501 (0.38)	195.3094 (1.21)	104.0924 (1.16)
ESTWAGE	---	---	---	---
EMPWAGE	---	---	---	---
$LAMBDA_E$	---	71.4501 (0.29)	---	---
$LAMBDA_{NE}$	---	---	-98.2976 (0.44)	---
Intercept	-4.8418 (2.12)	1854.6985 (2.08)**	483.1345 (0.50)	554.8608 (0.97)

Table 16 (Continued)

Variable	LOGIT	HHTIME EMPLOYED WOMEN	NOT EMPLOYED WOMEN	ALL WOMEN
R^2	---	0.3343	0.3553	0.3146
Adjusted R^2	---	0.2868	0.2832	0.2875

t-values are given in parentheses

Joint F statistic				
HOMEYRS	---	3.84**	1.85	20.71***
EDUCW	---	0.53	1.47	1.04
EXPRNW	---	1.54	0.89	3.42**
CLD	---	12.14***	4.93***	27.46***
AGEYC	---	5.84***	4.43**	25.23***
BINT	---	3.44**	1.17	8.04***

Table 17. Pearson correlation coefficients for selected variables [employed women, N = 256; not employed women, N = 170; all women, N = 426]

	CLD	AGEYC	BINT
Employed Women			
HHTIME	0.3597***	0.0667	0.2453***
AGEW	-0.3580***	-0.0414	-0.2129***
HOMEYRS	0.0310	0.1481**	0.0843
Not Employed Women			
HHTIME	0.4560***	0.1704**	0.4049***
AGEW	-0.7208***	-0.4573***	-0.5899***
HOMEYRS	-0.4960***	-0.2951***	-0.4009***
All Women			
HHTIME	0.3165***	0.0358	0.2449***
AGEW	-0.5554***	-0.3047***	-0.4056***
HOMEYRS	-0.3261***	-0.1919***	-0.2259***

**Significant at 5% level.
***Significant at 1% level.

Table 18. Report of the results of the four examples

	HHTIME IN HOURS PER WEEK			
	WOMAN NOT EMPLOYED; NO CHILDREN	WOMAN EMPLOYED; NO CHILDREN	WOMAN NOT EMPLOYED WHILE CHILDREN AT HOME	WOMAN NOT EMPLOYED ONLY FOR EARLY YEARS OF CHILD
AGEW	EXAMPLE I	EXAMPLE II	EXAMPLE III	EXAMPLE IV
20	34.61	20.86	26.35	26.35
21	35.05	20.47	25.86	25.86
22	35.46	20.10	25.40	25.40
23	35.86	19.76	24.96	24.96
24	36.24	19.43	24.54	24.54
25	36.61	19.13	38.01	38.01
26	36.97	18.85	38.76	38.76
27	37.31	18.59	37.65	37.65
28	37.63	18.35	36.63	36.63
29	37.94	18.14	43.53	34.64
30	38.24	17.94	42.04	32.78
31	38.52	17.77	47.37	31.06
32	38.78	17.62	47.99	29.48
33	39.04	17.49	46.74	28.04
34	39.28	17.38	45.58	26.73
35	39.50	17.39	44.52	25.56

Table 18 (Continued)

	HHTIME IN HOURS PER WEEK			
	WOMAN NOT EMPLOYED; NO CHILDREN	WOMAN EMPLOYED; NO CHILDREN	WOMAN NOT EMPLOYED WHILE CHILDREN AT HOME	WOMAN NOT EMPLOYED ONLY FOR EARLY YEARS OF CHILD
AGEW	EXAMPLE I	EXAMPLE II	EXAMPLE III	EXAMPLE IV
36	39.71	17.23	43.55	24.53
37	39.90	17.19	42.67	23.63
38	40.08	17.17	41.88	22.87
39	40.25	17.17	41.18	22.25
40	40.40	17.19	40.58	21.77
41	40.53	17.23	40.07	21.42
42	40.66	17.30	39.65	21.21
43	40.76	17.38	39.28	23.02
44	40.85	17.49	39.05	22.97
45	40.93	17.62	38.91	22.95
46	40.99	17.77	38.86	22.95
47	41.04	17.94	33.77	22.97
48	41.07	18.14	33.91	23.01
49	41.09	18.35	36.02	23.08
50	41.09	18.59	35.64	23.16
51	41.08	18.85	35.29	23.27
52	41.06	19.13	34.96	23.40

Table 18 (Continued)

	HHTIME IN HOURS PER WEEK			
	WOMAN NOT EMPLOYED; NO CHILDREN	WOMAN EMPLOYED; NO CHILDREN	WOMAN NOT EMPLOYED WHILE CHILDREN AT HOME	WOMAN NOT EMPLOYED ONLY FOR EARLY YEARS OF CHILD
AGEW	EXAMPLE I	EXAMPLE II	EXAMPLE III	EXAMPLE IV
53	41.02	19.43	34.65	23.56
54	40.96	19.75	34.36	23.73
55	40.90	20.10	34.10	23.93
56	40.81	20.46	33.85	24.15
57	40.71	20.85	33.63	24.39
58	40.59	21.26	33.43	24.65
59	40.47	21.69	33.25	24.94
60	40.30	22.14	33.10	25.24
61	40.16	22.62	32.97	25.57
62	39.99	23.11	32.85	25.93
63	39.81	23.63	32.77	26.30
64	39.60	24.17	32.70	26.70
Average Hours per Week	39.42	19.12	36.73	26.09
Average Hours per Year	2049.78	994.03	1909.98	1356.62

APPENDIX A:

COMPONENTS OF HOUSEHOLD WORK TIME

The variables that pertain to the care of household members and to the care of the household were created from information reported in the synthetic week. This involved several steps. First, from the list of all 223 activities, those activities that pertained to care of the household and to care of household members were separated out from all other activities. Second, specific categories of time use in the household were gathered into more general areas. The general areas are meal provision, care of house, care of grounds, care of household durables, care of clothing, care of adult family members, care of child family members, marketing and management. Time spent in the general area was the simple sum of time spent in the more specific area. Thus, the variable called meal provision was created by the summation of the variables:

- meal preparation: cooking, fixing lunches
- serving food, setting table, putting groceries away, unloading car after grocery shopping
- doing dishes, rinsing dishes, loading dishwasher
- meal cleanup, clearing table, unloading dishwasher

The variable called care of the household was created by the summation of the variables:

- routine indoor cleaning and chores, picking up, dusting making beds, washing windows, vacuuming, "cleaning," "fall/spring cleaning," "housework,"

- repairs, maintenance, indoors, fixing, repairing indoors furnace, plumbing, painting a room

- care of houseplants

- other indoor, not available whether cleaning or repair; "did things in house"

- miscellaneous, "worked around house", not available if indoor or outdoor

The variable called care of grounds was created by the summation of the variables:

- gardening; flower or vegetable gardening; spading, weeding, composting, picking, "worked in garden"

- routine outdoor cleaning and chores; yard work, raking leaves, mowing grass, garbage removal, snow shoveling, putting on storm windows, cleaning garage, cutting wood

- repair, maintenance, exterior; fixing repairs outdoors, painting the house, fixing the roof, repairing the driveway (patching)

- home improvements: additions to and remodeling done to the house, garage; new roof

- improvement to grounds around house; repaved driveway

- other outdoor; "worked outside," "puttering in garage"

The variable called care of household durables was created by the summation of the variables:

- repairs indoors; fixing, repairing appliances

- repairs indoors; fixing repairing, furniture

- car care; necessary repairs and routine care to cars; tune up

- car maintenance; changed oil, changed tires, washed cars; "worked on car" except when clearly as a hobby
- other household chores

The variable called care of clothing was created by the summation of the variables:

- laundry and clothes care - wash
- laundry and clothes care - iron, fold, mending, putting away clothes

The variable called care of adult family members was created by the summation of the variables:

- medical care to adults in household
- non-medical care to adults in household; routine non-medical care to adults in household; "got my wife up," "ran a bath for my husband"

The variable called care of child family members was created by the summation of the variables:

- baby care; care to children age 4 and under
- child care; care to children age 5-17
- child care; mixed ages or ages not available
- helping/teaching children learn, fix, make things; helping son bake cookies; helping daughter fix bike
- help with homework or supervising homework
- giving child orders or instructions; asking them to help; telling them to behave
- disciplining child; yelling at kids, spanking children; correcting children's behavior
- reading to child

- conversations with household children only; listening to children - indoor playing; other indoor activities with children including games

- outdoor playing; outdoor activities with children - including sports, walks, biking with, other outdoor games

- coaching/leading outdoor, non-organizational activities

- medical care at home or outside home; activities associated with children's health; "took son to doctor," "gave daughter medicine"

The variable called marketing and management is created by the summation of the variables:

- household paperwork; paying bills, balancing the checkbook, making lists, getting the mail, working on the budget

- groceries; supermarket, shopping for food

- durable household goods; shopping for large appliances, small appliances, cars, furniture

- house, apartment; activities connected to buying, selling, renting, looking for house, apartment, including phone calls; showing house, including traveling around looking at real estate property (for own use)

- all other shopping for goods; including for clothing, small appliances; at drug stores, hardware stores, department stores, "downtown" or "uptown," "shopping," "shopping center," buying gas, "window shopping"

- financial services; activities relared to taking care of financial business; going to the bank, paying utility bills (not by mail), going to accountant, tax office, loan agency, insurance office

- other government services: post office, driver's license, sporting licenses, marriage licenses, police station

- auto services; repair and other auto services including waiting for such services
- clothes repair and cleaning: cleaners, laundromat, tailor
- appliance repair; including furnace, water heater, electric or battery operated appliances; including watching repair person
- household repair services: inclduing furniture; other repair services, not available type; including watching repair person
- errands; "running errands," not available whether for goods or services; borrowing goods
- other professional services; lawyer, counseling - picking up food at a takeout place - no travel
- other services, "going to the dump"
- related travel; travel related to obtaining goods and services and/or household activities

For further information, see the Time Use Longitudinal Panel Study, 1975-1981: Volume 4: Users' Guide (Juster, Hill, Stafford and Parsons, 1983).

APPENDIX B:

DERIVATION OF LAMBDA_{NE}

$$E(X|X\leq C) = \frac{\displaystyle\int_{-\infty}^{C} X \frac{e^{-x}}{(1+e^{-x})^2}\,dx}{\displaystyle\int_{-\infty}^{C} \frac{e^{-x}}{(1+e^{-x})^2}\,dx} =$$

$$\frac{\displaystyle\int_{-\infty}^{C} X \frac{e^{-x}}{(1+e^{-x})^2}\,dx}{\displaystyle\left.\frac{1}{(1+e^{-x})}\right|_{-\infty}^{C}} =$$

$$\frac{\displaystyle\int_{-\infty}^{C} X \frac{e^{-x}}{(1+e^{-x})^2}\,dx}{F(c)}$$

Since

$$\frac{d\left[\dfrac{1}{1+e^{-x}}\right]}{dx} = -1 \cdot \frac{1}{(1+e^{-x})^2} \cdot \frac{1}{-1} \cdot e^{-x} =$$

$$\frac{e^{-x}}{(1+e^{-x})^2}$$

and, evaluating at the limits, note that as $x \to -\infty$

$(1 + e^{-x})$ gets very large

therefore: $$\left.\frac{1}{(1+e^{-x})}\right|_{-\infty}^{c} = \frac{1}{1+e^{-c}} - 0 =$$

$$F(c) - 0 = F(c)$$

since: $$F(c) = \frac{1}{(1+e^{-c})} = \frac{1}{(1+e^{c})}$$

Evaluating $$\int_{-\infty}^{c} x \frac{e^{-x}}{(1+e^{-x})^2}\, dx$$

by parts: $udv = uv - vdu + k$

noting above, let $u = x$ $\quad du = dx$

$$v = \frac{1}{(1 + e^{-x})} \qquad dv = \frac{e^{-x}}{(1 + e^{-x})^2} dx$$

Then:
$$\int_{-oo}^{C} X \frac{e^{-x}}{(1 + e^{-x})^2} dx =$$

$$X \left. \frac{1}{1 + e^{-x}} \right|_{-oo}^{C} - \int_{-oo}^{C} \frac{1}{1 + e^{-x}} dx + k$$

Integrating:
$$\int_{-oo}^{C} X \frac{1}{(1 + e^{-x})^2} dx =$$

$$\left. [\log (1 + e^{-x}) + x] \right|_{-oo}^{C}$$

Noting that as $x \to -oo$, the term $\log (1 + e^{-x})$ comes to be dominated by the e^{x} term, therefore $\log (1 + e^{-x})$ is approximately equal to $\log e^{-x} = -x$, therefore, $-x + x = 0$ evaluated as $x \to -oo$, therefore

$$\int_{-\infty}^{c} x \frac{1}{1 + e^{-x}} \, dx =$$

$$\left[\log (1 + e^{-x}) + x\right] \Big|_{-\infty}^{c} = \log (1 + e^{-c}) + c - 0$$

$$\text{evaluating:} \quad x \frac{1}{(1 + e^{-x})} \Bigg|_{-\infty}^{c} = \frac{c}{(1 + e^{-c})} - 0$$

since as $x \to -\infty$, $\frac{1}{(1 + e^{-x})}$ becomes very small much faster than x.

Thus:

$$E(X|X \le C) = \frac{[c / (1 + e^{-c})] - \log (1 + e^{-c}) - c + k}{F(c)}$$

$$= \frac{cF(c) - c - \log [1 / F(c)] + k}{F(c)}$$

since $F(c) = \dfrac{1}{(1 + e^{-c})}$

$$= \frac{c[F(c) - 1] - c - \log [1 / F(c)] + k}{F(c)}$$

$$= \frac{c[F(c) - 1] - c - \log F(c)^{-1} + k}{F(c)}$$

$$= \frac{c[F(c) - 1] + \log F(c) + k}{F(c)}$$

noting that

$$\log [1 - F(c)] = \log [1 - (1 / (1 + e^{-c}))]$$

$$= \log \frac{1 + e^{-c} - 1}{1 + e^{-c}}$$

$$= \log \frac{e^{-c}}{(1 + e^{-c})}$$

$$= \log e^{-c} - \log (1 + e^{-c})$$

$$= -c - \log [1 / F(c)]$$

$$= -c - \log F(c)^{-1}$$

$$= -c + \log F(c)$$

Or, $\log F(c) = c + \log [1 - F(c)]$

$$E(X|X \leq C) = c - \frac{c + c + \log [1 - F(c)]}{F(c)}$$

$$= c + \frac{\log [1 - F(c)]}{F(c)}$$

which is verified by Maddala (1983, p. 369).

To solve for $E(X|X > C)$ note that

$$E(X) = E(X|X < C) \; P(X < C) + E(X|X > C) \; P(X > C)$$

For the hyperbolic-secant-square ($SECH^2$) distribution:

$$P(X < c) = \int_{-oo}^{c} \frac{e^{-x}}{(1 + e^{-x})^2} dx = \frac{1}{(1 + e^{-x})^2} \Bigg|_{-oo}^{c}$$

$$= F(c)$$

$$P(X > c) = 1 - F(c)$$

$$E(X) = \frac{\displaystyle\int_{-\infty}^{\infty} x \frac{e^{-x}}{(1 + e^{-x})^{2}}\, dx}{\displaystyle\int_{-\infty}^{\infty} x \frac{e^{-x}}{(1 + e^{-x})^{2}}\, dx}$$

$$= \frac{\left. \dfrac{x}{(1 + e^{-x})} \right|_{-\infty}^{\infty} - \left. [\log(1 + e^{-x}) + x] \right|_{-\infty}^{\infty}}{\left. \dfrac{1}{(1 + e^{-x})} \right|_{-\infty}^{\infty}}$$

To evaluate the numerator of this expression, note that

$$\left. \frac{1}{(1 + e^{-x})} \right|_{-\infty}^{\infty}$$

approaches x as x approaches ∞ and approaches 0 as x approaches $-\infty$

and $\left[\log (1 + e^{-x}) + x\right] \Big|_{-\infty}^{\infty}$

approaches x as x approaches oo and approaches 0 as x approaches -oo

therefore, the numerator approaches 0 as x approaches oo and approaches 0 as x approaches -oo

$$\frac{1}{(1 + e^{-x})} \Bigg|_{-\infty}^{\infty} = 1 - 0 = 1$$

To evaluate the denominator of this expression, note that

$$\frac{1}{(1 + e^{-x})} \Bigg|_{-\infty}^{\infty}$$

approaches 1 as x approaches oo and approaches 0 as x approaches -oo

Therefore $E(x) = [0 / 1] = 0$

Solving:

$$0 = c + \frac{\log [1 - F(c)]}{F(c)} F(c) + E(x|x > c)[1 - F(c)]$$

$$E(x|x > c)[1 - F(c)] = - c + \frac{\log [1 - F(c)]}{F(c)} F(c)$$

For those who are not employed:

$$E(x|x > c) = \frac{-c}{[1 - F(c)]} - \frac{\log [1 - F(c)]}{[1 - F(c)]}$$

For those who are employed:

$$E(x|x < c) = c + \frac{\log [1 - F(c)]}{F(c)}$$

[This derivation was calculated by Mattila, 1986.]

APPENDIX C:

DEMAND FOR HOUSEHOLD TIME FOR LABOR FORCE PARTICIPANTS AND NON-PARTICIPANTS

The economic structure of the hours of work at home equation is not the same for labor force participants and non-participants. This can be demonstrated.

Assume an individual's utility function has the form

$$U = U(X, L, Tau) \tag{C.1}$$

where X: market goods
L: time spent on work at home or leisure
Tau: taste and technology variables

The individual faces two constraints. A time constraint:

$$\bar{T} = J + L \tag{C.2}$$

where $\bar{T}$: total time
J: time spent on work for wage
L: time spent on work at home or leisure

A cash income constraint:

$$I = V + WH = PX \tag{C.3}$$

where I: cash income
V: non-wage income
W: wage
J: time spent on work for wage
P: price of market goods
X: market goods

The individual acts to maximize utility subject to the time constraint and the cash income constraint:

$$M(X,L,J) = U(X,L,Tau) + L_1 [\overline{T} - L - J] + L_2 [V + WJ - PX] \qquad (C.4)$$

$$\frac{\partial M}{\partial X} = U_X - L_2 P = 0 \qquad (C.4i)$$

$$\frac{\partial M}{\partial L} = U_L - L_1 = 0 \qquad (C.4ii)$$

$$\frac{\partial M}{\partial J} = -L_1 + L_2 W \leq 0 \qquad (C.4iii)$$

$$\frac{\partial M}{\partial L_1} = T - L - H = 0 \qquad (C.4iv)$$

$$\frac{\partial M}{\partial L_2} = V + WJ - PX = 0 \qquad (C.4v)$$

From equation (C.4i):

$$U_X = L_2 P$$

From equation (C.4ii):

$$U_L = L_1$$

From equation (C.4iii):

$$W \leq [L_1 / L_2]$$

When equation (C.4iii) is an equality, the individual works for a wage as J > 0. Then

$$X^{*}, L^{*}, H^{*} = C(W, P, V, Tau, \bar{T}). \qquad (C.5)$$

When equation (C.4iii) is an inequality, the individual does not work for a wage as J = 0. Then

$$X^{*}, L^{*} = C(P, V, Tau, T). \qquad (C.6)$$

The decision to participate in the labor force and work for a wage can be thought of as a decision based on comparison of the reservation wage to the market wage. Let the labor supply function be

$$\begin{aligned} J_i = {} & B_1 + B_2 AGEW + B_3 DMAR + B_4 WAGEH + B_5 CLD \\ & + B_6 CLD^2 + B_7 AGEYC + B_8 AGEYC^2 + B_9 BINT \\ & + B_{10} BINT^2 + B_{11} OTHINC + B_{12} OWNSFD \\ & + B_{13} W + \mu_i^J \end{aligned} \qquad (C.7)$$

Then the reservation wage at J = 0 is

$$W^R = [-1/B_{13}][B_1 + B_2 AGEW + B_3 DMAR + B_4 WAGEH$$

$$+ B_5 CLD + B_6 CLD^2 + B_7 AGEYC + B_8 AGEYC^2 + B_9 BINT$$

$$+ B_{10} BINT^2 + B_{11} OTHINC + B_{12} OWNSFD + \mu^J_i] \qquad (C.8)$$

$$= B^*_1 + B^*_2 AGEW + B^*_3 DMAR + B^*_4 WAGEH + B^*_5 CLD + B^*_6 CLD^2$$

$$+ B^*_7 AGEYC + B^*_8 AGEYC^2 + B^*_9 BINT + B^*_{10} BINT^2$$

$$+ B^*_{11} OTHINC + B^*_{12} OWNSFD + \mu^R_i \qquad (C.8i)$$

Let the labor demand function be

$$W^D_i = A_1 + A_2 EDUCW + A_3 EDUCW^2 + A_4 EXPRNW + A_5 EXPRNW^2$$

$$+ \mu^D_i \qquad (C.9)$$

The participation decision is then indexed by

$$D_i = \begin{cases} 1 \text{ if } J_i > 0, \text{ occurs when } W_i^R \leq W_i^D \\ 0 \text{ if } J_i = 0, \text{ occurs when } W_i^R > W_i^D \end{cases}$$

and the probability of participation is

$$P_i = Pr[D_i = 1] = Pr[W_i^R \leq W_i^D] = Pr[\mu_i^R - \mu_i^D <$$

$$(A_1 - B_1^*) + A_2 EDUCW + A_3 EDUCW^2 + A_4 EXPRNW$$

$$+ A_5 EXPRNW^2 - B_2^* AGEW - B_3^* DMAR - B_4^* WAGEH - B_5^* CLD$$

$$- B_6^* CLD^2 - B_7^* AGEYC - B_8^* AGEYC^2 - B_9^* BINT - B_{10}^* BINT^2$$

$$- B_{11}^* OTHINC - B_{12}^* OWNSFD]$$

$$= Pr[C_i < X_i \underline{\delta}] = F_\epsilon (X_i \underline{\delta})$$

(C.10)

where

$$C = \mu_i^R - \mu_i^D$$

$$X_i = [1, EDUCW, EDUCW^2, EXPRNW, EXPRNW^2, AGEW,$$
$$DMAR, WAGEH, CLD, CLD^2, AGEYC, AGEYC^2,$$
$$BINT, BINT^2, OTHINC, OWNSFD]$$

$\underline{\delta}$ = the parameters to be estimated in a probit type model

F_ϵ = the cumulative distribution function for ϵ

Now, it is clear that individuals are not randomly assigned to (1) nonparticipants (J = 0) or (2) particpants (J > 0). Labor force participation depends on X_i, the exogenous variables in equations (C.8) and (C.9). The economic structure of the hours of housework or leisure equations are different for those who participate in the labor force and for those who do not participate in the labor force. For those who participate in the labor force the equation is

$$L_i = C_1 + C_2 AGEW + C_3 DMAR + C_4 WAGEH + C_5 CLD + C_6 CLD^2$$
$$+ C_7 AGEYC + C_8 AGEYC^2 + C_9 BINT + C_{10} BINT^2$$
$$+ C_{11} OTHINC + C_{12} OWNSFD + C_{13} W + \mu_i^L \quad (C.11)$$

For those who do not participate in the labor force, the equation is

$$L_i = C_1 + C_2 AGEW + C_3 DMAR + C_4 WAGEH + C_5 CLD + C_6 CLD^2$$

$$+ C_7 AGEYC + C_8 AGEYC^2 + C_9 BINT + C_{10} BINT^2$$

$$+ C_{11} OTHINC + C_{12} OWNSFD + \mu_i^{L*} \qquad (C.12)$$

[This derivation was calculated by Huffman, 1986.]

APPENDIX D: OUTLINE OF MODELS

A. Equations of Model I

1. The logistic regression or the logit equation

$$Y = f(AGEW, AGEW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD). \quad (D.1)$$

2. The regression equation used to obtain unbiased parameter estimates which, in turn, will be used to estimate the wage of the women who are employed

$$WAGE = f(EDUCW, EDUCW2, EXPRNW, EXPRNW2, LAMBDA_E). \quad (D.2)$$

3. The estimated wage of employed women

$$ESTWAGE = f(EDUCW, EDUCW2, EXPRNW, EXPRNW2). \quad (D.3)$$

4. The estimated hours of household work spent by employed women

$$HHTIME_E = f(AGEW, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, LAMBDA_E). \quad (D.4)$$

5. The estimated hours of household work spent by not employed women

$$HHTIME_{NE} = f(AGEW, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, LAMBDA_{NE}). \quad (D.5)$$

6. The estimated hours of household work spent by all women

$$HHTIME_T = f(AGEW, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, EMPWAGE).$$

(D.6)

B. Equations of Model II

1. The logistic regression or the logit equation

$$Y = f(AGEW, AGEW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD).$$

(D.7)

2. The estimated hours of household work spent by employed women

$$HHTIME_E = f(AGEW, AGEW2. DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, LAMBDA_E).$$

(D.8)

3. The estimated hours of household work spent by not employed women

$$HHTIME_{NE} = f(AGEW, AGEW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, LAMBDA_{NE}).$$

(D.9)

4. The estimated hours of household work spent by all women

$$HHTIME_T = f(AGEW, AGEW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD)$$

(D.10)

C. Equations of Model III

1. The logistic regression or the logit equation

Y = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2 DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD).

(D.11)

2. The regression equation used to obtain unbiased parameter estimates which, in turn, will be used to estimate the wage of the women who are employed

WAGE = f(EDUCW, EDUCW2, EXPRNW, EXPRNW2, $LAMBDA_E$).

(D.12)

3. The estimated wage of employed women

ESTWAGE = f(EDUCW, EDUCW2, EXPRNW, EXPRNW2).

(D.13)

4. The estimated hours of household work spent by employed women

$HHTIME_E$ = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, $LAMBDA_E$).

(D.14)

5. The estimated hours of household work spent by not employed women

$HHTIME_{NE}$ = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, ESTWAGE, $LAMBDA_{NE}$).

(D.15)

6. The estimated hours of household work spent by all women

$$HHTIME_T = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, EMPWAGE) \quad (D.16)$$

D. Equations of Model IV

1. The logistic regression or the logit equation

$$Y = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD). \quad (D.17)$$

2. The estimated hours of household work spent by employed women

$$HHTIME_E = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, LAMBDA_E). \quad (D.18)$$

3. The estimated hours of household work spent by not employed women

$$HHTIME_{NE} = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD, LAMBDA_{NE}). \quad (D.19)$$

4. The estimated hours of household work spent by all women

$$HHTIME_T = f(HOMEYRS, HOMEYRS2, EDUCW, EDUCW2, EXPRNW, EXPRNW2, DMAR, WAGEH, CLD, CLD2, AGEYC, AGEYC2, BINT, BINT2, OTHINC, OWNSFD). \quad (D.20)$$

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ACKNOWLEDGEMENTS

Sincere and heartfelt gratitude is expressed to the many individuals who have helped me complete this endeavor.

Several good friends challenged me and encouraged me to reach for this goal. Thank you for believing in me and for helping me to transform what had been a vague hope into a realizable goal.

Committee members gave me generous portions of their time, their technical expertise, their support and their encouragement. My major professor, Dr. Mattila, deserves special recognition for reviewing countless computer runs and for patiently editing what must have seemed to be endless revisions of this thesis. Dr. Mattila, Dr. Huffman, Dr. Winter, thank you for investing yourselves in your teaching and for your investment in my education.

Several individuals at the Iowa State University Statistical Laboratory skillfully guided me through the intricacies and idiosyncrasies of SAS. Dr. Winter provided similar competent aid with SPSS-X. Thank you for sparing me countless hours of frustration.

My husband, Dennis, generously increased the amount of time that he devoted to meal provision, care of house, care of clothing, marketing and management, and care of wife while I wrote about the time that women spend on such tasks. Thank you for believing in division of household labor according to comparative ability and time available rather than according to gender alone. I am grateful that you are not only my partner, but also my dear friend (143).

My parents, Marvin and Freda Black, have poured abundant amounts of love, prayer, and other valuable resources into me all the days of my life. I love you both and I am glad that we "found" each other. Thank you for supporting both me and my education so generously.

To all of those who have cheered me on, again, I offer a hearty thank you.