U.S. Department of Housing and Urban Development
Office of Policy Development and Research

Women In The Mortgage Market

WOMEN IN THE MORTGAGE MARKET

Statistical Methods and Tables for Use in Appraising the Stability of Women's Income

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EXECUTIVE SUMMARY

This study develops statistical methods, packaged as actuarial tables, to project women's expected income stream during the crucial early years of a mortgage. Although actuarial tables generally connote statistical calculations on life expectancy, probability of property loss, or other contingencies in human life, tables on expected income growth and income stability could be used to assess mortgage risk for various loan applicant categories in much the same manner as annuity tables and insurance schedules are used.

The stability of a woman's earned and unearned income, the "value" of her financial credentials, and her legitimate versus her actual or perceived access to mortgage credit has provoked controversy within the financial community. Perhaps this is so because until very recently there have been virtually no empirical data available to statistically support or reject those economic assumptions about the working patterns of women implicit in traditional mortgage underwriting criteria. Partial returns (years 1967-1971) from a ten-year longitudinal survey on the labor market experience of a national sample of women ages 30-44, conducted by Dr. Herbert S. Parnes of the Center for Human Resource Research of Ohio State University, have changed the research picture. Actuarial tables that predict (1) growth in family income, (2) probability of a 5 percent decline in income, and (3) probability of a 20 percent decline in income, over a two- and a four-year period by year, as a function of present family characteristics and financial circumstances, were generated by applying an econometric autoregression model to these data. The tables contain statistics that will assist lenders to make mortgage decisions on the merits of each case rather than applying rules-of-thumb based on generalizations about women as a class.

To help ensure cooperation and product acceptability within the financial community, an informal survey of institutions heavily involved with mortgage underwriting was conducted at the study onset. Interviews with representatives of the Mortgage Bankers Association, Federal Home Loan Mortgage Corporation, U. S. League of Savings Associations, Federal Housing Administration and Mortgage Guarantee Insurance Corporation, and others, provided invaluable information on lender information needs, preferred format of tables, and suggested research emphasis. Lenders candidly discussed their reservations about extending present underwriting guidelines to women applicants, and their concomitant reluctance to assume a less well-defined risk than in the proven mortgage market of married male applicants. They remain uncertain about how to assess the risk of the two-income family where the wife's earnings contribute substantially to total family income.

The actuarial tables indicate that, even in the late 1960's, women were performing substantially better with respect to income growth and income stability than today's mortgage banker would expect. They statistically support those provisions of the Housing and Community Development Act of 1974 which extend fair housing practices to women:

- The income growth and stability for single women during the longitudinal study period, 1966 to 1970, was on an even par with the industry standard -- or the traditional male-headed one-earner family.

- Projected 1970 income for two-earner families in which the working wife makes the substantial contribution of 40 percent to family income was, for every income level charted, only 10 percent below the industry standard and 25 to 125

percent above the mortgage banker's estimates, depending on the underwriting guidelines adopted to discount the wife's earnings.

- The standard errors associated with income growth projections for two-earner families are only 3 to 5 percent of the 1970 mean estimates; hence, one can project expected income growth without incurring substantially more variation, or statistical risk, than is implicit in the regular income growth projections.

- Differences in family income stability, as measured by the probability of a 5 percent income decline for one or more years during the crucial early life of the mortgage between two-earner and similarly situated traditional families were (on the average) about 7 to 10 percentage points. But such differences do not statistically support the current underwriting practice which treats a wife's earnings as secondary income and "discounts" it by as much as 50 percent.

- Income growth patterns for women family heads fell within 7 or 8 percentage points of their male counterparts, although their income was somewhat more volatile.

Statistical projections based on the income/earnings pattern of women during the period 1966-1970 are conservative, given changes over the past decade in the social and economic status of women. Post-actuarial series data from the Bureau of the Census and the Bureau of Labor Statistics document a rapidly changing working profile of American women; they suggest that the "traditional" female work patterns (exhibiting marked differentials by race, marital status, and presence of young children) in the early post World War II years are gradually being replaced by a consistent pattern which is closer to

that of their male co-workers. Related research on changes in family structure and marital roles stemming from the availability of new income opportunities -- notably women's own earnings -- and social benefits outside traditional family arrangements provide economic, sociological, and psychological explanations for important trends across both the income growth and income stability actuarial tables. These statistics and corroborative findings from other studies support the conclusion of the Project Director, Doris Hull, that the tables do not provide statistical justification for different treatment of women borrowers and co-borrowers.

Chapter 1

INTRODUCTION

1. INTRODUCTION

The stability of a woman's earned and unearned income, the "value" of her financial credentials, and her legitimate versus her actual or perceived access to mortgage credit has provoked controversy within the financial community. Perhaps this is so because until recently there have been virtually no empirical data available to statistically support or reject those economic assumptions about the working patterns of women implicit in traditional mortgage underwriting criteria. Partial returns (years 1967-1971) from a ten-year longitudinal survey on the labor market experience of a national sample of women ages 30-44, conducted by Dr. Herbert S. Parnes[1], have changed the research picture. The availability of these longitudinal data on the work experience, earnings, income, and assets of women prompted the Office of Policy Development and Research and the Office of Fair Housing and Equal Opportunity of the U. S. Department of Housing and Urban Development to sponsor this study to develop "Statistical Methods and Tables for Use in Appraising the Stability of Women's Income." Technical support was provided by Dr. Josephine McElhone, staff economist at the Federal Home Loan Bank Board.

1.1 Study Objective and Background

The primary study objective was to develop an appropriate statistical methodology, packaged as actuarial tables, to project women's expected income stream year by year during the crucial early years of a mortgage. Although actuarial tables generally connote

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[1] Dr. Parnes is Director of the Center for Human Resource Research at the Ohio State University, Columbus, Ohio.

statistical calculations on life expectancy, probability of property loss, or other contingencies in human life, tables on expected income growth and income stability could be used to assess mortgage risk for various loan applicant categories in much the same manner as annuity tables and insurance schedules are used.

Recent legislative advances to promote equal opportunity for women in housing (the Housing and Community Development Act of 1974) and in securing credit (the Equal Credit Opportunity Act of 1975, which includes mortgage transactions) had, however, cast doubt upon the basic study mission. Has this legislation obviated the need for statistical tables comparing the stability of women's future income with that of similarly situated men? Some feminist advocates argue that it has, whereas others believe that such tables could provide invaluable statistical backing for the new statutes.

A legal prohibition against sex discrimination in home financing cannot by itself rectify women's limited bargaining power in the housing credit market. A law will not alter lenders' traditional beliefs that women are higher credit risks than men; that women are less reliable debtors; and that women, especially if they are young and do not hold advanced degrees or managerial positions, have only a temporary attachment to the work force. Lenders and mortgage insuring agencies will remain reluctant to lend to single women or to give full credit to married women's income -- until these beliefs are debunked by actuarial statistics to the contrary. Discriminatory practices can easily be masked under the subjective cloak of "discretion" or "sound business practices." Dr. Josephine McElhone of the Federal Home Loan Bank Board, in testimony before the National Commission on Consumer Finance, has stated:

> "Without actuarial tables [on the stability of a woman's income], a law prohibiting sex discrimination in housing lending would be an unenforceable addition to the statute books. But given the necessary data, it could become a meaningful piece of legislation, and could be of tremendous value in combatting mortgage lending practices which are discriminatory toward a substantial percentage of American citizens."[2]

Persons and institutions involved in the primary and secondary mortgage lending and insuring markets appeared at the Commission hearings to voice their growing dissatisfaction about the variable and subjective underwriting practices with respect to women borrowers and co-borrowers.[3] Women and consumer advocate groups repeatedly charged that industry credit practices had little, if any, economic justification and were based on outmoded beliefs about women. Further, an economic analysis by Dr. McElhone demonstrated that the accepted industry practice of discounting all income other than "base earnings of the borrower" had a particularly adverse effect upon minority families, where the wife's earnings typically represent a substantial portion of total family income.[4]

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2 Statement by Josephine McElhone, "The Economic Rationale for Mortgage Lending Standards Affecting Women Borrowers," before the National Commission on Consumer Finance, May 22, 1972.

3 See, for example, statements by John P. Farry, President of the United States Savings and Loan League, and Steven W. Rhode, staff member of the Center for National Policy Review at Catholic University Law School, before the National Commission on Consumer Finance, May 22, 1972 and May 23, 1972.

4 Josephine McElhone, "Mortgage Lender Discounting of Secondary Incomes: Its Rationale and Impact" (Unpublished, 1973).

In response to this complex issue of sex and/or racial discrimination in home financing, HUD awarded a contract to KETRON, INC., in June 1974 to develop actuarial tables on the projected growth in family income, and on the relative income stability for women borrowers and co-borrowers during the crucial years of a mortgage. These tables can serve two related purposes, albeit in two distinct user communities:

- To enable lending institutions and insurers to make a more precise assessment of the risks associated with loans to women, and

- To enable HUD, and other agencies involved in Equal Opportunity Compliance, to make a more accurate determination of the extent to which loans are being extended in a manner consistent with the risks involved.

The definition of a user-oriented study product such as actuarial tables is a novelty in applied economic research; it has made the conduct of this contract challenging, precarious, and at times frustrating for all parties involved: KETRON, the Government Technical Representative, other HUD policy and line staff working to create equal access to homeownership for women, and various feminist and consumer advocate groups.

Interviews with representatives of national lending associations indicated that the financial community would welcome statistically sound tables of income growth patterns for various categories of women. They have recently been stampeded by women borrowers, co-borrowers, and advocates for equal treatment of women in the mortgage market. Lenders want, as a conservative and sound business practice, to extend loans only to the lowest risk categories. The actuarial tables might provide, then, a convenient barometer on the historical

performance of various categories of women with respect to expected income growth, stability of income, and where applicable, stability of the borrower/co-borrower unit.

To conclude that lenders are not particularly interested in tables that permit direct male/female comparisons on expected income growth and stability is, frankly, an understatement; they are completely satisfied with, and would be reluctant to modify, present underwriting practices for male applicants -- at least, married men -- which are based broadly on industry history and experience. On the other hand, HUD, to enforce the Housing and Community Development Act of 1974 extending fair housing practices to women, wants tables that will permit such comparisons. Tables that clearly display the relative risk associated with loans to various classes of male and female mortgage applicants could help HUD determine whether a particular lending institution generally approves mortgages for male-headed families with annual earnings of $9,000, but tends to reject similar loan applications from female-headed families. It should be emphasized here, however, that the actuarial tables only predict projected income growth and income stability; no data are available to explore the lenders' assumption that mortgage risk, or likelihood of foreclosure, is correlated with these variables.[5]

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5 John P. Herzog and James S. Early, Home Delinquency and Foreclosure, NBER General Series 91 (New York: 1970). An extensive research study of the incidence and statistical predictors (borrower and loan characteristics) of mortgage foreclosure and delinquency in the post-war years was conducted by the National Bureau of Economic Research, with financial support from the Research and Educational Trust Fund of the Mortgage Bankers Association of America. But their application of cross-sectional regression coefficients time series analysis is questionable; hence, no conclusions can be drawn on how changes in borrower income over time affect delinquency risk.

1.2 Organization of the Report

The main text of this report is divided into three chapters. Chapter 2, a synopsis of the lender perspective on women applicants, is derived from an informal survey of lending institutions, insuring agencies, and banking associations. Chapter 3 presents a policy-oriented overview of the study product -- a series of two and four year actuarial tables which predict income growth and income stability for various categories of women borrowers. The final chapter contains a detailed discussion of the statistical model developed to appraise the stability of women's income, and how this model was applied to the Parnes longitudinal survey to generate the actuarial tables. Because the tables reference working patterns of women during the period 1966-1970, and because the labor force participation rates of women, especially married women, have risen dramatically in the past decade, the statistical model may be of greater importance in developing an understanding of the factors bearing on mortgage loans to women than the tables themselves.

Appendix A contains two series of actuarial tables that predict (1) growth in family income, (2) probability of a 5 percent decline in income, and (3) probability of a 20 percent decline in income over a two- and four-year period by year, as a function of existing family characteristics and financial circumstances. These tables contain statistics that will assist lenders to make decisions on the merits of each case rather than applying generalizations about women as a class. The autoregressions used to generate the two actuarial projection series are presented in Appendix B. Appendix C presents numerical results of Chow-type tests of significance on the validity of splitting the Parnes sample by race to develop separate regression models and actuarial series.

Chapter 2

THE MORTGAGE BANKERS' PERSPECTIVE: AN INFORMAL SURVEY OF LENDING INSTITUTIONS, INSURING AGENCIES, AND BANKING ASSOCIATIONS

2. THE MORTGAGE BANKERS' PERSPECTIVE: AN INFORMAL SURVEY OF LENDING INSTITUTIONS, INSURING AGENCIES, AND BANKING ASSOCIATIONS

The study results and findings will prove useful to current legislative and feminist advocacy movements seeking to gain equal access to homeownership for women -- only if the actuarial tables are accepted by the financial community. To help ensure cooperation and product acceptability, an informal survey of institutions involved with mortgage underwriting was conducted at the study onset. Interviews were held with representatives from nine national financial associations:

Mortgage Bankers Association,
Federal Home Loan Mortgage Corporation,
Veteran's Administration,
Farmer's Home Administration,
Mortgage Guarantee Insurance Corporation,
Continental Mortgage Insurance, Incorporated,
U. S. League of Savings Associations,
Federal Housing Administration,
National Savings and Loan League.

These interviews provided invaluable information on lender information needs, preferred format of tables, and suggested research emphasis. Lenders also candidly discussed their reservations about extending present underwriting guidelines to women applicants, and their concomitant reluctance to assume a less well-defined risk than in the proven mortgage market of married male applicants.

Representatives of two banking associations indicated that the industry is prepared to treat the single woman, the woman head of household, or two women living together, just as they would treat men in similar circumstances. They are uncertain, however, about how to assess the risk of the two-income family where the wife's earnings

contribute substantially to total family income. They acknowledge that only a small proportion of foreclosures are caused by the loss of secondary wage earner income. But, this may be viewed with equal logic either as an argument that married women's incomes are stable, or as evidence that present industry practices of discounting portions of married women's incomes are intelligent and effective. Institutional representatives cited marital problems, however, as a leading cause of defaults and foreclosures. Cases where couples separate and simply walk away from a property are not uncommon.

Current methods to predict the expected future income stream for a woman co-borrower are crude, although most lenders employ a 50 percent discount factor. A senior underwriter for a major private mortgage insurer said, "Traditionally, women co-borrowers could be divided into three basic groups: those 'just getting started' working to buy furniture and household appliances; those working to buy a good automobile or accumulate a down payment on a house; and those with a professional interest in continuing work." He noted, however, that a continuation of the second income appears to be a growing economic necessity for many American families and that recognition of this necessity has, in turn, definitely altered social attitudes toward the working wife. He wondered how the increasing economic pressures and changing social outlook would be reflected in our actuarial tables. Another lending institution representative firmly believed that the current industry practice of heavily discounting a co-borrower's earnings is justifiable. He was confident that actuarial tables developed in this study would show that married women are not as stable in income as similarly situated men.

The interviewees repeatedly bemoaned the rising number of two-income families applying for mortgage loans, and were surprisingly

frank about their inability to assess future income growth and stability for these families. As one representative mused, "I'd like to see a study of what actually happens after the mortgage is granted." He believed that some women work just long enough to accumulate a down payment and qualify for a mortgage, while others may be strongly motivated by the continuing financial obligation.

The treatment of other secondary income appears to be something of a mystery, although it is obvious that lenders are extremely wary of alimony and court ordered child support payments. Most felt that this source of income could not generally be relied upon, so they discounted support payments almost entirely in considering a woman's income for a five-year period. In recent months, at least one state human rights agency has interpreted the "disparate impact" of refusing to consider certain sources of income (such as alimony, public assistance, and child support) as de facto sex discrimination. Women are far more likely to be recipients of such income, due to their more frequent custody of children and their traditionally secondary wage-earning role. Extension of this interpretation to home financing has forced lenders to reconsider this traditional discounting procedure for single women and woman family heads. All institutional representatives were particularly anxious to obtain quantitative statistics on the continuity of such income.[6]

These interviews confirmed the popular suspicion that lenders often rely upon statistically unsubstantiated generalizations in

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6 Unfortunately, the Parnes survey data combine alimony and child support payments with "contributions from family members living elsewhere, annuities, etc." under the heading, "Other Income," thus rendering an analysis of the continuity of such income impossible.

reviewing mortgage loan applications. Although the frequently heard statement that "each case is evaluated on its own merit" apparently applies to women borrowers and co-borrowers, they too are subject to the inviolate lending principles, "two and one-half times base salary," and "total debt service, including mortgage repayment, not to exceed 33 percent of adjusted stable income." Such fixed ratio principles may have worked well to delimit acceptable risks for married male mortgage applicants, but across-the-board application of these principles renders homeownership a financial impossibility for most single women, woman family heads, and young working couples. The interviewees indicated, however, that the mortgage banking industry is prepared to change these traditional lending ratios and other accepted underwriting practices for women borrowers and co-borrowers -- if the actuarial tables or other historically based research studies on the income stability of women indicate this should be done.

Chapter 3

DISCUSSION OF FINDINGS

3. DISCUSSION OF FINDINGS

The actuarial tables developed in this study indicate that, even in the late 1960s, women were performing substantially better with respect to income growth and income stability than today's mortgage banker would expect. For example, the income growth and stability for single women during the longitudinal study period, 1966 to 1970, was on a par with the industry standard -- the traditional male-headed, one-earner family. Projected 1970 income for two-earner families in which the working wife makes the substantial contribution of 40 percent to family income was, for every income level considered, only 10 percent below the industry standard -- and 25 to 125 percent above mortgage bankers' estimates, depending on the underwriting guidelines adopted to discount the wife's earnings. Income growth patterns for women family heads fell within 8 or 9 percentage points of their male counterparts.

Before launching into a detailed discussion of the actuarial statistics and their implications for women borrowers and co-borrowers in the mortgage market, however, it seems appropriate to define the key variables of the study and the conceptual models. In the second section, the discussion turns to study findings with respect to a married woman and potential co-borrower, since lenders voiced more concern about her income continuity and about their ability to properly appraise a two-income joint mortgage application. Study findings on the income growth and income stability of single women and women heads of household are discussed in the third section. The final section presents an interpretive summary of the actuarial statistics, and draws supportive material from other research on the changing socioeconomic status of women.

3.1 Derivation of Key Study Concepts from Mortgage Credit Analysis

Definitional conventions and current practices in mortgage credit analysis provided the logical framework for this study. Discrepancies and statistically unsubstantiated practices suggested by the tables would be easier to identify, and eliminate, if the actuarial information in this study explicitly references the present system.

Standards

Income stability and risk of default must be considered in relation to a standard of some kind. Interviews with individuals representing mortgage lenders and insurers indicated that the earnings of a married man represent the prevailing standard for judging income stability. Credit analyses in connection with mortgage loans generally refer to the "base earnings of the borrower" as the single income source automatically counted at full value, while other income sources (including "base earnings of co-borrower," that is, wife) are frequently discounted by 50 percent or more. As the number of mortgage loans to unmarried men and women (who would also be considered primary borrowers) currently represents a relatively small proportion of the total, it is accurate to regard the earnings of married men as the standard with respect to income stability for the purpose of securing a mortgage loan.

The comparison group of married men displays a certain degree of earnings instability itself. Not only are the mortgage applications of some families presumably rejected by reason of anticipated instability in the earnings of the man, as indicated by work history or related factors on the standard application form, but even a number of

accepted applicants eventually default on their loans for financial reasons.

It appears, then, that in determining whether there is any basis for discounting the earnings of working wives or single women, the earnings of women borrowers and co-borrowers should be considered in relation to the actual earnings stability of married men rather than assessed in absolute and isolated terms.

In the case of co-borrowers, however, the analysis of stability should be directed toward the joint income of husband and wife, rather than that of the woman alone. Two reasons prompt the suggestion of this standard:

> The stability of family income when both the husband and wife work is dependent upon not only the continuation of earnings of both the husband and the wife, but also upon their remaining together as a family unit; and
>
> The wife's work effort and income may be voluntarily reduced without injury to the total family budget as a result of an increase in income from other sources (most frequently, the husband's income).

In practice, mortgage lenders and insurers wish to ascertain that the amount of family income which they have deemed sufficient to service mortgage debt will continue for at least the initial critical years of the mortgage, ordinarily the first four years. With respect to co-borrowers, the basic question is this: Does the inclusion of the wife's earnings at full value in the computation of adjusted family income increase the lenders' or insurers' risk in comparison with the risk inherent in loans based entirely on the earnings of married men? The first step in answering this question is to

formulate a specific definition of adjusted stable family income.

Adjusted Stable Family Income

In considering the stability of family income, it is important to study both (1) that portion of family income which the mortgage lender regards as sufficiently stable to serve as the basis for supporting a property loan (adjusted family income); and (2) total family income from all sources. "Stable income" is usually defined as follows: the full value of the base annual earnings of the primary borrower, and stable unearned income such as Social Security payments, annuities, and pensions, plus 50 percent of secondary income such as co-borrower earnings, overtime pay, bonuses, and sales commissions, provided that "the type of income is reasonably stable for an extended period of time but the amount is uncertain." However, "if it appears that the amount [of secondary income] is stable, but the duration doubtful, do not consider it in analyzing the mortgage debt ratio."[7] New guidelines state that a woman's income should be considered "without prejudice," which has been interpreted on the basis of derivation to mean "without prejudgment to presumed characteristics of a group."[8] Given the subjective latitude afforded lenders by these new regulations, the Federal Home Loan Mortgage Corporation standard appears to provide a better benchmark for these income

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7 Federal Home Loan Mortgage Corporation Guidelines and Use of the Computer in Underwriting Loans (Washington: Federal Home Loan Mortgage Corporation, 1974), pp. 6-8.

8 Federal Home Loan Bank Board, "Guidelines Relating to Nondiscrimination in Lending," Federal Register, 39, No. 243 (December 7, 1974), p. 43619.

stability analyses.

Analyzing only that income which the banker considers acceptable for lending purposes does not permit a comparison of the stability of total family income over time, and does not indicate the effect of questionable female-biased income adjustments in reducing apparent risk. On the other hand, focusing the study on total income from all sources would inject presumably unstable components (rental income, sales commissions, unemployment compensation) into the analysis, which is designed to identify the degree of instability introduced by the inclusion of women's earnings, at full value, into adjusted family income.

To put the question of stability in perspective, it would be useful to review a brief example of current underwriting practice. If two families, each with a total income of $16,000 were to apply for mortgage loans for the same house, their applications would be analyzed differently if there were a difference in the sources of income. In the case of a family in which the husband provides the entire $16,000 of total family income, that $16,000 will be considered at full value (provided that he possesses a reasonably stable employment and credit record) in computing the total loan for which the family may be eligible. However, a family in which the total income is derived from husband's earnings of $9,000, wife's earnings of $6,000, and investment income of $1,000 would generally find that their family income is adjusted to approximately $12,500 for credit purposes. The wife's income would ordinarily be discounted by 50 percent or more, as would the investment income. If the second family should qualify for the loan on an adjusted income basis, the lender will, from that point forward, be concerned only with the maintenance of family

income in excess of $12,500. There is, of course, an underlying assumption that underwriting standards relate adjusted family income to debt service in an adequate manner.

As a risk averter, the lender is not particularly interested in charting the growth of total family income from its actual sum of $16,000. From the lender's perspective, the question is: Will total family income from all sources in future years equal or exceed adjusted family income for the base year?

Discounting the earnings of women is, of course, a reflection of the lender's assumption that such earnings are more unstable than those of men and that greater risk of default is therefore involved. To test this assumption, income growth, probability of a 5 percent decline in income, and probability of a 20 percent decline in income over a two-year period (1966-1968) and a four-year period (1966-1970) were projected and compared for the following loan applicant categories:

- Married woman, not working. Adjusted family income is defined as earnings of the husband plus stable unearned income such as Social Security payments, pension and Veterans' compensation. Unearned income such as rental income, interest, and stock dividends is excluded.

- Married woman, working. Adjusted family income is defined as the combined earnings of husband and wife at full value plus stable unearned income.

- Single woman. Adjusted family income is defined as earnings of the woman at full value plus stable unearned income.

- Woman head of household. Adjusted family income is defined as earnings of the woman at full value plus stable unearned income.

The family income growth and income stability tables reference "adjusted family income" as defined above in 1966 (the base year). Hence, if a nonworking wife's incidental temporary earnings during 1966 dissipate in 1968, this type of income drop would not register in any of the actuarial projections.

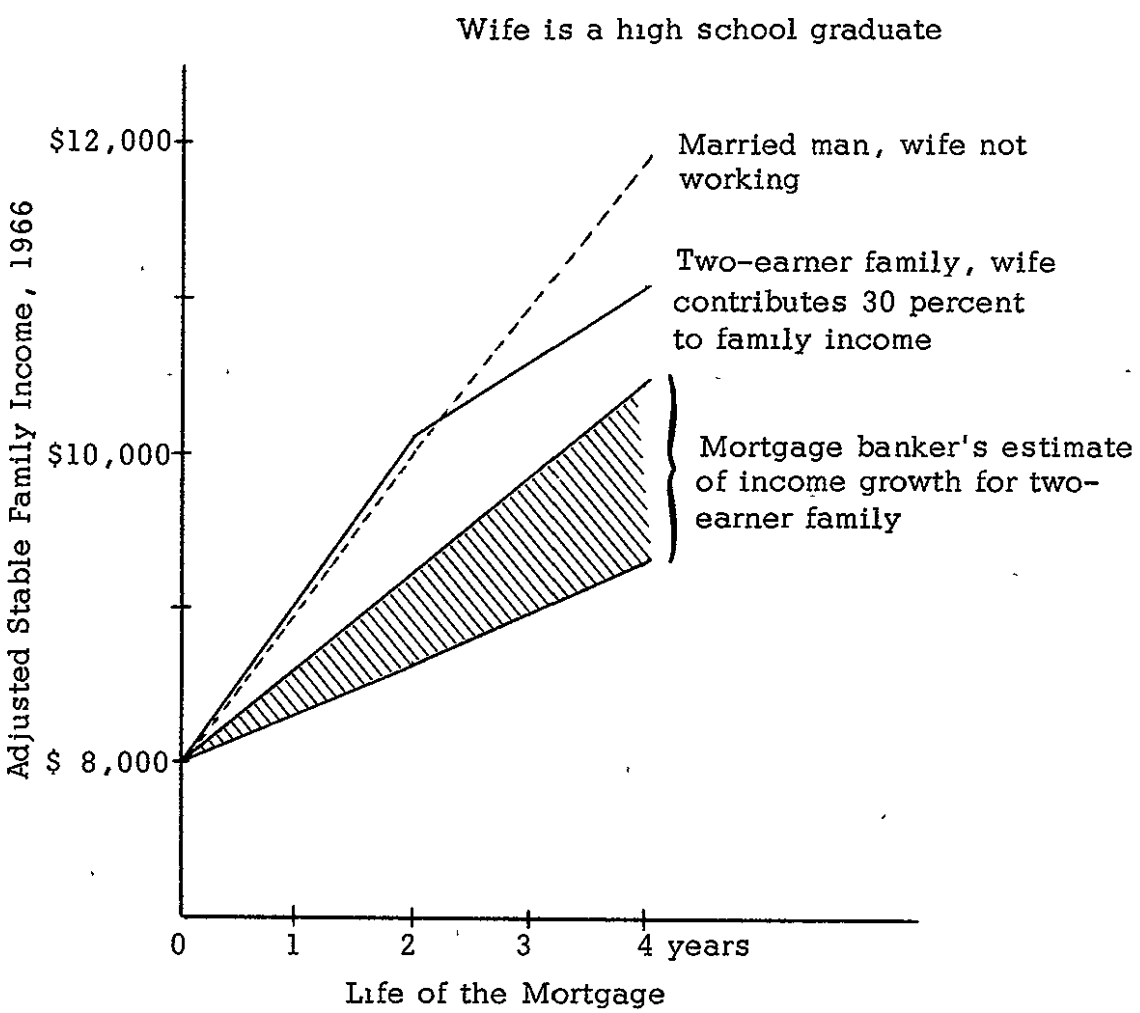
3.2 Married Women: Potential Co-Borrowers

Figure 1 compares the income growth for married women who are high school graduates against lending industry expectations during the first four years of a hypothetical mortgage granted January 1, 1967 on the basis of an adjusted stable family income of $8,000 in 1966. The dashed line represents actual income growth of "married man, wife not working," the industry standard for assessing the relative risk associated with loans to other applicant categories. The solid line represents income growth for a similarly situated two-earner family, in which a working wife contributed 30 percent to total family income in 1966. The shaded area depicts a typical lender's estimate of the income growth for the two-earner (male borrower and female co-borrower) family. The upper boundary assumes the lender counts the husband's earnings at full value, but discounts the wife's by 50 percent; the lower boundary assumes the lender discounts the wife's earnings altogether, which is a conservative but common practice in mortgage underwriting for married women of childbearing age and/or employed in nonprofessional blue collar or clerical occupations.

Note that actual income growth for this two-earner family between 1966 and 1970, although somewhat less than the industry standard, was 20 percent better than the lender's favorable projection

FIGURE 1

Projected Growth in Income for Two-Earner Families as Compared to Industry Standard and Mortgage Bankers' Expectations, 1966-1970



Source: Statistics in Tables A1 and A13 (Appendix A) and B-1 (Appendix B).

(as represented by the upper boundary of the shaded area) and 125 percent above the conservative estimate (the lower boundary).

Figure 2, which is extracted from Table A13 in the Four Year Actuarial Projections of Family Income Growth (Appendix A), shows projected family income growth between 1966 and 1970 as a function of "Family Income in 1966," "Woman's Contribution to Income," and "Woman's Education." The lower part of this figure forms the numerical basis for the 1970 projections on Figure 1. It is read as follows: assume that four families had an adjusted stable family income of $8,000 in 1966 and were identical with respect to all other characteristics (age, children, job tenure, education), except that in one case the wife did not work (column 1) and in the others the wives contributed 20 percent (column 2), 30 percent (column 3), and 40 percent (column 4) to family income, respectively. Then, reading

FIGURE 2

Projected Growth in Family Income by Married Women's Contribution, 1966-1970

Adjusted stable family income, 1966	Woman's Contribution to Income 0%	20%	30%	40%
Woman is not a high school graduate				
$ 6,000	$ 8,654	$ 7,962	$ 7,917	$ 7,817
$ 8,000	10,695	9,760	9,700	9,639
$10,000	12,737	11,558	11,482	11,406
Woman is a high school graduate				
$ 6,000	$10,023	$ 9,516	$ 9,298	$ 9,080
$ 8,000	11,960	11,346	11,055	10,764
$10,000	13,898	13,176	12,812	12,449

Source: Table A13 (Appendix A).

across the table left to right for families with an adjusted stable in-

come of $8,000 in 1966 (middle row) and the woman with a high school diploma, one would expect a "married man, wife not working," or the industry standard, to enjoy on the average an annual income of $11,960 (column 1) in 1970.[9] Similarly, projected average family income in 1970 for a two-earner family, in which the wife's earnings represented 20 percent of total family income in 1966, would be $11,346 (comumn 2); projected average 1970 family income for a two-earner family in which the wife's earnings represented 30 percent of total family income in 1966, would be $11,055 (column 3); and projected average 1970 family income for a two-earner family, in which the wife's earnings represented 40 percent of total family income in 1966, would be $10,764 (column 4). The difference between the two extremes -- the standard family in which the wife does not work (column 1) and a two-earner family in which the working wife makes the substantial contribution of 40 percent to family income (column 4)-- does not exceed 11 percent for any of the charted income levels. It is substantially less than would be suggested by a 50 percent discount factor.

A comparison of the top half of Figure 2 against the lower half shows that a wife's education, in addition to the combined husband-wife earnings, is a good statistical predictor of a two-earner family's ability to maintain steady income growth. Holding all other factors constant (adjusted stable family income in 1966, percentage contribution to income by wife, age, number of children, etc.), a two-earner family in which the wife is a high school graduate has a projected 1970

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9 All family income projections are expressed in 1970 dollars, not adjusted for inflationary price increases between 1966 and 1970.

income about 15 percent higher than a family in which the wife does not have twelve or more years of formal schooling. Less education does not, however, increase the 5 to 11 percent gap in actual family income growth between the two-earner family and the one-earner (male) industry standard. Hence, if education is a proxy for blue collar versus white collar occupations, the actuarial projections statistically reject the popular lender hypothesis that women employed in nonprofessional or blue collar jobs have a less stable attachment to the work force than do professional women.

Tables A1, A2, A13, and A14 in Appendix A present the full set of two and four year actuarial projections of mean income growth for single and two-earner families, with the standard errors. Standard errors were omitted from Figure 2 because their inclusion, as numbers in parentheses below mean estimates, generally tends to impair table readability. They capture, however, an important dimension of lender risk -- namely, the statistical likelihood or chance that actual family income growth will exceed, or fall short of, the average value for the actuarial class. The 1970 income predictions in Figures 1 and 2 of $11,960 for the standard family and $11,055 for a two-earner family in which the wife contributed 30 percent to family income in 1966 have standard errors of $203 and $391, respectively.[10] This means that the actual 1970 income for the standard family will fall between $11,562 and $12,358 with a probability of .95. The corresponding 1970 income range at the 95 percent statistical confidence level for the two-earner family in this example is $10,289 - $11,821. Although the standard errors associated with the two-earner family income growth

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[10] The "standard error," also referred to as the "standard deviation," supplies information about the amount of error in the sample estimate of the true population mean.

projections are generally $100 to $200 above those associated with "married man, wife not working," they are only 3 to 5 percent of the 1970 mean annual income estimate. The difference in standard error sizes does not, then, provide statistical justification for the 50 percent discount factor. One can project expected growth in family income for two-earner families without incurring substantially more variation, or statistical risk, than is implicit in the standard income growth projections.

Of particular interest to the lender is the probability that family income will drop for an extended period below the base year value adopted for the mortgage loan calculation. A second set of actuarial tables, Tables A5, A6, A17, and A18 in Appendix A, Family Income Stability: Probability of a 5 Percent Decline in Family Income, was generated following the lenders' premise that a 5 percent decline in annual income signals a risky financial situation. Since the base year value is equivalent to the definition of adjusted stable family income used in this study, the probabilities of an income decline do not include temporary fluctuations. For example, the type of income drop in which a nonworking wife's incidental temporary earnings in 1966 dissipate in 1968, would not register in any of the actuarial projections. If, on the other hand, paid employment for a working wife whose income as a co-borrower was included in the family 1966 base year value ceases (either voluntarily or involuntarily) in one of the subsequent years, a drop will probably register -- unless there is a compensatory increase in the husband's salary or stable unearned income.

Figure 3 is an abbreviated version of Table A17 from the family income stability table series in Appendix A. The probabilities of an income decline in Figure 3 are read in exactly the same manner as

FIGURE 3

Family Income Stability: Probability of a
5 Percent Decline in Family Income for Married Women, 1966-1970

Adjusted stable family income, 1966	Woman's Contribution to Income 0%	20%	30%	40%
Woman is not a high school graduate				
$ 6,000	.302	.376	.409	.441
$ 8,000	.300	.378	.421	.464
$10,000	.297	.379	.433	.487
Woman is a high school graduate				
$ 6,000	.174	.231	.241	.251
$ 8,000	.196	.259	.273	.287
$10,000	.219	.287	.305	.322

Source: Table A17 (Appendix A).

the 1970 income growth projections in Figure 2. That is, a family with an adjusted stable family income of $8,000 in 1966, in which the wife, who is a high school graduate, does not work has a .196 probability (column 1) of experiencing a drop in annual income below $8,000 for one or more of the years during the critical period (1966-1970). The probabilities of an income decline for similarly situated two-earner families are as follows: .259 for a family in which wife's earnings represented 20 percent of total family income in 1966 (column 2); .273 for a family in which wife's earnings represented 30 percent of total family income in 1966 (column 3); and .287 for a family in which wife's earnings represented 40 percent of total family income in 1966 (column 4).

The probability that the borrower/co-borrower family unit will separate is imbedded in the family income stability projections. In fact, marital disruptions account for approximately 3 to 5 percentage points of the difference between the probabilities of an income decline

for one and two-earner families. A "marital disruption" is defined as occurring when a woman who reported her marital status in 1966 as "married" indicates in a subsequent interview (either 1968 or 1970) that she is "separated," "divorced," "widowed," or "single." Total family income for the actuarial projections is then set equal to her income only -- which may be a serious understatement of the financial resources of the separated borrower/co-borrower unit. Since the Parnes longitudinal survey is based on a national sample of women, present income of former or late husbands is not reported. The data show that marital disruptions are twice as likely in two-income families than in the traditional "husband is the breadwinner" structure. Marital disruptions occurred between 1966 and 1970 in 3.5 percent of the sample families classified in 1966 as "wife not working;" the disruption rate for the "wife working" portion of the sample was approximately 7 percent. This observation tends to confirm lenders' fears about marital problems, especially if one income is not sufficient to sustain the joint mortgage loan.

The Parnes marital disruption rates are consistent with Ross and Sawhill's recent study of marital instability over the period 1968-1972 using the Michigan Panel Study of Income Dynamics.[11] They find that holding other family characteristics (including husband's earnings) constant, a one thousand dollar increase in the wife's earnings is associated with a one percentage point increase in marital separation rates. Another corroborative finding from the Ross and Sawhill study is that fluctuations in family income growth, especially

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11 Heather L. Ross and Isabel V. Sawhill, Time of Transition: The Growth of Families Headed by Women (Washington: The Urban Institute, 1975).

in the downward direction, are associated with higher separation rates. Their economic model of marital instability helps explain why the probabilities of a 5 percent income decline in Figure 3 are higher for two-earner families than for traditional families.

As in the family income growth projections, Figure 3 shows that wife's education correlates positively with family income stability. Married women who have a high school diploma are about one-half as likely to experience a decline in family income for one or more years during the critical period of a mortgage loan as those women who do not. Education is the best statistical predictor of family income stability; variations in Figure 3 down the columns ("adjusted stable family income") and across the rows ("woman's contribution to income") wane in comparison to the education differential. Education is, of course, a convenient proxy variable for a number of complex social and economic factors that affect family income and marital stability -- including age at marriage, type of employment (blue collar versus white collar), and attitude toward divorce.

The standard errors associated with the probabilities of a 5 percent income decline in Figure 3 are 6 to 9 percent of the mean estimates. Observed differences, then, in family income stability between the traditional and two-earner families are statistically significant at the 95 percent confidence level. But, no data are available to explore the lenders' assumption that a decline in family income increases the likelihood of mortgage foreclosure.

Lenders are particularly concerned about the statistical likelihood of a substantial decline, say 20 percent, in annual income when assessing the desirability of, and risk associated with, various mortgage applicant categories. A family may be able to weather a

5 percent income decline even for a year or two; thus, with cooperation from the lending institution, both parties can probably avoid the financial loss and embarrassment of mortgage default and foreclosure. Accordingly, a third series of actuarial tables, Tables A9, A10, A21, and A22 in Appendix A, Family Income Stability: Probability of a 20 Percent Decline in Family Income, was generated. Twenty percent was selected as the cutoff point since this reduction corresponds to the triggering mechanism proposed in Congressional committee draft legislation for assistance under the Emergency Homeowners Relief Act of 1975. This Act provides temporary financial relief from mortgage debt for families who experience a severe curtailment of income due to unemployment or other adverse economic circumstances. The probability of this precarious financial situation occurring during one or more of the critical years of a mortgage, is, on the average, 12 percent for families in which the wife does not work and 16 percent for two-earner families. As in the Family Income Stability: Probability of a 5 Percent Decline in Family Income tables, holding all other factors constant (including "adjusted stable family income, 1966" and "woman's contribution to income"), a high school diploma reduces the probability of a substantial decline for both traditional and two-earner families by more than one-third. In contrast to the actual 4 percentage point difference between the industry standard and two-earner families, the underwriting practice of discounting a married woman's earnings at 50 percent or more implies that a substantial decline or curtailment in her income is almost (statistically) certain. The traditional industry practice is not supported by the income stability differential between one- and two-earner families.

3.3 Single Women and Women Family Heads: Potential Borrowers

Study findings on the income growth and income stability of single women and women family heads reinforces, and extends, the positive statistical profile of women co-borrowers developed from the actuarial data for married women. A lender estimate appropriate for the 1966 to 1970 time frame for single women and women family heads could not be developed from information obtained in the interviews with representatives of the mortgage banking community. They contended that the "industry is now prepared to treat the single woman, the female family head, or the situation of two women living together, the same as it treats males in similar circumstances." However, testimony before the National Commission on Finance on sex discrimination in mortgage lending (May 1972),[12] a national survey of savings and loan associations conducted by the U. S. Savings and Loan League (1972),[13] and a survey of savings and loan institutions and commercial banks in Hartford, Connecticut, (1973)[14] indicate that this has not been the accepted underwriting practice. Unmarried persons -- men or women -- have experienced extreme difficulty in securing mortgages for homeownership. This disadvantage, however, has not been shared equally by men and women. Both surveys conclude that single women have had to present a stronger paper position than single men to obtain a mortgage: their credit and income must be more secure than those of men of the same status, and their credit histories are more closely scrutinized.

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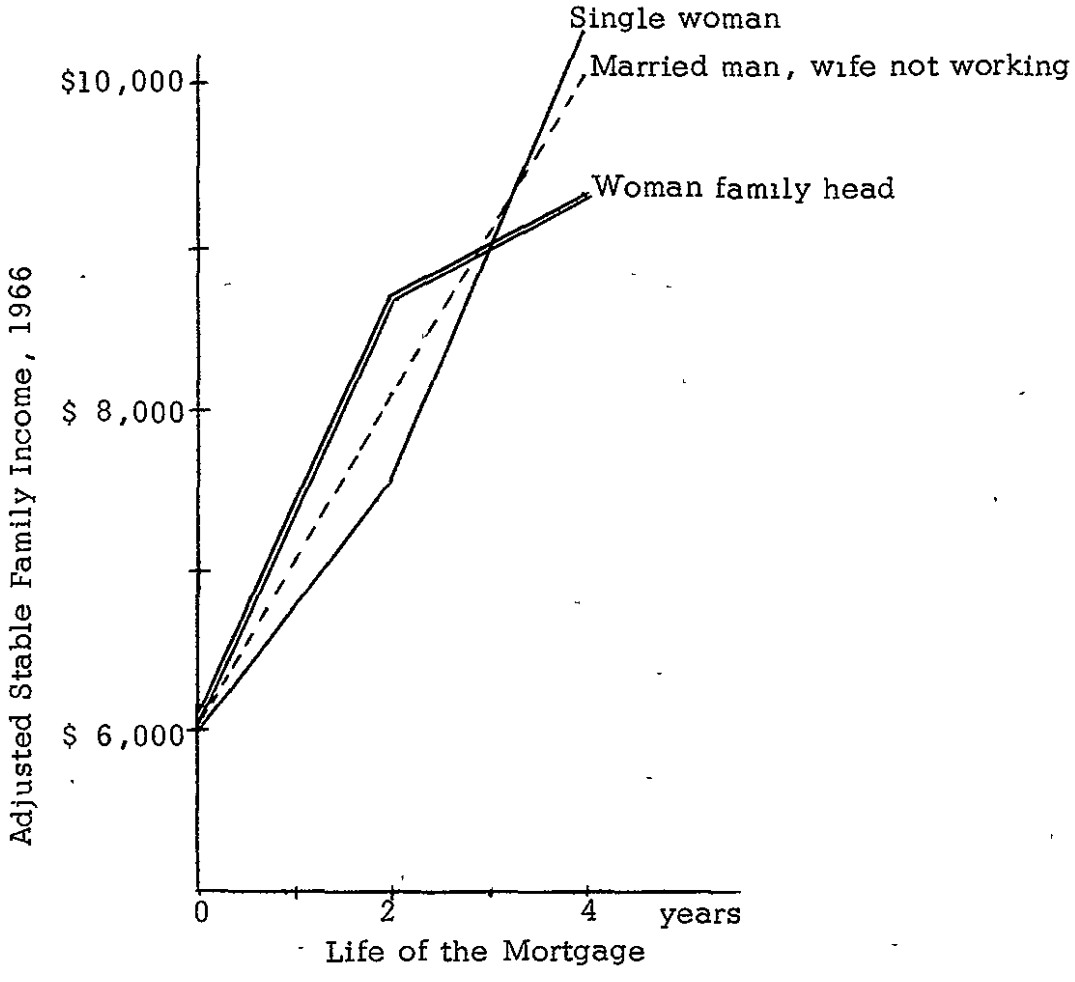
12 See statements of McElhone, Farry and Rhode, op. cit.

13 U. S. Savings and Loan League, "Survey on Loans Made to Women" (Unpublished, 1972).

14 Mortgage Money: Who Gets It? A Case Study in Mortgage Discrimination in Hartford, Connecticut (Washington: U. S. Comission on Civil Rights, 1974).

FIGURE 4

Projected Growth in Income for Single Women and Women Family Heads as Compared to Industry Standard, 1966-1970



Source: Tables A3 and A15 (Appendix A).

Figure 4 compares the projected income growth of women family heads and single women against the industry standard, "married men, wife not working." It has been assumed that all women in this example have high school diplomas since, as previously mentioned, the analyses show that education significantly increases their expected income growth and stability. Figure 4 shows that the actual

income growth from 1966-1970 for single women with a stable income of $6,000 in 1966 kept pace with the industry standard. Moreover, projected 1970 income levels for women family heads were, on the average, only 7 percent below their traditional male counterparts.

Figure 5 which is extracted from the actuarial series on projected income growth by marital status, Tables A3, A4, A15, and A16 in Appendix A, contains the statistical backup for Figure 3. Its format is similar to Figure 2, and is read in much the same manner. Figure 5 delineates income growth projections for three women -- one married but not working (column 1), one single (column 2), and one a family head (column 3). All have an adjusted stable family income of $6,000 in 1966 and are average with respect to all other characteristics for their education category and marital class. The projected family incomes for women with a high school education in 1970 reading from

FIGURE 5

Projected Growth in Family Income by Woman's Marital Status, 1966-1970

Adjusted stable family income, 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$4,000	$ 6,613	$ 7,119	$6,504
$6,000	8,654	10,321	--**
$8,000	10,695	13,524	--**
Woman is a high school graduate			
$4,000	$ 8,085	$ 7,119	$7,597
$6,000	10,023	10,321	9,341
$8,000	11,960	13,524	--**

* Education was not a significant factor in explaining projected income growth for single women. (See Tables B1 and B4 in Appendix B.)

** Family income level is too far from sample mean to yield a statistically valid projection.

Source: Table A15 (Appendix A).

left to right across the second row of the lower half of the figure are: (1) $10,023 for the married woman, (2) $10,321 for the single woman, and (3) $9,341 for the female family head. Since the mean income growth for each marital group lies within one standard deviation of the others, however, the probability is .95 that the 1970 incomes of all three women will be within 10 percent of each other. The standard errors associated with these projections for single women and women heads of household run from 6 to 15 percent of the mean estimate. These errors (which are somewhat larger than those for the industry standard) reflect the small cell sizes in the Parnes sample for these marital classes, as opposed to an inability to "fit" the regression forecast model to their employment/earnings patterns.

Figure 6 presents the probability of a 5 percent decline in family income during one or more of the critical first four years of a mortgage by marital status for women who are high school graduates. This figure is analogous to Figure 3.

As in the married women family income stability tables, education substantially reduces the probability of an income decline for women heads of household. Both income growth and income stability of single women in the Parnes sample, however, are not statistically correlated with a high school diploma.

The probability that a single woman or woman head of household will marry (or remarry) is implicit in these family income growth and income stability projections. If a woman who is not married in 1966 marries (or remarries) during the longitudinal study period, her adjusted stable family income includes the earnings and other stable income of her new husband. This, of course, is the converse (and brighter side) of the marital disruption problem discussed within the

FIGURE 6

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1970

Adjusted stable family income, 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$4,000	.305	.210	.635
$6,000	.302	.190	--**
$8,000	.300	.169	--**
Woman is a high school graduate			
$4,000	--**	.210	.223
$6,000	.174	.190	.254
$8,000	.196	.169	--**

* Education was not a significant factor in explaining income stability for single women. (See Tables B2 and B5 in Appendix B.)

** Family income level is too far from sample mean to yield a statistically valid projection.

Source: Table A19 (Appendix A).

context of the married women and potential co-borrowers tables.

The full actuarial series in Appendix A on projected income stability by marital status, Family Income Stability: Probability of a 5 Percent Decline in Family Income (Tables A7, A8, A19, and A20) and Family Income Stability: Probability of a 20 Percent Decline in Family Income (Tables A11, A12, A23, and A24) show that women heads of household are up to 1.5 times as susceptible to dips in family income as all other marital classes. Female family heads without a high school diploma seem particularly vulnerable to prolonged dips in earnings, probably caused by involuntary job loss.

The actuarial tables discussed here represent confident estimates only for white potential women borrowers and co-borrowers. Because of data limitations in the Parnes Survey of Mature Women,

the results for blacks, whites, and other minorities could not be combined into a single regression model without use of cumbersome weighting procedures. But, differentiation on the basis of race, while computationally convenient, carries adverse political and legal overtones. Therefore, Chow-type tests of significance were performed to statistically establish whether the sample should be subdivided by race. These tests, which are described in detail in Section 4.2 and in Appendix C, showed that the regression plane for white women is different than the regression plane for black women on both dependent variables: the income growth and probability of an income decline. Sample stratification by race then, is a mathematical necessity. Moreover, one cannot make meaningful comparisons across the four loan applicant categories unless race is controlled for. Otherwise, "woman head of household" projections, for example, would be heavily biased toward the income growth and stability projections of blacks and other minorities, whereas "married, not working" would be weighted toward whites. Virtually all previous studies on the labor force participation of women show marked differentials by race. Specifically, black and other minority women exhibit consistently higher labor force participation rates, about 10 percent higher than white women. Also, the labor market behavior of black women is practically insensitive to the presence of young children and numbers of children -- variables which historically have been influential for white women.

Appendix B contains separate actuarial series for white and black family/individual loan applicant categories. The white tables were presented as figures here because of their superior statistical quality. The sample of white women is three times as large as the sample of blacks, so standard errors associated with the black

estimates are generally two to three times the white standard errors. One observes, however, the same trends in the black actuarial tables: (1) differences between the industry standard and the two-earner family in which the wife's earnings represent 40 percent of total family income are, for all charted income levels, less than 10 percent; (2) income growth and income stability projections for single women keep pace with the industry standard; and, (3) income growth rates for women family heads fall only 8 percentage points behind the industry standard, although their income stability is somewhat more volatile.

3.4 Interpretive Summary

The actuarial tables on the projected income growth and stability of women borrowers and co-borrowers statistically support those provisions of the Housing and Community Development Act of 1974 which extend fair housing lending practices to women. Moreover, statistical projections based on the income/earnings patterns of women during the period 1966 to 1970 are conservative, given the changes over the past decade in the economic and social status of women.

The labor force participation rates of all adult women, especially women ages 20 to 44, has maintained a steady secular rise since 1950.[15] During the last ten years, however, women have entered the full-time working force at unprecedented rates: labor force participation for women ages 20 to 34 increased by 14 percentage

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15 Manpower Report of the President (Washington: U. S. Department of Labor and U. S. Department of Health, Education and Welfare, 1975). See especially Chapter 3, "The Changing Economic Role of Women," and Table A-4 in the Statistical Appendix, "Civilian Labor Force Participation Rates for Persons 16 Years and Over, by Color, Sex and Age: Annual Averages, 1948-1974."

points; the corresponding rise for women ages 35 to 44 was 9 percentage points. This upward trend was not dampened by the severe deterioration of the economy during 1974. Well over a million women workers, mostly married women ages 25 to 34, were added to the labor force that year. These national Census statistics document the rapidly changing working profile of American women; they suggest that the "traditional" female work patterns (exhibiting marked differentials by race, marital status, and presence of young children) of the early post World War II years are gradually being replaced by a single pattern closer to that of male workers.

The number of two-earner families in which both husband and wife work has increased from 10.9 million in 1966 (the base year for the actuarial projections) to 14.7 million in 1974, or a net gain of 35 percent.[16] Moreover, Bell's recent study on the economic contribution of a wife's employment to family income shows that not only do most American families now contain two working partners, but that such families appear in both the upper and lower segments of the income distribution.[17] By examining the numerical distributions behind published Census and Bureau of Labor Statistics mean estimates, Bell reveals several significant and perhaps unfamiliar statistics on the working wife's pattern of employment in 1971-1972: (1) some 52 percent of all working wives worked full year; (2) four out of five married women seek full-time and year round employment; and (3) about

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16 Ibid., Table B-3, "Employment Status of Head in Husband-Wife Families by Employment Status of Family Members, Selected Dates, 1955-1974."

17 Carolyn Shaw Bell, "Working Women's Contributions to Family Income," Eastern Economic Journal, I, No. 3 (July 1974), pp. 185-201.

half of the working wives contributed 20 to 50 percent of family income. These statistics do not support the popular claim that married women have a much less strong attachment to the labor force than men. In fact, the author interprets them as follows: "Most families with working wives expect such women to contribute regularly, with fifty-two paychecks a year, and [these] expectations are fulfilled."[18] Her conclusion, which is supported by incisive statistical tabulations, is that the two-earner family now represents the typical American lifestyle.

Part of the steady increase in the labor force participation of women over the past decade is attributed to the steady increase in marital separation rates and to the concomitant growth of families headed by women. A central hypothesis of Ross and Sawhill's research cited previously "is that the changing economic and social status of women is a major source of the behavioral evolution leading to female-headed families."[19] That is, the availability of new income opportunities -- notably women's own earnings -- and social welfare benefits outside traditional family arrangements enable women and children to exist in units of their own should they choose or be required to do so. Ross and Sawhill's analysis on the stocks and flows of female-headed families provides economic, sociological, and psychological explanations for certain trends one sees in both the income growth and income stability tables across the four marital classes/loan applicant categories. For example, husbands' earnings through

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18 Ibid., p. 193.

19 H. Ross and I. Sawhill, op. cit., p. 5.

marriage (or remarriage) of single women during the study period, 1966-1970, do contribute to their strong pattern of income growth and stability. The somewhat higher tendency of two-earner families to separate is reflected in their income stability actuarial series. One-third of the married women, classified as nonworking wives in 1966, entered the labor force between 1966 and 1970; the earnings of these working wives represented at least 15 percent of their total family income.

These statistics and corroborative study findings from other researchers on changes in the social and economic status of women in the post-actuarial series decade, 1966-1976, support the conclusion that these tables do not provide statistical justification for different treatment of women borrowers and co-borrowers. Rather, the tables provide statistical support for nondifferential treatment of women borrowers and co-borrowers, as required in the two recent Legislative Acts.

Chapter 4

STUDY METHODS

4. STUDY METHODS

This chapter presents a technical discussion of the mathematical models and data preparation procedures used to generate the actuarial tables from the Parnes longitudinal survey data tapes for mature women. Each step has been carefully delineated so that economists, financial analysts, statisticians and others whose interest has been piqued by the tables can fully understand all the assumptions and approximations contained therein. In addition, other researchers using the Parnes longitudinal survey data tapes should profit from the detailed discussion of the data editing, quality control checking, and reduction procedures. Hopefully, they will not stumble upon the small number of reporting inconsistencies which still seem to plague the edited Parnes tapes. These tapes contain excellent longitudinal survey data on labor market experience, earnings, income, and assets; the analyses conducted in this study were among the first to be performed on the newly edited Parnes tapes released in late January 1975.

This chapter is organized into five major sections:

Overview of the Study Methods and Definition of Key Variables

Data Preparation Procedures

A Model to Estimate Future Income

A Measurement of Risk: Growth and Stability Computation of Standard Errors

Using the Tables.

The methodological discussion throughout this chapter is directed

primarily toward readers having a working knowledge of statistics and economic theory. The content of key mathematical equations is, however, explained in narrative for nontechnical readers.

4.1 Overview of Study Methods and Definition of Key Variables

As discussed earlier, the study product -- a series of actuarial tables on the projected income growth and stability of women borrowers and co-borrowers -- is designed to serve two distinct users: (1) the financial/credit community of lenders, mortgage bankers, and insurers, and (2) HUD and other Federal agencies involved in Equal Opportunity Compliance. Initial study specifications called for the development of tables that would permit a direct comparison of the working patterns and expected earnings of men and women. Unfortunately, the best available data base, the Parnes National Longitudinal Survey of Mature Women Ages 30-44, has no longitudinal earnings/employment data for single men. Also, the original concept of using the husbands of the subset of "married women, husband present" in the Parnes survey as a longitudinal sample of married men had serious methodological flaws. The problem lies in attempting to compare a group against itself. The work patterns of a married couple are not the same as the work patterns of single males and females, since family circumstances determine and influence work patterns. Therefore, women have been classified with respect to four marital states, and the earnings variable in the original model has been replaced with joint or family income:

$$\text{Married women,}^{20} \text{ not working,}$$

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[20] The category "married women" is an abbreviation for the Census category, "married women, husband present."

Married women, working,
Single women, and
Women heads of household.

This revised study approach is wholly consistent with the mortgage banker's requirements since the tables predict changes (in particular, a significant drop) in family income effected through marital breakups as well as through decreased earnings or withdrawal from the labor force. The comparison group, "married men, wife not working," which seems to be the industry standard for assessing the relative risk associated with loans to other applicant categories, is appropriate for both the financial and Equal Opportunity user communities.

The basic conceptual model developed to generate actuarial tables on the projected growth and stability of family income during the first four years of a mortgage stems from traditional mortgage credit analysis. Discrepancies and statistically unsubstantiated practices suggested by the tables would be easier to identify, and eliminate, if the actuarial information explicitly references the present system. A careful step-by-step derivation of the model is given in Chapter 3. The discussion here focuses on definitional issues and refinements not covered earlier. Most concern definitional constraints and assumptions about how women are initially classified into one of the four defined loan-applicant categories.

Marital and employment status is defined insofar as possible with respect to December 31, 1966, the end of the first year for which detailed data are available from the Parnes survey. Because a mortgage lender would require income information (such as occupation, wage or salary rate, and weeks worked) for at least one previous year in order to consider a loan application, the first survey year

(1966) was used as the base year for this study.

Marital status. If a woman was married on December 31, it was assumed (following the Internal Revenue Service filing status convention) that she had been married for the entire year. Similarly, if her marriage was broken and she is divorced at the time of the interview, she was categorized as "woman family head" or "single" (depending on the presence of children).

Number of children. It is assumed that a woman has the same number of children on December 31, 1966 which she reports at the time of the survey, with the following exception. If a woman (re)married in 1967, it was determined if she adopted children from her husband's family at the time of their marriage. If so, these children were not counted in her family since she was not legally responsible for them on December 31, 1966.

Employment status. The distinction between "working" and "not working" is more difficult to define.

A woman was classified as "working" and as a co-borrower if her 1966/67 employment pattern as reported in the 1967 survey is described by any of the following:

> She was currently employed (at time of 1967 interview) and began this job at least three months prior to December 31, 1966 (that is, September 1966 or earlier).
>
> She was employed six months or more in 1966 and was employed at the 1967 interview date. This work pattern indicates a strong attachment to the labor force; hence, it was assumed that she merely switched jobs with, perhaps, a short period of (voluntary) unemployment in between.

She was not employed at the time of the 1967 interview, but worked 50 weeks or more in 1966.

She was not employed at time of interview, but worked six months or more in 1966, and her last job began during September - December 1966. This pattern of employment indicates a strong attachment to the labor force, and she probably was working on December 31, 1966.

All other women were, by definition, "not working," and their earnings, if any, did not enter the initial computation of adjusted family income. This operational definition was the best proxy for "having worked at a regular job for at least three months in 1966, prior to application for a mortgage loan on December 31, 1966." Only in unusual circumstances would a lender include a woman's earnings in the mortgage application if she had been employed for less than three months.

Families remain in their original applicant categories, even if the marital and/or employment status of either the presumed borrower or co-borrower changed during the longitudinal study period, 1966-1970. If a husband and wife became separated, total family income is set equal to the woman's earnings only. (Since the Parnes longitudinal survey is based on a national sample of women, income data on ex-husbands are nonexistent.) Conversely, if a single woman marries, her total family income includes the earnings of her new husband. Also, if a wife is classified as "working" and a potential co-borrower in 1966 and her paid employment ceases, either voluntarily or involuntarily, in one of the subsequent years, family income stability is gauged with respect to the original 1966 joint earned income.

4.2 Data Preparation Procedures[21]

This section discusses selected definitional constraints imposed on the analyses of the expected patterns of growth in family income of women borrowers and co-borrowers by the format, content, and quality of the Parnes Mature Women Survey data tapes. As mentioned earlier, these longitudinal data are of unusually high calibre; however, one is always required to make some methodological sacrifices when trying to estimate economic models with survey data that were collected for another purpose. Parnes' primary intent was to examine the labor force attachment and employment experience of mature women ages 30 to 44, and their desire and ability to reenter the regular paid work force during the longitudinal study period, 1966-1976. The analysis in the present study, on the other hand, focused on family income and the employment and nonemployment factors that affect income growth and fluctuation.

Two major data preparation issues are addressed here: definition of a universe of potential women borrowers and co-borrowers from the sample, and assessment of the national representativeness and quality of the edited Parnes sample.

4.2.1 Definition of a Sample of Potential Women Borrowers and Co-Borrowers

The Parnes national sample of 5,083 women who were 30 to 44 years of age when initially interviewed in mid-1967 provides an

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[21] Leonard Cupingood, KETRON Senior Analyst, was primarily responsible for the development and implementation of the data editing and quality control procedures described here.

excellent basis for a corresponding national sample of women borrowers and co-borrowers. Their age interval, 30 to 44 years, is a setback because the lending industry representatives voiced more concern about the desire and ability of younger women -- in particular, women of childbearing age -- to maintain uninterrupted employment (and presumably, a continuous earnings stream) during the crucial years of a mortgage loan. Also, since one of the Parnes survey requirements was to provide separate reliable statistics on the work experience of blacks and other races, households in predominantly black and other nonwhite race enumeration districts (EDs) were sampled at a rate three times that of households in predominantly white EDs. The sample was designed to provide approximately 5,000 interviews for each of the four Parnes Work Experience surveys -- about 1,500 black and other nonwhite minority races and 3,500 whites.[22]

Since statistical projections were to be made for women borrowers and co-borrowers on the basis of their marital status, it was decided a priori to divide the sample into four parts: (1) married women, not working; (2) married women, working; (3) single women; and (4) women heads of household. Further stratification by race was

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22 The Parnes survey of Mature Women is one of a series of four National Longitudinal Surveys on Work Experience. These longitudinal studies cover four subsets of the United States population: men 45-59 years of age, women 30-44 years of age, and young men and young women 14-24 years of age. The National Longitudinal Surveys are based on a multistage probability sample located in 235 sample areas comprising 485 counties and independent cities representing every State and the District of Columbia. Within each of the 1,900 Primary Sampling Units a probability sample of housing units was selected to represent the civilian noninstitutionalized population. Within the household sample, nationally representative samples were drawn for each of the four age-sex cohorts.

analytically tested, partly because previous studies on the labor-force participation of women show marked differentials by race[23 24 25] and partly because the black women were oversampled in the Parnes survey relative to white women. Black and white women could not be combined into a single regression model without the use of cumbersome weighting procedures. Therefore, Chow-type tests of significance were performed to statistically establish whether the sample should be further subdivided by race. This procedure involved running three sets of eight regressions on income growth and income stability by marital class: one set for whites alone, a second set for blacks alone, and a third set for the combined (total) sample. (Hispanics, Orientals, and other nonblack minorities are included in the white sample.) Then, a statistical test based on the F-distribution can be constructed from the parameters of these regressions. This procedure tests whether the white observations and the black observations could have come from the same population. The first two sets of regressions are defined in mathematical terms as follows:

$$(1) \qquad Y_i = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ldots + \alpha_K X_K + \epsilon_i \quad (i=1, \ldots, W)$$

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23 Jacob Mincer and S. Polochock, "Family Investments in Human Capital: Earnings of Women." Paper presented at Population Conference II, Chicago, June 4-5, 1973.

24 G. Cain, Married Women in the Labor Force (Chicago: University of Chicago Press, 1966).

25 G. Cain, "Unemployment and the Labor Force Participation of Secondary Workers," Industrial and Labor Relations Review, XX, No. 2 (January 1967), pp. 275-297.

and

$$(2) \qquad Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_K X_K + \epsilon_i \quad (i=W+1, \ldots, W+B)$$

where equation (1) represents the white sample containing W observations and equation (2) represents the black sample containing B observations.

The null hypothesis (H_0) which is being tested is

$$H_0: \ \alpha_0 = \beta_0, \ \alpha_1 = \beta_1, \ \ldots, \ \alpha_K = \beta_K.$$

In other words, if the null hypothesis is true, equations (1) and (2) have essentially the same regression coefficients and thus are equivalent. The white and black samples could have drawn from the same population. Then, in order to compute the relevant test statistic,[26] a third regression equation using observations from the combined samples is required.

$$(3) \qquad Y_i = \gamma_0 + \gamma_1 X_1 + \ldots + \gamma_K X_K + \epsilon_i \quad (i=1, \ldots, W, \ldots, W+B).$$

Then, using the parameters from these regressions, an F-statistic was computed as follows:

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26 See, for example, J. Johnston, Econometric Methods (New York: McGraw-Hill, 1963), pp. 119-122.

$$F_{K,(B+W-2K)} = \frac{N}{D}$$

where:

$$N = \frac{S - (S_B + S_W)}{K}$$

$$D = \frac{S_B + S_W}{B+W-2K},$$

and where:

W = number of white women in the sample,

B = number of black women in the sample,

S_W = residual sum of squares error in the regression for whites only,

S_B = residual sum of squares error in the regression for blacks only,

S = residual sum of squares error in the combined regression, and

K = number of parameters in the regression.

The ratio $\frac{N}{D}$ has an F-distribution with K and $(B+W-2K)$ degrees of freedom. This ratio is compared against pretabulated values of F with K and $(B+W-2K)$ degrees of freedom at a given confidence level, 95 and 99 percent here. Tables C1 through C4 in Appendix C show the results of these tests for each marital class and dependent variable. The hypothesis being tested was: Is the regression plane for the white sample the same as the regression plane for the black sample? The last column of these tables indicates the acceptance or rejection of the hypothesis. In most cases, the hypothesis is rejected -- implying that the two regression planes are different, and that the sample should be stratified by race.

Women in families who reported net farm income in 1966 (323) were excluded from the national sample of potential women borrowers and co-borrowers. It is difficult to assess "working" versus "not working" and actual earnings for persons who live on farms because their work is often paid for by in-kind income, such as free board, produce, and so forth. Mortgage and financial markets also operate differently in rural areas. Furthermore, HUD has stated that this segment of potential women borrowers is not of interest in the present study.

Separated women were originally excluded from the samples of "women heads of household" and "single women," but this omission penalizes black and other stable, single-parent, low-income families who are financially unable to obtain a divorce or legal separation. There was concern that the ambiguous legal/marital status of these women might affect their labor force attachment and/or family income stability; hence, their inclusion in the "single women" and "women heads of household" loan applicant categories might penalize divorced and unmarried women who are legally able to secure credit and own property in all States. However, excluding separated women in these loan applicant categories would reduce the black samples to sizes that are definitely too small to permit income projections by class (71 to 59 single; 293 to 185 heads of household).

The marital class "married, spouse absent" (46 women) was eliminated from the sample of potential women co-borrowers. This definition covers temporary situations where a husband is absent from the home because he is serving in the Armed Forces overseas, is institutionalized, or is incarcerated.

These adjustments left 4,780 women in our sample universe of

potential borrowers and co-borrowers.

4.2.2 Assessment of the National Representativeness and Quality of the Parnes Sample

Earnings/income projections given in either actuarial tables or by the economic autoregression model that generates such tables must represent unbiased national means. Otherwise, they are not true statistical indicators of the projected growth or likelihood of decline in family income for individual mortgage situations as represented by the cell means. About 35 percent of the 4,780 observations in the reduced borrower/co-borrower subset of the Parnes sample had missing data elements on either the husband's or wife's income for one or more of the three years and hence, were unusable for the autoregression. This startling finding prompted a question of whether the remaining truncated sample was still nationally representative of women ages 30 to 44 and whether the income data items as reported were of sufficient quality to support actuarial income projection tables.

The truncated Parnes sample consists of those observations for which the income component has been reported in all three survey years -- 1966, 1968, and 1970. Figure 7 presents a summary of the valid and invalid observations by marital class for both white and black respondents. About 60 to 65 percent of all observations have valid income components.

The truncated sample was compared against the 1970 Census of Population[27] for three classes of individual and family situations:

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27 Census of Population: 1970 DETAILED CHARACTERISTICS, Final Report PC(1)-D1, United States Summary (Washington: U. S. Bureau of the Census, 1973).

married men, wife present; single women; and female heads of household. These groups were chosen to conform with the standard Census classifications. The previous definition of the two marital classes, "married women, working" and "married women, not working," was not used for the purposes of this comparison due to differing definitions of employment status. All other characteristics of the reduced sample were matched as closely as possible with those used in the 1970 Census. It was impossible, however, to match the Parnes and Census

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FIGURE 7

Summary of Valid Income Component Observations on Parnes Sample

A valid income component is defined as a complete longitudinal set containing legitimate income observations for the years 1966, 1968, and 1970 for a sampled woman and, if she is married, her husband.

Marital Class*	White	Black
Married women, not working	1188	242
Married women, working	616	274
Single women	156	52
Women head of household	136	168
	2096**	736**

* In order to be consistent with Census classifications, families in which the husband is not working are classified in one of the "married" categories rather than under "head of household." Similarly, women who are separated and have no children are included under "head of household."

** Fifty-eight valid observations for white women (2154 - 2096) and 143 valid observations for black women (879 - 736) were deliberately excluded from this figure; they represent married women with spouse absent and separated women with children in the household. (Later, as discussed in Paragraph 4.2.1, separated women were included in the "single" and "female family head" applicant categories.)

samples exactly on all pertinent characteristics. Here is a brief rundown of known discrepancies:

- The Census income data for families represent calendar year 1969, whereas the sample represents family income for 1968. This difference would yield lower incomes, on the average, for the truncated Parnes sample.

- The Census age interval classification for head of household was 35 to 44 (for 1969), while the closest matching interval in our sample was 32 to 46. Note that for the purposes of the comparison, heads of households whose ages were outside the interval were not included.

- On the Parnes file, annual family income in excess of $50,000 (or a net loss in annual family income of $50,000) is set equal to $50,000 (or -$50,000). The data tape was intentionally edited this way. Thus, extreme value observations are lost.

- The Parnes sample is a sample of women, while the Census statistics are based on a sample of families. It is not clear what effect this difference will have on the income levels of the samples.

It was decided to adopt the Census income cells for the comparative income distribution. Their cell intervals were increments of $1,000 for the first $10,000 of income, and then became large beyond $10,000.

Figure 8 presents the mean incomes for both samples. The mean income for the Parnes "marrieds" is lower than the mean income for Census "marrieds." The fact that the data are one year behind the Census data accounts for part of the deficiency (by the amount of average income increase for married couples from 1968 to 1969). Also, the lack of extreme value incomes in excess of $50,000 reduces real

FIGURE 8

Parnes Income in 1968 Compared with
Census Mean Income in 1969 by Marital Class

Marital Class	Census 1969 Mean Income Household Head Ages 35-44	Parnes 1968 Mean Income Household Head Ages 32-46
White Respondents		
Married, wife present	13,384	11,646
Single	5,230	6,290
Female head of household	6,258	5,540
Black Respondents		
Married, wife present	9,249	7,898
Single	3,227	3,000
Female head of household	4,625	4,050

mean income as reported in the Parnes sample.

Even though the sample characteristics do not conform exactly to those of Census, statistical Chi-square tests were performed to test the hypotheses that the reduced sample income distribution was the same as the Census income distribution. Although not mathematically precise, these tests help in judging the reasonableness of the sample data.

For the single and female family head classes, the sample data distribution fits the Census income distribution over the entire income range with two exceptions. Black female family heads in the Parnes sample report slightly lower incomes than their Census counterparts, but the small sample size (168 respondents) left little room for further adjustment or truncation on the basis of income. Mean annual family income for single white women in the Parnes sample is about 20 percent higher than the Census sample; however, this difference is fully explained by the inclusion of husband's earnings in 1968 family

income for women who were classified as "single" in the base year (1966) Parnes sample, but who married (or remarried) during the period, 1966-1968.

For the married classes, the sample seems to lack observations at the extreme ranges of income. Restricting the distribution to an income range of $3,000 to $15,000 produces a reasonably good fit to the Census distributions. Since there are known differences between the two samples, especially with regard to the different year of observation, it seems reasonable to extend the income ranges of married couples for the analysis to at least $2,000 to $25,000. This income range should include virtually all cases of interest to the mortgage lender. Hence, the married samples were truncated to exclude families whose income was below $2,000 in 1966. Figure 9 summarizes these analyses of income distributions and Figure 10 displays them in the form of a cumulative percentage distribution.

An additional analysis on the "quality of the income data reported" was performed for husbands' earnings. Prior studies have shown that the best predictor of a married man's earnings next year is his earnings in the current year. A simple model of the form

$$Y_{70} = \alpha + \beta Y_{68}$$

was used to regress income in 1970 (Y_{70}) on income in 1968 (Y_{68}). The β coefficients obtained were .88 for black husbands and .89 for white husbands. Observations in which a marital breakup occurred during 1968 to 1970 were excluded from the analysis. These results are virtually identical to those obtained by Ashenfelter in his studies on male earnings using the Continuous Work History Sample extracted

Figure 9

Distribution of Parnes Income (Truncated Sample) in 1968 versus Distribution of Census Income in 1969 by Marital Class

Marital Class	Income: Less than $1,000	$1,000 - 1,999	$2,000 - 2,999	$3,000 - 3,999	$4,000 - 4,999	$5,000 - 5,999	$6,000 - 6,999	$7,000 - 7,999	$8,000 - 9,999	$10,000 - 14,999	$15,000 - 24,999	More than $25,000	Total
White Respondents													
Married men, wife present													
Parnes (observed)	-	-	-*	11	25	46	69	94	227	563	-	-*	1035
Census (expected)	-	-	-	22.8	32	50.7	67.3	89	222.5	551	-	-	
$x^2 = 8.79$													
Single women													
Parnes (observed)	6	11	5	12	11	18	14	11	13	16	3	0	120
Census (expected)	18	12	9.5	10.5	11	11.5	11	9	12	11	2	.5	
$x^2 = 18.7$													
Female heads of household													
Parnes (observed)	16	15	17	26	24	25	19	20	20	17	2	1	202
Census (expected)	19.5	13	17	20.5	21	21	18.5	16	23	24	7.5	1.5	
$x^2 = 9.9$													
Black Respondents													
Married men, wife present													
Parnes (observed)	-	-	-*	26	34	27	37	27	40	77	-	-*	268
Census (expected)	-	-	-	18	22	27	30	30.5	53.5	86	-	-	
$x^2 = 16.5$													
Single women													
Parnes (observed)	16	15	15	13	7	1	3	2	3	2	0	0	77
Census (expected)	18.5	13	10	10	7.5	6	4	3	3	2	0	0	
$x^2 = 8.8$													
Female heads of household													
Parnes (observed)	14	27	24	28	32	16	14	2	9	4	2	0	172
Census (expected)	21	20.5	24.5	24.5	19	15	12	8.5	11.5	11	3	0	
$x^2 = 24.5$													

* The income distributions for married persons were restricted to a range of $3,000 to $15,000 for these statistical tests.

Figure 10

Cumulative Percentage Distribution of Parnes Income (Truncated Sample) in 1968 versus Distribution of Census Income in 1969 by Marital Class

White Respondents

	Cumulative Percentage											
Marital Class	Less than $1,000	$1,000 - 1,999	$2,000 - 2,999	$3,000 - 3,999	$4,000 - 4,999	$5,000 - 5,999	$6,000 - 6,999	$7,000 - 7,999	$8,000 - 9,999	$10,000 - 14,999	$15,000 - 24,999	More than $25,000
Married men, wife present												
Parnes (observed)	-	-	-*	1.0	3.4	8.3	14.8	23.4	45.0	100.0	-	-*
Census (expected)	-	-	-	2.2	5.3	10.2	16.7	25.3	46.9	100.0	-	-
Single women												
Parnes (observed)	5.0	14.2	18.3	28.3	37.5	52.5	64.2	73.3	84.2	97.5	100.0	100.0
Census (expected)	15.2	25.6	33.6	42.5	51.8	61.5	70.5	78.1	88.2	97.6	99.5	100.0
Female heads of household												
Parnes (observed)	7.9	15.3	23.8	36.6	48.5	60.9	70.3	80.2	90.0	98.5	99.5	100.0
Census (expected)	9.7	16.1	24.5	34.6	44.9	55.3	64.5	72.3	83.6	95.5	99.3	100.0
Black Respondents												
Married men, wife present												
Parnes (observed)	-	-	-*	9.7	22.3	32.5	46.3	56.3	71.3	100.0	-	-*
Census (expected)	-	-	-	6.7	15.0	25.2	36.3	47.8	67.9	100.0	-	-
Single women												
Parnes (observed)	20.8	40.2	59.7	76.6	85.7	87.0	90.9	93.5	97.4	100.0	100.0	100.0
Census (expected)	24.1	40.7	53.4	66.3	76.7	83.9	89.3	93.3	97.1	99.6	99.9	100.0
Female heads of household												
Parnes (observed)	8.1	23.8	37.8	54.1	72.7	81.9	90.1	91.2	96.5	98.8	100.0	100.0
Census (expected)	12.3	24.3	38.5	52.7	63.9	72.7	79.7	84.7	91.5	97.9	99.8	100.0

* The income distributions for married persons were restricted to a range of $3,000 to $15,000 for these statistical tests.

from Social Security records,[28] thus attesting that annual income was accurately and consistently reported in the Parnes survey.

4.3 A Model to Estimate Future Income Growth and Stability

An econometric autoregression model was used to estimate the projected growth in family income and the probability of income decline for different classes of women borrowers and co-borrowers. The 1968 income data were regressed on the 1966 baseline to generate the two-year tables and 1970 data on 1966 to generate the four-year tables in Appendix A. Some regressions were performed using 1966, 1968, and 1970 income data. Although the regression coefficients were consistent with the 1970/1966 regressions, they were discarded because a lender would not have actual data on a family's income in 1968 if the mortgage application were made January 1, 1967. This model was successfully used by Ashenfelter to predict post-training period earnings for manpower program graduates, and to estimate the relative effects of various demographic characteristics on their future earnings.[29] This application demonstrated that the best predictor of a person's earnings in year (t+1) is his (her) earnings in year t. This model is appropriate for the present study on the future income stream of women borrowers and co-borrowers because the primary input to the loan application is their current annual earnings (t) and the

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28 O. Ashenfelter, "Progress Report on the Development of a Continuous Performance Information System on the Impact of the Manpower Development and Training Act," Technical Analysis Paper 12A, Office of Evaluation, ASPER, U. S. Department of Labor, October 1973.

29 Ibid.

unknown is their earnings in future years (t+1, t+2, ..., etc.).

Suppose Y_t is adjusted family income at time t (1966, the base year), so that Y_{t+1} is income at time t+1 (1968) and Y_{t+2} is income at t+2 (1970). Measurements were taken at two-year intervals, so (t+1) refers to income two years after the base year, or 1968. X represents a vector of demographic characteristics that may or may not change from period to period. For example, if the age of a woman's oldest child is an element of X, then that part of X changes over time. On the other hand, if one element of X represents a woman's race, then that part of X does not change over time. Suppose for the moment that X does not change over time. A simple autoregression in income is

$$Y_{t+1} = \alpha + \beta_1 Y_t + \beta_2 X + \epsilon_{t+1}, \tag{4}$$

and the parameters β_i may be determined by the least-squares estimation. But if equation (4) holds for period t+1, it must also hold for period t+2, so that,

$$\begin{aligned} Y_{t+2} &= \alpha + \beta_1 Y_{t+1} + \beta_2 X + \epsilon_{t+1} \\ &= \alpha_0 + \beta_1 (\alpha_0 + \beta_1 Y_t + \beta_2 X + \epsilon_{t+1}) + \beta_2 X + \epsilon_{t+2} \\ &= \alpha_0 (1 + \beta_1) + \beta_2 (1 + \beta_1) X + \beta_1^2 Y_t + \beta_1 \epsilon_{t+1} + \epsilon_{t+2} \\ &= (1 + \beta_1)(\alpha_0 + \beta_2 X) + \beta_1^2 Y_t + \beta_1 \epsilon_{t+1} + \epsilon_{t+2}. \end{aligned}$$

In the same way, repeated substitution in equation (4) gives, for n periods into the future,

$$(5) \qquad Y_{t+n} = [\alpha + \beta_2 X] \sum_{i=0}^{n-1} \beta_1^i + \beta_1^n Y_t + \sum_{i=0}^{n-1} \beta_1^i \epsilon_{t+n-i}.$$

Now, equation (5) is an identity that shows that if all the β and ϵ values are known, given the knowledge of Y at time t and all the X values one can make a perfect forecast of Y at n periods into the future. Of course, ϵ values are not known so such a perfect forecast is impossible. On the other hand, if all the expected ϵ values are assumed to be zero, a forecast using the knowledge of the α and β values, Y_t, and X can still be made that will have an expected value equal to that of Y at n periods into the future. That is, a forecast can be made that is not correct for every specific case, but that is correct on the average. Likewise, the variability in this forecast can be calculated so that some idea of how close the forecasts will be on average can be obtained. To see how this is done, notice that if the expected ϵ value is zero, then from (5)

$$(6) \qquad E(Y_{t+n}) = (\alpha + \beta_2 X) \sum_{i=0}^{n-1} \beta_1^i + \beta_1^n Y_t,$$

where it is assumed that Y_t is known with certainty. Assuming that the β values are known, one may subtract (6) from (5), square the result and take the expectations to get

$$(7) \qquad Var(Y_{t+n}) = \sigma^2 \sum_{i=0}^{n-1} \beta_1^i = \sigma^2 \left(\frac{1-\beta_1^n}{1-\beta_1} \right),$$

where σ^2 is the (common) variance of each one of the ϵ values. An immediate result from (7), incidentally, assuming $0 < \beta_1 < 1$ as is most certainly true, is that the forecast error variance increases with n; that is, the typical error in the forecast increases as one tries to forecast further into the future. The potential hazard of chained error

terms is avoided, however, since lenders regard years one through four as the crucial years for a typical mortgage having an expected life of 10 to 12 years.

The X vector consisted of twelve explanatory variables, where some, such as "presence of a child under six," represented binary or grouped data and others, such as "woman's income in 1966," were linear. They are defined as follows:

X_1 = 1, if woman's age in 1966 is 35-39;
0, otherwise

X_2 = 1, if woman's age in 1966 is 40-44;
0, otherwise

X_3 = 1, if exactly 1 child is present in household in 1966;
0, otherwise

X_4 = 1, if at least 2 children are present in household in 1966;
0, otherwise

X_5 = 1, if a child under six years of age is present in household in 1966;
0, otherwise

X_6 = 1, if woman has a high school education;
0, otherwise

X_7 = 1, if woman's job tenure is between one and two years;
0, otherwise

X_8 = 1, if woman's job tenure is more than two years;
0, otherwise

X_9 = husband's income in 1966

X_{10} = woman's income in 1966

X_{11} = other stable income in 1966

X_{12} = 1, if family owned home in 1966;
0, otherwise (rented).

Separate regression models for the years 1968 and 1970 were fitted on the data for 1966. The regression results are presented in

Appendix B. Regression coefficients that were statistically significant at the 95 percent confidence level are asterisked. These separate models produce two-year and four-year forecasts based on income level and other demographic variables in the base year, 1966. Equations (5), (6), and (7) can be used to extend these forecasts into the future and generate forecasts for years 1972, 1974, etc.

4.4 A Measurement of Risk: Computation of Standard Errors

Standard errors were computed for each projected income growth and income decline cell in the tables. All computations were derived from the general formula[30] for the variance of the estimate of the dependent variable at a given point:

$$\text{(8)} \qquad \text{Var}(\hat{Y}_i) = \sigma^2[(X_i-\bar{X})' \ (X'X)^{-1} \ (X_i-\bar{X}) + \frac{1}{n}],$$

where σ^2 is the common variance of the random disturbance terms, and n is the number of observations,

$$(X_i-\bar{X}) = \begin{bmatrix} X_{i1}-\bar{X}_1 \\ \vdots \\ X_{ik}-\bar{X}_k \end{bmatrix}$$ a matrix of the coordinates of the deviations of the given point from their corresponding sample means,

and $(X'X)^{-1}$ is a constant multiple $\left(\frac{1}{\sigma^2}\right)$ of the variance-covariance matrix of the regression coefficient estimates.

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30 Jan Kmenta, Elements of Econometrics (New York: Macmillan Publishing Company, 1971).

All explanatory variables except husband's income and woman's income were held fixed at the sample means. Therefore, for the situations in which only one income is present (married woman, not working; single; and woman family head), the variance reduces to

$$\mathrm{Var}(\hat{Y}_i) = (X_{ik} - \bar{X}_k)^2 \times \mathrm{Var}(\hat{\beta}_k) + \frac{\sigma^2}{n},$$

where:

X_{ik} is the given income point,

$\bar{X}_k$ is the sample mean of the income,

$\mathrm{Var}(\hat{\beta}_k)$ is the variance of the regression coefficient for income, and

σ^2 and n are as above.

Since σ^2 is not known, the unbiased estimate s^2 (sample variance of the estimate) was used to obtain

$$s^2_{\hat{Y}_i} = (X_{ik} - \bar{X}_k)^2 \, \mathrm{Var}(\hat{\beta}_k) + \frac{s^2}{n}. \tag{9}$$

For the two-income situation (namely, married woman, working), the variance of the estimate at each point was computed using:

$$s^2_{\hat{Y}_i} = (X_{i,k-1} - \bar{X}_{k-1})^2 V(\hat{\beta}_{k-1}) + 2(X_{i,k-1} - \bar{X}_{k-1})(X_{ik} - \bar{X}_k)\,\mathrm{Cov}(\hat{\beta}_{k-1}, \hat{\beta}_k)$$

$$+ (X_{ik} - \bar{X}_k)^2 V(\hat{\beta}_k) + \frac{s^2}{n}, \tag{10}$$

where:

$\bar{X}_{k-1}$, $\bar{X}_k$ are the sample means for the incomes,

$X_{i,k-1}$, X_{ik} are the two income points, and

$Cov(\hat{\beta}_{k-1}, \hat{\beta}_k)$ is the covariance of the two income regression coefficients.

They provide a measure of reliability of the income growth and probability of an income decline projections and thus, a measure of risk. The mathematical definition of risk is the expected loss. In general, then, the risk is equal to the weighted average of all possible outcomes, with the weights equaling the corresponding probabilities of occurrence for each outcome event. A rational banker would want to maximize his expected return for a given risk level, or equivalently, minimize his risk for a given expected return.

One caveat is in order here. The standard errors associated with the tables for black women are higher than those for white women. This is a natural outcome simply because the black women sample is about one-third the size of the white woman sample. Standard errors reflect the variability of the regression model estimates given the Parnes sample data.

4.5 Using the Tables

This section describes how the actuarial tables in Appendix A were generated using the economic autoregression model, and how to read these tables. The set of multivariate regression analyses in Appendix B form the analytical base for the actuarial projections. Three regression coefficients, β_9 (husband's income in 1966), β_{10} (woman's income in 1966), and β_6 (education of twelve or more years) consistently show up as significant predictors at the 95 percent level

of confidence of family income in 1970 (the dependent variable). Accordingly, the tables were generated using separate multivariate regression models stratified by marital status (married woman, not working; married woman, working; single woman; and woman family head), race (white; black), and education (high school graduate; not high school graduate), where 1968 edited Parnes income data were regressed on 1966 income data (two-year projections) and 1970 income data were regressed on 1966 (four-year projections). Further, these regression analyses controlled for age, number of children, presence of a child under six, and other (stable unearned) income in 1966. The final regressions did not include two variables -- job tenure (X_7, X_8) and homeowner/renter (X_{12}) -- which had been tested in the regressions in Appendix B, but generally found not to be significant in explaining either the family income growth or probability of an income decline dependent variable. Hence, these variables were eliminated from the final set of 48 regressions. In some cases, however, women family heads with job tenure of at least two years had a lower probability of an income decline. The coefficients in the final regressions used to generate the actuarial tables are consistent with those in Appendix B.

Each entry in the actuarial tables represents a projection for a family average with respect to the above characteristics. For example, refer to Table A1. For a family earning $8,000 in 1966 and the wife contributing 20 percent of these earnings, the projected family income in 1968 is $8,992. This projection holds for white families, which are average with respect to age, family composition, and other income, and in which the wife does not have a high school education.

Standard errors are given in parentheses under the projected

cell mean. The standard errors ($s_{\hat{Y}_i}$) can be translated into statistical confidence intervals by simply multiplying ($s_{\hat{Y}_i}$) by 1.96 for the 95 percent confidence level. That is, for all married couples earning $8,000 in 1966 and the wife, not a high school graduate, contributing 20 percent of the family income, the true average family income will be within $478 of $8,992 with a probability of .95. This is not a forecast for any individual family; actuarial tables project mean values for large numbers of persons in different actuarial group classes.

Since it is not altogether clear how one gets these projections from the regression analyses, a "typical" calculation will be described. Refer to Table B1, column (2), "wife working." Note that the mean projected family income in 1970 is $12,826, the mean value for husband's income in 1966 is $7,243 with β_9 equal to .950, and the mean value for wife's income in 1966 is $3,281 with β_{10} equal to .661. Since this is an attempt to project income growth at different 1966 family income levels and for different percentage contributions by the wife to 1966 income, one must first remove effects of the variables from the 1970 mean to obtain an across-the-board base value. So, one subtracts $\beta_9 \times \bar{X}_9$ (or .950 x $7,243) plus $\beta_{10} \times \bar{X}_{10}$ (or .661 x $3,281) from $12,826 to yield $3,786. Then, substitute the desired 1966 family income level for projection (say, $6,000) and wife's percentage contribution (say, 30 percent) back into the regression as follows. Husband's assumed 1966 income ($4,200) is multiplied by β_9 (.950) and wife's assumed 1966 income ($1,800) is multiplied by β_{10} (.661) to yield $5,180, which is added to the base increase, $3,786, to give a projected 1970 family income of $8,966. The tables in Appendix A cannot be reproduced from the regressions in Appendix B because, as mentioned earlier, the final regressions stratified on

education in addition to race and marital status, and eliminated two nonsignificant explanatory variables. This procedure was selected as a statistically superior method of projection.

The family income stability tables, Probability of a 5 Percent Decline in Family Income and Probability of a 20 Percent Decline in Family Income, are interpreted in the same manner as the income growth projection tables. The dependent variable, "probability of an income drop," used in the family stability regression is binary. It is assigned a value of 1 if the family's income fell below the 1966 base, and a value of 0 otherwise. The R^2 values are not presented for these regressions in Appendix B since they have an ambiguous statistical meaning for a binary dependent variable.

APPENDIX A

Two-Year and Four-Year Projections on Family Income Growth and Stability for Potential Women Borrowers and Co-Borrowers

Tables A1 through A24 present two- and four-year actuarial projection series on expected family income growth and stability for potential women borrowers and co-borrowers. The tables show projected income in 1968 (1970) and the probabilities of an income decline of 5 percent and 20 percent for one or more years during the two-year (four-year) projection period as a function of a woman's marital status, race, education, family income in 1966, and (if she is married) her percentage contribution to family income in 1966. Each entry in the actuarial tables represents an income growth (or probability of an income decline) projection for a family which is average with respect to age, number of children, presence of a child under six, and other (stable unearned) income in 1966. Section 4.5 of the main text, Using the Tables, describes how the tables were generated using the economic autoregression model and how to read the tables.

Standard errors are given in parentheses under the projected cell means. Standard errors can be translated into statistical confidence levels by simply multiplying them by 1.96 for the 95 percent confidence level. That is, the true average family income growth (or probability of an income decline) will fall within the range defined by plus-or-minus 1.96 times the standard error around the projected mean, with a probability of .95. These are not forecasts, however, for individual families; actuarial tables project mean values for large numbers of persons in different actuarial group classes.

"White" as used in these tables includes all non-Negro minorities such as Mexican Americans, American Indians, and Orientals. Given the race classifications (Negro, white, and other) used in the Parnes sample, it was impossible to separate all minorities from Anglos.

Each actuarial series contains three types of projections as follows:

TABLE A1

Projected Growth in Family Income, 1966-1968

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	$5,352 (203)	$5,423 (366)	$5,370 (356)	$5,319 (357)
$ 6,000	7,172 (145)	7,207 (290)	7,130 (267)	7,052 (273)
$ 8,000	8,991 (158)	8,992 (244)	8,888 (201)	8,785 (221)
$10,000	10,811 (231)	10,777 (248)	10,647 (184)	10,518 (223)
$12,000	12,630 (326)	12,562 (299)	12,406 (228)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	$8,046 (173)	$8,714 (342)	$8,548 (334)	$8,381 (342)
$ 8,000	9,974 (135)	10,367 (269)	10,145 (249)	9,923 (265)
$10,000	11,902 (129)	12,019 (234)	11,742 (194)	11,465 (222)
$12,000	13,830 (159)	13,672 (253)	13,339 (195)	13,006 (232)
$14,000	15,758 (209)	15,325 (316)	14,936 (252)	14,548 (290)

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A2

Projected Growth in Family Income, 1966-1968

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	$5,227 (373)	$4,803 (278)	$4,800 (263)	$4,797 (287)
$ 6,000	6,996 (412)	6,243 (257)	6,238 (210)	6,234 (263)
$ 8,000	8,765 (620)	7,681 (345)	7,676 (276)	7,671 (343)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	$5,516 (395)	$5,050 (495)	$5,088 (496)	$5,127 (511)
$ 6,000	7,679 (334)	7,176 (405)	7,234 (366)	7,291 (368)
$ 8,000	9,841 (484)	9,302 (424)	9,379 (314)	9,455 (270)
$10,000	12,003 (723)	11,428 (541)	11,525 (373)	11,619 (271)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A3

Projected Growth in Family Income, 1966-1968

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	$3,341 (278)	$3,406 (289)
$4,000	$5,352 (203)	5,466 (211)	5,239 (436)
$6,000	7,172 (145)	7,592 (242)	-- --
$8,000	8,991 (158)	9,718 (347)	-- --
Woman is a high school graduate			
$2,000	-- --	$3,341 (278)	$4,238 (293)
$4,000	-- --	5,466 (211)	6,431 (303)
$6,000	$8,046 (173)	7,592 (242)	8,623 (483)
$8,000	9,974 (135)	9,718 (347)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A4

Projected Growth in Family Income, 1966-1968

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	$2,688 (239)	$2,917 (156)
$4,000	$5,227 (373)	4,739 (297)	4,877 (327)
$6,000	6,996 (412)	6,791 (497)	-- --
$8,000	8,765 (620)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	$2,688 (239)	$3,154 (232)
$4,000	$5,516 (395)	4,739 (297)	4,985 (294)
$6,000	7,679 (334)	6,791 (497)	6,816 (476)
$8,000	9,841 (484)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A5

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1968

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.204 (.032)	.227 (.068)	.243 (.066)	.259 (.056)
$ 6,000	.215 (.023)	.237 (.053)	.261 (.049)	.285 (.050)
$ 8,000	.226 (.025)	.246 (.045)	.279 (.037)	.311 (.041)
$10,000	.237 (.036)	.256 (.046)	.296 (.034)	.337 (.041)
$12,000	.248 (.051)	.266 (.055)	.314 (.042)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	.127 (.017)	.123 (.035)	.132 (.035)	.141 (.035)
$ 8,000	.146 (.014)	.142 (.028)	.155 (.026)	.167 (.027)
$10,000	.165 (.013)	.162 (.024)	.178 (.020)	.193 (.023)
$12,000	.184 (.016)	.182 (.026)	.201 (.020)	.219 (.024)
$14,000	.203 (.021)	.202 (.033)	.224 (.026)	.245 (.030)

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A6

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1968

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.323 (.041)	.278 (.053)	.278 (.050)	.278 (.054)
$ 6,000	.341 (.045)	.354 (.049)	.354 (.040)	.355 (.050)
$ 8,000	.358 (.068)	.430 (.065)	.430 (.052)	.432 (.065)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	.320 (.072)	.388 (.072)	.372 (.072)	.357 (.074)
$ 6,000	.323 (.061)	.353 (.059)	.330 (.053)	.307 (.054)
$ 8,000	.325 (.088)	.318 (.062)	.288 (.046)	.257 (.039)
$10,000	.328 (.132)	.283 (.079)	.246 (.054)	.207 (.040)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A7

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1968

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.164 (.037)	.313 (.050)
$4,000	.204 (.032)	.152 (.028)	.377 (.075)
$6,000	.215 (.023)	.141 (.032)	-- --
$8,000	.226 (.025)	.129 (.046)	-- --
Woman is a high school graduate			
$2,000	-- --	.164 (.037)	.139 (.033)
$4,000	-- --	.152 (.028)	.153 (.034)
$6,000	.127 (.017)	.141 (.032)	.167 (.054)
$8,000	.146 (.014)	.129 (.046)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A8

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1968

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.363 (.059)	.309 (.041)
$4,000	.323 (.041)	.376 (.073)	.411 (.087)
$6,000	.341 (.045)	.389 (.123)	-- --
$8,000	.358 (.068)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	.363 (.059)	.237 (.043)
$4,000	.320 (.072)	.376 (.073)	.275 (.055)
$6,000	.323 (.061)	.389 (.123)	.314 (.089)
$8,000	.325 (.088)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A9

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1968

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.129 (.022)	.134 (.051)	.139 (.049)	.144 (.049)
$ 6,000	.107 (.016)	.129 (.040)	.137 (.037)	.144 (.038)
$ 8,000	.086 (.018)	.124 (.034)	.135 (.028)	.144 (.031)
$10,000	.064 (.026)	.119 (.034)	.133 (.025)	.145 (.031)
$12,000	.043 (.036)	.114 (.041)	.130 (.032)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	.059 (.012)	.046 (.026)	.058 (.025)	.070 (.026)
$ 8,000	.065 (.009)	.055 (.020)	.071 (.019)	.086 (.020)
$10,000	.070 (.009)	.064 (.018)	.084 (.015)	.102 (.017)
$12,000	.076 (.011)	.072 (.019)	.096 (.015)	.119 (.018)
$14,000	.081 (.015)	.081 (.024)	.108 (.019)	.135 (.022)

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A10

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1968

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.163 (.033)	.213 (.049)	.238 (.046)	.264 (.051)
$ 6,000	.189 (.036)	.230 (.045)	.268 (.037)	.307 (.046)
$ 8,000	.216 (.054)	.247 (.061)	.299 (.049)	.350 (.061)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	.187 (.057)	.203 (.054)	.196 (.055)	.190 (.056)
$ 6,000	.153 (.048)	.179 (.045)	.169 (.040)	.158 (.040)
$ 8,000	.120 (.069)	.155 (.047)	.141 (.034)	.127 (.030)
$10,000	.087 (.104)	.131 (.059)	.114 (.041)	.096 (.030)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A11

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1968

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.111 (.029)	.254 (.046)
$4,000	.129 (.022)	.097 (.022)	.282 (.070)
$6,000	.107 (.016)	.083 (.026)	-- --
$8,000	.086 (.018)	.069 (.037)	-- --
Woman is a high school graduate			
$2,000	-- --	.111 (.029)	.090 (.027)
$4,000	-- --	.097 (.022)	.085 (.028)
$6,000	.059 (.012)	.083 (.026)	.081 (.044)
$8,000	.065 (.009)	.069 (.037)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A12

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1968

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.260 (.054)	.209 (.037)
$4,000	.163 (.033)	.234 (.068)	.252 (.078)
$6,000	.189 (.036)	.208 (.113)	-- --
$8,000	.216 (.054)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	.260 (.054)	.179 (.038)
$4,000	.187 (.057)	.234 (.068)	.131 (.048)
$6,000	.153 (.048)	.208 (.113)	.215 (.078)
$8,000	.120 (.069)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A13

Projected Growth in Family Income, 1966-1970

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	$6,613 (337)	$6,165 (626)	$6,134 (610)	$6,104 (610)
$ 6,000	8,654 (240)	7,962 (495)	7,917 (457)	7,871 (463)
$ 8,000	10,695 (263)	9,760 (418)	9,700 (343)	9,639 (378)
$10,000	12,737 (384)	11,558 (425)	11,482 (315)	11,406 (382)
$12,000	14,778 (541)	13,356 (512)	13,265 (390)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	$10,023 (260)	$9,516 (536)	$9,298 (525)	$9,080 (537)
$ 8,000	11,960 (203)	11,346 (422)	11,055 (391)	10,764 (417)
$10,000	13,898 (194)	13,176 (367)	12,812 (305)	12,449 (349)
$12,000	15,836 (238)	15,006 (396)	14,569 (307)	14,134 (364)
$14,000	17,773 (314)	16,835 (495)	16,326 (396)	15,819 (455)

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A14

Projected Growth in Family Income, 1966-1970

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	$5,095 (234)	$5,333 (557)	$5,086 (526)	$4,839 (574)
$ 6,000	6,711 (258)	6,979 (515)	6,609 (426)	6,238 (527)
$ 8,000	8,327 (389)	8,626 (691)	8,132 (553)	7,638 (687)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	$6,789 (564)	$6,314 (735)	$6,227 (736)	$6,140 (757)
$ 6,000	8,601 (477)	8,604 (601)	8,473 (543)	8,342 (546)
$ 8,000	10,413 (691)	10,893 (629)	10,719 (465)	10,544 (400)
$10,000	12,225 (1033)	13,183 (803)	12,965 (554)	12,746 (402)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A15

Projected Growth in Family Income, 1966-1970

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	$3,916 (612)	$3,918 (607)
$4,000	$6,613 (337)	7,119 (463)	6,504 (915)
$6,000	8,654 (240)	10,321 (532)	-- --
$8,000	10,695 (263)	13,524 (762)	-- --
Woman is a high school graduate			
$2,000	-- --	$3,916 (612)	$5,853 (412)
$4,000	$8,085 (342)	7,119 (463)	7,597 (426)
$6,000	10,023 (260)	10,321 (532)	9,341 (679)
$8,000	11,960 (203)	13,524 (762)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A16

Projected Growth in Family Income, 1966-1970

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	$3,906 (393)	$2,984 (203)
$4,000	$5,095 (234)	6,034 (489)	4,650 (426)
$6,000	6,711 (258)	8,162 (817)	-- --
$8,000	8,327 (389)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	$3,906 (393)	$3,800 (277)
$4,000	$6,789 (564)	6,034 (489)	5,647 (351)
$6,000	8,601 (477)	8,162 (817)	7,502 (568)
$8,000	10,413 (691)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A17

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1970

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.305 (.036)	.375 (.073)	.396 (.071)	.418 (.071)
$ 6,000	.302 (.025)	.376 (.058)	.409 (.053)	.441 (.055)
$ 8,000	.300 (.028)	.378 (.049)	.421 (.040)	.464 (.044)
$10,000	.297 (.041)	.379 (.050)	.433 (.037)	.487 (.045)
$12,000	.294 (.057)	.381 (.060)	.445 (.046)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	.174 (.020)	.231 (.041)	.241 (.040)	.251 (.041)
$ 8,000	.196 (.015)	.259 (.032)	.273 (.030)	.287 (.032)
$10,000	.219 (.015)	.287 (.028)	.305 (.023)	.322 (.027)
$12,000	.241 (.018)	.316 (.031)	.337 (.024)	.356 (.028)
$14,000	.263 (.024)	.344 (.038)	.369 (.030)	.391 (.035)

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

TABLE A18

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1970

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.418 (.044)	.419 (.055)	.411 (.052)	.402 (.057)
$ 6,000	.448 (.048)	.500 (.051)	.487 (.042)	.475 (.052)
$ 8,000	.478 (.072)	.580 (.069)	.564 (.055)	.547 (.068)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	.339 (.077)	.424 (.085)	.428 (.085)	.431 (.087)
$ 6,000	.422 (.065)	.389 (.069)	.394 (.062)	.399 (.063)
$ 8,000	.506 (.094)	.354 (.072)	.360 (.054)	.367 (.046)
$10,000	.590 (.141)	.319 (.092)	.326 (.064)	.335 (.046)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level was too far from sample mean for a statistically valid projection.

TABLE A19

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1970

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.231 (.042)	.457 (.051)
$4,000	.305 (.036)	.210 (.032)	.635 (.077)
$6,000	.302 (.025)	.190 (.036)	-- --
$8,000	.300 (.028)	.169 (.052)	-- --
Woman is a high school graduate			
$2,000	-- --	.231 (.042)	.191 (.037)
$4,000	-- --	.210 (.032)	.223 (.038)
$6,000	.174 (.020)	.190 (.036)	.254 (.060)
$8,000	.196 (.015)	.169 (.052)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A20

Family Income Stability: Probability of a 5 Percent Decline in Family Income, 1966-1970

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.376 (.059)	.447 (.044)
$4,000	.418 (.044)	.392 (.073)	.619 (.092)
$6,000	.448 (.048)	.408 (.122)	-- --
$8,000	.478 (.072)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	.376 (.059)	.307 (.047)
$4,000	.339 (.077)	.392 (.073)	.366 (.060)
$6,000	.422 (.065)	.408 (.122)	.424 (.097)
$8,000	.506 (.094)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A21

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1970

White, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.202 (.028)	.225 (.065)	.234 (.063)	.242 (.063)
$ 6,000	.168 (.020)	.225 (.051)	.236 (.047)	.251 (.048)
$ 8,000	.133 (.022)	.225 (.043)	.242 (.035)	.260 (.039)
$10,000	.098 (.032)	.225 (.044)	.247 (.032)	.269 (.039)
$12,000	.063 (.045)	.224 (.053)	.251 (.040)	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	-- --	-- --	-- --	-- --
$ 6,000	.104 (.015)	.098 (.034)	.110 (.033)	.123 (.034)
$ 8,000	.111 (.012)	.117 (.027)	.133 (.025)	.149 (.026)
$10,000	.119 (.011)	.136 (.023)	.156 (.019)	.175 (.022)
$12,000	.126 (.014)	.154 (.025)	.179 (.019)	.202 (.023)
$14,000	.134 (.019)	.173 (.031)	.202 (.025)	.228 (.029)

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level was too far from sample mean for a statistically valid projection.

TABLE A22

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1970

Black, Married Women

Total family income in 1966	Woman's contribution to income			
	0	20%	30%	40%
Woman is not a high school graduate				
$ 4,000	.279 (.040)	.351 (.055)	.367 (.052)	.383 (.057)
$ 6,000	.298 (.044)	.377 (.051)	.401 (.042)	.425 (.052)
$ 8,000	.317 (.066)	.404 (.068)	.435 (.055)	.467 (.063)
$10,000	-- --	-- --	-- --	-- --
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --
Woman is a high school graduate				
$ 4,000	.236 (.069)	.302 (.073)	.299 (.073)	.294 (.075)
$ 6,000	.243 (.058)	.276 (.060)	.270 (.054)	.264 (.054)
$ 8,000	.250 (.084)	.249 (.062)	.242 (.046)	.234 (.040)
$10,000	.257 (.126)	.222 (.080)	.214 (.055)	.204 (.040)
$12,000	-- --	-- --	-- --	-- --
$14,000	-- --	-- --	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates. Dashes indicate that family income level was too far from sample mean for a statistically valid projection.

TABLE A23

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966-1970

White, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.152 (.033)	.349 (.052)
$4,000	.202 (.028)	.129 (.025)	.430 (.078)
$6,000	.168 (.020)	.107 (.029)	-- --
$8,000	.133 (.022)	.085 (.041)	-- --
Woman is a high school graduate			
$2,000	-- --	.152 (.033)	.188 (.033)
$4,000	-- --	.129 (.025)	.164 (.034)
$6,000	.104 (.015)	.107 (.029)	.166 (.055)
$8,000	.111 (.012)	.085 (.041)	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

TABLE A24

Family Income Stability: Probability of a 20 Percent Decline in Family Income, 1966–1970

Black, by Marital Status

Total family income in 1966	Married, not working	Single*	Family head
Woman is not a high school graduate			
$2,000	-- --	.207 (.054)	.344 (.043)
$4,000	.279 (.040)	.181 (.067)	.444 (.091)
$6,000	.298 (.044)	.154 (.112)	-- --
$8,000	:317 (.066)	-- --	-- --
Woman is a high school graduate			
$2,000	-- --	.207 (.054)	.243 (.043)
$4,000	.236 (.069)	.181 (.067)	.198 (.055)
$6,000	.243 (.058)	.154 (.112)	.152 (.088)
$8,000	.250 (.084)	-- --	-- --

Note: Standard errors are given in parentheses below mean estimates.
Dashes indicate that family income level is too far from sample mean for a statistically valid projection.

* Education was not a significant factor in explaining projected income growth and stability for single women, so separate estimates were not developed.

APPENDIX B

Regression Models Explaining Four-Year Family Income Growth and Stability for Potential Women Borrowers and Co-Borrowers

Tables B1 through B6 present results of the 1970 income growth, probability of 5 percent income decline, and probability of 20 percent income decline regressions. These regressions form the analytical base for the actuarial tables in Appendix A. The Parnes sample is divided into eight self-contained partitions, defined by marital class/loan applicant category (married women, not working; married women, working; single women; and women family heads) and race (white; black). Regression coefficients which are significant at the 95 percent confidence level are asterisked.

The regressions are grouped by dependent variable and race as follows:

TABLE B1

1970 Family Income Regression: White

$$Y = \sum_{i=1}^{12} \beta_i X_i + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.
Age 35-39	X_1	.328	- .680*	.332	- .018	.356	-1.08	.279	-1.22
Age 40-44	X_2	.301	- .984*	.402	.128	.306	-2.30*	.412	-1.01
One child	X_3	.089	.862	.167	.737	--	--	.275	-2.57
Two or more children	X_4	.860	.616	.688	.524	--	--	.721	-2.37
Presence of child under 6	X_5	.510	- .815*	.223	.164	--	--	.260	.877
Education - 12 or more years	X_6	.702	1.28*	.692	1.21*	.713	- .746	.574	1.99*
Job tenure - 1 to 2 years	X_7	--	--	.147	- .541	.050	-2.17	.113	-1.57
Job tenure - more than 2 years	X_8	--	--	.565	.164	.718	-1.59	.549	-1.07
Husband's income, 1966	X_9	8.530	.975*	7.243	.950*	--	--	--	--
Woman's income, 1966	X_{10}	.221	.582*	3.281	.661*	4.400	1.73*	2.481	1.05*
Other income, 1966	X_{11}	.096	1.39*	.070	1.38*	.265	.678	.506	.222
Home ownership	X_{12}	.786	.127	.805	1.19*	.238	-1.56	.397	.604
Family income '70	Y	12.076	--	12.826	--	7.760	--	5.429	--
R^2		.358		.273		.423		.262	
α		2.82		1.31		3.18		5.03	
Sample size - N		1138		600		160		204	

* Significant at 95 percent level.

TABLE B2

Probability of a 5 Percent Decline in Family Income, 1966-1970: White

$$Y = \sum_{i=1}^{12} \beta_i X_i + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.
Age 35-39	X_1	.328	.049*	.332	-.049	.356	-.012	.279	.063
Age 40-44	X_2	.301	.120*	.402	-.053	.306	-.043	.412	.041
One child	X_3	.089	-.040	.167	-.159*	--	--	.275	.799*
Two or more children	X_4	.860	-.024	.688	-.104*	--	--	.721	.816*
Presence of child under 6	X_5	.510	.026	.223	-.018	--	--	.260	-.022
Education - 12 or more years	X_6	.702	-.099*	.692	-.147*	.713	-.021	.574	-.266*
Job tenure - 1 to 2 years	X_7	--	--	.147	.017	.050	-.083	.113	-.033
Job tenure - more than 2 years	X_8	--	--	.565	-.020	.718	-.056	.549	-.117*
Husband's income, 1966	X_9	8.530	.009*	7.243	.006	--	--	--	--
Woman's income, 1966	X_{10}	.221	.064*	3.281	.031*	4.400	-.009	2.481	.044*
Other income, 1966	X_{11}	.096	.050*	.070	.020	.265	.109*	.506	.159*
Home ownership	X_{12}	.786	-.016	.805	-.050	.238	.036	.397	.029
Prob. of a 5% decline in fam. inc.	Y	.238	--	.345	--	.206	--	.309	--
R^2		--		--		--		--	
α		.185		.488		.283		-.508	
Sample size - N		1138		600		160		204	

* Significant at 95 percent level.

TABLE B3

Probability of a 20 Percent Decline in Family Income, 1966-1970: White

$$Y = \sum_{i=1}^{12} \beta_i X_i + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.
Age 35-39	X_1	.328	.017	.332	-.039	.356	-.027	.279	.015
Age 40-44	X_2	.301	.049*	.402	-.020	.306	.006	.412	.008
One child	X_3	.089	.023	.167	-.083	--	--	.275	.672
Two or more children	X_4	.860	.016	.688	-.009	--	--	.721	.707*
Presence of child under 6	X_5	.510	.009	.223	.007	--	--	.260	-.028
Education - 12 or more years	X_6	.702	-.035	.692	-.081*	.713	-.011	.574	-.179*
Job tenure - 1 to 2 years	X_7	--	--	.147	.027	.050	-.005	.113	.018
Job tenure - more than 2 years	X_8	--	--	.565	-.019	.718	-.061	.549	-.169*
Husband's income, 1966	X_9	8.530	.0002	7.243	.005	--	--	--	--
Woman's income, 1966	X_{10}	.221	.055*	3.281	.023*	4.400	-.009	2.481	.018
Other income, 1966	X_{11}	.096	.057*	.070	.036	.265	.112*	.506	.133*
Home ownership	X_{12}	.786	-.010	.805	-.155*	.238	.042	.397	.047
Prob. of a 20% decline in fam. inc.	Y	.128	--	.193	--	.125	--	.240	--
R^2		--		--		--		--	
α		.101		.306		.184		-.392	
Sample size - N		1138		600		160		204	

* Significant at 95 percent level.

TABLE B4

1970 Family Income Regression: Black

$$Y = \sum_{i=1}^{12} \beta_i X_i + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.
Age 35-39	X_1	.366	- .698	.335	.371	.155	.441	.331	.671*
Age 40-44	X_2	.317	- .339	.346	.232	.563	.154	.334	.065
One child	X_3	.089	1.18	.179	1.92*	--	--	.198	1.19
Two or more children	X_4	.817	1.06	.677	1.40	--	--	.785	.759
Presence of child under 6	X_5	.574	.093	.342	- .199	--	--	.386	- .032
Education - 12 or more years	X_6	.307	1.42*	.456	2.11*	.437	.286	.321	.594*
Job tenure - 1 to 2 years	X_7	--	--	.106	- .255	.014	- .791	.102	- .987*
Job tenure - more than 2 years	X_8	--	--	.612	.047	.634	- .557	.566	- .857*
Husband's income, 1966	X_9	4.939	.833*	4.679	1.03*	--	--	--	--
Woman's income, 1966	X_{10}	.309	.584*	2.659	.845*	2.509	1.11*	1.411	.914*
Other income, 1966	X_{11}	.073	1.21*	.040	-2.71*	.123	- .785	.320	.574*
Home ownership	X_{12}	.535	.267	.555	- .969	.183	-1.18	.208	.606*
Family income '70	Y	6.420	--	8.747	--	4.447	--	2.722	--
R^2		.414		.401		.381		.409	
α		.795		-.061		2.06		.443	
Sample size - N		202		263		71		293	

* Significant at 95 percent level.

TABLE B5

Probability of a 5 Percent Decline in Family Income, 1966-1970: Black

$$Y = \sum_{I=1}^{12} \beta_I X_I + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_I Reg. Coeff.	Mean	β_I Reg. Coeff.	Mean	β_I Reg. Coeff.	Mean	β_I Reg. Coeff.
Age 35-39	X_1	.366	.111	.335	-.040	.155	.106	.331	-.056
Age 40-44	X_2	.317	.075	.346	.035	.563	-.179	.334	-.043
One child	X_3	.089	-.090	.179	-.047	--	--	.198	-.354
Two or more children	X_4	.817	.126	.677	-.170*	--	--	.785	-.300
Presence of child under 6	X_5	.574	.036	.342	-.003	--	--	.386	.066
Education - 12 or more years	X_6	.307	-.035	.456	-.178*	.437	.053	.321	-.122*
Job tenure - 1 to 2 years	X_7	--	--	.106	.050	.014	-.165	.102	.120
Job tenure - more than 2 years	X_8	--	--	.612	-.035	.634	.082	.566	-.037
Husband's income, 1966	X_9	4.939	.025*	4.679	.018	--	--	--	--
Woman's income, 1966	X_{10}	.309	.037	2.659	-.002	2.509	.005	1.411	.060*
Other income, 1966	X_{11}	.073	.245*	.040	.167	.123	.371*	.320	.169*
Home ownership	X_{12}	.535	-.072	.555	.027	.183	.017	.208	-.085
Prob. of a 5% decline in fam. inc.	Y	.421	--	.422	--	.380	--	.345	--
R^2		--		--		--		--	
α		.345		.545		.331		.584	
Sample size - N		202		263		71		293	

* Significant at 95 percent level.

TABLE B6

Probability of a 20 Percent Decline in Family Income, 1966-1970: Black

$$Y = \sum_{i=1}^{12} \beta_i X_i + \alpha$$

Variable		Married women, not working		Married women, working		Single women		Women family heads	
		Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.	Mean	β_i Reg. Coeff.
Age 35-39	X_1	.366	.128*	.335	-.027	.155	-.100	.331	-.025
Age 40-44	X_2	.317	.058*	.346	-.009	.563	-.118	.334	-.009
One child	X_3	.089	.154	.179	-.093	--	--	.198	-.162
Two or more children	X_4	.817	.097	.677	-.164*	--	--	.785	-.144
Presence of child under 6	X_5	.574	-.048	.342	-.046	--	--	.386	.051
Education - 12 or more years	X_6	.307	-.049	.456	-.218*	.437	-.137	.321	-.073
Job tenure - 1 to 2 years	X_7	--	--	.106	.102	.014	-.169	.102	.126
Job tenure - more than 2 years	X_8	--	--	.612	-.077	.634	.153	.566	-.044
Husband's income, 1966	X_9	4.939	.008	4.679	.002	--	--	--	--
Woman's income, 1966	X_{10}	.309	.040	2.659	.000	2.509	-.018	1.411	.013
Other income, 1966	X_{11}	.073	.047	.040	.258*	.123	.315*	.320	.113*
Home ownership	X_{12}	.535	-.006	.555	.023	.183	-.079	.208	-.075
Prob. of a 20% decline in fam. inc.	Y	.272	--	.316	--	.268	--	.273	--
R^2		--		--		--		--	
α		.106		.576		.335		.406	
Sample size - N		202		263		71		293	

* Significant at 95 percent level.

APPENDIX C

Numerical Results of Chow-Type Tests of Significance on Validity of Separating the Parnes Sample by Race

Tables C1 through C4 present numerical results of Chow-type tests of significance on validity of separating the Parnes sample by race. Stratification by race was analytically tested, partly because previous studies on the labor-force participation of women show marked differentials by race and partly because the black women were oversampled in the Parnes survey relative to white women. Black and white women could not be combined into a single regression model without using weighting procedures. Chow-type tests of significance were performed to statistically establish whether the sample should be subdivided by race. This procedure involved running three sets of eight regressions on income growth and income stability by marital class: one set for whites alone, a second set for blacks alone, and a third set for the combined (total) sample. Then, using the parameters from these regressions, an F-statistic was computed as follows:

$$F_{k,(B+W-2k)} = \frac{N}{D}$$

where:

$$N = \frac{S - (S_B + S_W)}{k}$$

$$D = \frac{S_B + S_W}{B + W - 2k},$$

and where:

W = number of white women in the sample,

B = number of black women in the sample,

S_W = residual sum of squares error in the regression for whites only,

S_B = residual sum of squares error in the regression for blacks only,

S = residual sum of squares error in the combined regression, and

k = number of parameters in the regression.

$\frac{N}{D}$ has an F-distribution with k and (B+W-2k) degrees of freedom.

The tables display the parameter values (S_W, S_B, W, B, etc.) and the results of these tests for each loan applicant category and dependent variable. The hypothesis being tested was: Is the regression plane for the white sample the same as the regression plane for the black sample? The last column of these tables indicates that acceptance or rejection of the hypothesis. In most cases, the hypothesis is rejected -- implying that the two regression planes are different, and thus providing statistical substantiation for the stratification of the sample on the race variable.

Test results are presented in tabular form by loan applicant category as follows:

TABLE C1

Chow-Type Tests of Significance on Validity of Separating the Parnes' Sample by Race

LOAN APPLICANT CATEGORY: Married Women, Not Working (Industry Standard)

Definition of Regression Analyses	Residual sum of squares - white S_W	Residual sum of squares - black S_B	Residual sum of squares - combined S	No. parameters - k	No. whites - w	No. blacks - b	$N = \frac{S-(S_B+S_W)}{k}$	$D = \frac{S_B+S_W}{b+w-2k}$	$\frac{N}{D} = F_{k,b+w-2k}$	Significance
Family income in 1970 on family income in 1966 and in 1968	19464.60	780.00	20903.5	12	1076	178	54.908	16.459	3.336	Yes-99%
Family income in 1970 on family income in 1966	23873.90	1075.59	25247.0	9	1076	178	33.057	20.186	1.638	No
Probability of a 5 percent income decline, 1966-1970, on family income in 1966 and in 1968	130.23	31.235	167.467	12	1076	178	.500	.1313	3.808	Yes-99%
Probability of a 5 percent income decline, 1966-1970, on family income in 1966	166.76	37.513	208.61	9	1076	178	.4819	.1653	2.915	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966 and in 1968	73.607	22.305	99.585	12	1076	178	.3061	.0780	3.924	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966	84.505	25.410	112.344	9	1076	178	.2699	.0889	3.060	Yes-99%

TABLE C2

Chow-Type Tests of Significance on Validity of Separating the Parnes' Sample by Race

LOAN APPLICANT CATEGORY: Married Women, Working (Two-Income Family)

Definition of Regression Analyses	Residual sum of squares - white S_W	Residual sum of squares - black S_B	Residual sum of squares - combined S	No. parameters - k	No. whites - w	No. blacks - b	$N = \frac{S - (S_B + S_W)}{k}$	$D = \frac{S_B + S_W}{b+w-2k}$	$\frac{N}{D} = F_{k, b+w-2k}$	Significance
Family income in 1970 on family income in 1966 and in 1968	13992.7	4118.92	18417.3	14	555	219	21.834	24.278	.899	No
Family income in 1970 on family income in 1966	14464.7	4253.16	18992.8	11	555	219	24.995	24.891	1.004	No
Probability of a 5 percent income decline, 1966-1970, on family income in 1966 and in 1968	91.255	31.640	126.11	14	555	219	.2296	.1647	1.394	No
Probability of a 5 percent income decline, 1966-1970, on family income in 1966	111.579	44.606	158.22	11	555	219	.185	.2077	.8907	No
Probability of a 20 percent income decline, 1966-1970, on family income in 1966 and in 1968	56.629	25.900	85.815	14	555	219	.2347	.1106	2.122	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966	65.051	31.589	99.452	11	555	219	.2556	.1285	1.989	Yes-95%

TABLE C3

Chow-Type Tests of Significance on Validity of Separating the Parnes' Sample by Race

LOAN APPLICANT CATEGORY: Single Women

Definition of Regression Analyses	Residual sum of squares - white S_W	Residual sum of squares - black S_B	Residual sum of squares - combined S	No. parameters - k	No. whites - w	No. blacks - b	$N = \frac{S - (S_B + S_W)}{k}$	$D = \frac{S_B + S_W}{b+w-2k}$	$\frac{N}{D} = F_{k, b+w-2k}$	Significance
Family income in 1970 on family income in 1966 and in 1968	2953.38	572.80	3813.91	9	128	59	31.97	20.865	1.532	No
Family income in 1970 on family income in 1966	3462.18	603.51	4302.26	7	128	59	33.796	23.501	1.438	No
Probability of a 5 percent income decline, 1966-1970, on family income in 1966 and in 1968	14.391	6.168	22.966	9	128	59	.2674	.1217	2.197	Yes-95%
Probability of a 5 percent income decline, 1966-1970, on family income in 1966	20.340	11.038	34.040	7	128	59	.3809	.1814	2.099	Yes-95%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966 and in 1968	9.165	5.749	17.164	9	128	59	.25	.0882	2.834	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966	12.413	8.796	23.306	7	128	59	.2996	.1226	2.444	Yes-95%

TABLE C4

Chow-Type Tests of Significance on Validity of Separating the Parnes' Sample by Race

LOAN APPLICANT CATEGORY: Women Family Heads

Definition of Regression Analyses	Residual sum of squares - white S_W	Residual sum of squares - black S_B	Residual sum of squares - combined S	No. parameters - k	No. whites - w	No. blacks - b	$N = \frac{S-(S_B+S_W)}{k}$	$D = \frac{S_B+S_W}{b+w-2k}$	$\frac{N}{D} = F_{k,b+w-2k}$	Significance
Family income in 1970 on family income in 1966 and in 1968	2097.55	317.675	2538.62	11	105	185	11.218	9.012	1.245	No
Family income in 1970 on family income in 1966	2415.16	633.59	3221.89	9	105	185	19.288	11.209	1.716	No
Probability of a 5 percent income decline, 1966-1970, on family income in 1966 and in 1968	10.107	29.055	43.029	11	105	185	.3515	.1461	2.406	Yes-99%
Probability of a 5 percent income decline, 1966-1970, on family income in 1966	14.753	40.039	59.434	9	105	185	.5158	.2014	2.561	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966 and in 1968	9.685	27.767	42.072	11	105	185	.42	.1397	3.006	Yes-99%
Probability of a 20 percent income decline, 1966-1970, on family income in 1966	13.032	37.599	55.529	9	105	185	.5442	.1751	3.108	Yes-99%

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