Income Distribution and Family Structure

by

Christine Siegwarth Meyer

B.S., Engineering
United States Military Academy, 1988

Submitted to the Department of Economics in Parital Fulfillment
of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY
in Economics

at the
Massachusetts Institute of Technology
June 1995

Signature of Author_____
Department of Economics
May 24, 1995

Certified by_____
Olivier Blanchard
Professor of Economics
Thesis Supervisor

Certified by_____
Thomas Piketty
Assistant Professor of Economics
Thesis Supervisor

Accepted by_____
Richard Eckaus
Professor of Economics
Chairman, Departmental Committee on Graduate Studies

Income Distribution and Family Structure

by Christine Siegwarth Meyer

Submitted to the Department of Economics in May 1995,
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Economics

Abstract

This thesis examines the effect of changes in family structure on the distribution of family income in the United States from 1960 to the present. In particular, the impacts of the increased divorce rate and the rising age of marriage are analyzed.

The first chapter develops a model of the divorce and remarriage process in which information about individual characteristics is revealed only after agents marry for the first time. Additionally, information about income is observable by the potential remarriage partner, but information about non-pecuniary traits is not. Income is then a signal about the non-pecuniary characteristics which will lead to higher correlation of spousal incomes in remarriage than in first marriage, and, under certain assumptions, leads to a positive effect of income on the probability of remarriage. Together, these effects lead to a higher family income inequality in a world with rather than without divorce.

These predictions are then tested in the second chapter using a Cox proportional hazard model for remarriage and a Heckman two-step procedure for predicting inequality in a world without divorce. Results show that 3.9% of the inequality in family income can be attributed to divorce. Furthermore, the presence of divorce can conservatively explain 8.9% of the increase in family income inequality from 1980 to 1990.

The third chapter examines the effect of the rising age at marriage on the correlation of spousal incomes. The correlation of husband and wife incomes are found to be positively affected by the age at marriage. This increase is due to a positive effect of the age at marriage on the correlation of interspousal hours worked and the interspousal correlation of wage residuals. Since these two components are not observed at early ages, these results suggest that those who marry at later ages match better because of increased information.

Thesis Advisor: Dr. Olivier Blanchard
Title: Professor of Economics

Thesis Advisor: Dr. Thomas Piketty
Title: Assistant Professor of Economics

ACKNOWLEDGEMENTS

As I come to another milestone in my life and reach another goal that, at times, seemed very distant, it is very clear to me that I am indebted to the guidance and support of certain people who have helped me both professionally and personally.

In thanking people who shaped my life, I naturally begin with my parents. They instilled in me, at an early age, the importance of life-long learning. Dinner table conversation always revolved around the question: What did you learn today? It is in that spirit that I plan to continue long after my formal education has ended.

In this latest phase of learning, I wish to single out several professors who, through their advice and encouragement, taught me, not only about economics, but also about good teaching. At the risk of accidentally omitting some who were important contributors to my education, I wish to thank Thomas Piketty, Olivier Blanchard, Steve Pischke, Frank Levy, and John Gruber for their advice and guidance.

By the same token, much of my learning here at MIT come through conversations with fellow students. I am especially indebted to Lucia Nixon, not only for her conceptual advice and editing, but also for her friendship during some of the most anxious and trying times. Thanks also go to Alex Pfaff and Kip King for great advice and support.

Gratitude goes also to the National Science Foundation, whose financial support made this course of study possible.

Most importantly, I would like to thank my husband, Richard Meyer. During the entire four years of the program, he did more than his fair share, both in the mundane household tasks as well as in his role as my confidant and greatest supporter. It is no overstatement to say that this degree would not have been possible without his love and assistance.

TABLE OF CONTENTS

INTRODUCTION

The rise in the inequality of male wages has been the subject of numerous studies (Katz and Murphy, 1992 and Karoly, 1993). In this thesis, I concentrate on the increase in family income inequality which cannot be explained by the widening of the male wage distribution with particular focus on the effect of changes in family structure on the increase in family income inequality in the United States.

The three chapters of this thesis examine three possible effects of the changes in family structure on family income inequality. The first and second chapters, "Remarriage and Income Distribution" and "Remarriage and Income Distribution: An Empirical Analysis" develop a theoretical model of the divorce and remarriage process and test its implications. The first effect on income inequality of family structure changes is an increase in the age at marriage caused by an increase in the percent of marriages which are remarriages. This increases the correlation of spousal incomes, and thus, family income inequality. This introduction suggests that, for the time period 1978-1986, this accounts for only a small percentage of the increase in family income inequality. The second effect of family structure changes analyzed in chapters 1 and 2 is an increase in family income inequality caused by an increase in the number of divorced persons. This group is not only more unequal than its married counterpart because divorced agents lose the insurance effect of marriage, but also because individuals in the extremes of the income distribution have lower probabilities of remarriage than average income individuals. Chapter 3, "Age at Marriage and the Correlation of Husband and Wife Incomes", examines a third channel through which changes in family structure affect family income inequality. A rising age at marriage, which increases the correlation of spousal incomes through increases in the correlation of spousal hours worked and through increases in the spousal correlation of unobservable components of the wage, accounts for approximately 17% of the increase in family income inequality in the United States form 1978 to 1986.

As an introduction to this thesis, an estimate of the overall impact of changes in family structure on family income inequality is made. This estimate is only a rough

approximation, and should not be regarded as precise. Rather, it should be seen as a first attempt to develop a broad picture of the causes of the increase in family income inequality and the relative importance of each of the contributing factors. Three sources are used to generate this approximation: (1) data from the Panel Study of Income Dynamics (PSID) on heads of households and their wives in 1978 and 1986, (2) tables generated by Cancian, Danziger and Gottschalk (1993) disaggregating family income inequality, and (3) similar tables generated by Blackburn and Bloom (1994).[1] The three sources cover roughly the same time period but do not necessarily examine the same individuals, nor do they report the results in exactly the same way. Combining the information from all three sources gives a clear picture of the impact of changes in family structure on family income inequality.

The estimate of the impact of changes in family structure on the increase in family income inequality will be done in three steps. First, the overall increase in family income inequality will be decomposed into changes in the inequality of male and female wages, changes in the share of total family income accounted for by each source (male earnings and female earnings), and changes in the correlation of spousal income. Second, the correlation of spousal incomes is further analyzed to determine what percent can be accounted for by increases in the labor force participation of women. Finally, that portion of the increase in the correlation of spousal income that is not due to increased labor force participation of women is examined further to assess how much is due to the rising age at marriage and how much is due to an increase in the percent of all marriages which are remarriages.

The remainder of this analysis is organized in the following way. Section I describes the three data sources used. Section II analyzes the overall change in family income inequality and performs the basic decomposition. Section III investigates the role of changing female labor force participation on the correlation of spousal incomes and on family income inequality. Section IV explores the role of the rising age at marriage on the correlation of spousal incomes and Section V integrates the results from the previous sections into a

[1]Henceforth, every time I refer to Blackburn and Bloom or Cancian, Danziger and Gottschalk, I am citing these particular papers.

complete breakdown of the increase in family income inequality and provides conclusions.

I. Data

Before discussing the results of this analysis, the relevant differences between the three sources of data will be addressed. The PSID data employed here is the same data used in "Age at Marriage and the Correlation of Husband and Wife Earnings" (Meyer, 1995). As discussed at length in that paper, this sample is representative of all marriages in 1986, but the 1978 cohort does not include those people married in 1978, but divorced and remarried since 1986. A limitation of this data set is that family income is computed as the sum of husband and wife earnings and does not include income from sources other than wage income.[2] However, the key advantage of this data is that it is available to me at the individual level, and thus the necessary statistics can be computed directly.

The tables generated by Cancian, Danziger and Gottschalk use total family income data from the Current Population Survey. The analysis in this introduction uses their findings generated by the 1978 and 1988 surveys. All figures in the original paper are reported separately for blacks and whites. Because the PSID sample is comprised mainly of whites (77%), I report the findings for the white population from this article. The tables created by Blackburn and Bloom also use total family income from Current Population Survey data. However, in the Blackburn and Bloom study, the years are 1980 and 1988. Families of all races are grouped together for this analysis.

II. Increase in Family Income Inequality and Basic Decomposition

One consistent trend across all studies is that the inequality of family income has

---

[2]Since top-coding procedures changed in 1983, in order to find equivalent income measures in 1978 and 1986, the early top-coding procedures were applied to the 1986 data. Top-coding does result in an understatement of the income inequality. This correction also leads to an underestimation of the increase in inequality from 1978 to 1986 since the share of income held by those making over $99999 (the top-coding value) has increased over this time. However, this correction results in levels of family income inequality and increases in inequality that are substantially more similar to the other two sources.

increased over time. Table 1 shows various measures of inequality from the three sources described above. In each of the samples, there is evidence that inequality has risen during the 1980s, the mean percentage increase in inequality using the various measures reported being around 12%.

Table 1 - Family Income Inequality

Sample[3]	Inequality Measure[4]	1978 / 1980[5]	1986 / 1988	Percent Change
Meyer	Squared Coefficient of Variation (CV^2)	.384	.409	6.6
Meyer	Gini Coefficient	.316	.342	8.2
CD&G	CV^2	.321	.377	17.4
CD&G	Gini Coefficient	.301	.324	7.6
B&B	CV^2	.304	.349	14.8
B&B	Mean Logarithmic Deviation	.198	.224	13.1
B&B	Theil's Entropy Measure	.145	.167	15.2

In order to determine how much of this rise in family income inequality can be attributed to changes in family structure, other explanations will first be eliminated. The first step taken will determine how much of the change can be explained by changes in the inequality of male and female wages, respectively. This is done by decomposing the change in the squared coefficient of variation of total family income into four components: the percent associated with changes in the CV^2 for husbands' incomes, the CV^2 for wives' incomes, the correlation of husband and wife income, and the income shares of husband and

[3]B&B represents Blackburn and Bloom. CD&G stands for Cancian, Danziger and Gottschalk.

[4]CV^2 is defined as the variance divided by the square of the mean.

[5]Each heading shows two dates because the various studies do not cover exactly the same time periods.

wife.[6]

There are two ways to do this calculation. One way is to separately change one element (e.g. inequality of husband's earnings, inequality of wife earnings, correlation of husband and wife incomes or income shares) at a time in the 1978 CV^2 equation and look at the impact. In other words, the husbands' CV^2 for 1988 is first entered in the 1978 equation, keeping all other factors at the 1978 level, and the impact is noted. Then, the wives' CV^2 for 1988 is entered in the 1978 equation, keeping the all other components at the 1978 level, and its impact is recorded. This will be called the individual method. The second way is to first change, for instance, husband's CV^2 to its 1988 level and record the impact on inequality. Then, keeping husband's CV^2 at the 1988 level, the wife's CV^2 is changed to its 1988 level and the impact is recorded. In other words, at each stage, one additional variable is changed, and this will therefore be referred to as the sequential method. The advantage of this second method is that the sum of the changes associated with each source sum to 100%. The disadvantage is that the order in which the changes are made affects the result.[7] In each of these two methods, the percent of the total change attributed to a particular source is the change in inequality had only the value of that one source changed, divided by the total change in inequality. Therefore, it need not be between 0% and 100%. Blackburn and Bloom use the individual method, while Cancian, Danziger and Gottschalk use the sequential method. The PSID data was analyzed using both methods to compare the results to both other studies and to examine whether the methods used substantially affects the predictions.

---

[6]The squared coefficient of variation of family income can be decomposed into the various sources of family income as follows: $CV^2=\sum_{j=1}^{J} s_j^2 CV_j^2 + 2\sum_{j=1}^{J}\sum_{k=j+1}^{J} s_j s_k CV_j CV_k \rho_{jk}$ where s_j is the share of family income attributed to the jth source, CV_j^2 is the squared coefficient of variation of the jth source, and ρ_{jk} is the correlation coefficient between the jth and kth sources of income.

[7]Cancian, Danziger and Gottschalk (1993) present a table in which the sequential method is used and the changes are made in several different orders. The basic results do not change.

Table 2 - Decomposition of Squared Coefficient of Variation of Total Family Income

Study	Percent of Change Associated with Changes in:				
	Husband	Wife	Changes in Shares	Correlation	Total Change of CV^2
Meyer (sequential)	62%	-32%	-38%	109%	.025
Meyer (individual)	62%	-32%	-14%	98%	.025
CD&G (sequential)[8]	109%	-53%	_	44%	.057
B&B (individual)[9]	62%	-20%	31%	44%	.045

Table 2 shows that there is considerable variation in the decomposition between the three samples. However, the first two rows, based on PSID data, suggest that this is probably not due to the method of calculating the percentages. Three clear patterns appear. First, the inequality of male earnings has been a prime contributing factor in the rise in family income inequality. Since all three calculations which look at the effect of husband's earnings separately from the share effect (ie. Meyer (sequential), Meyer (individual), and B&B(individual)) conclude that 62% of the rise in inequality can be attributed to the increased inequality in men's earnings, this figure will be used throughout the remainder of this analysis. Second, Table 2 suggests that changes in the inequality of wife earnings, by themselves, substantially lowered family income inequality during this time.[10] For the remainder of the calculations in this paper, it will be assumed that the change in the distribution of women's earnings would have led to a decrease in the inequality of family

[8]Cancian, Danziger and Gottschalk decompose the change in the squared coefficient of variation of family income into the percent associated with income sources other than wives earnings, the percent associated with the level and share changes in wife's earnings, and the percent associated with the correlation of wives earnings and other sources. Thus the "share" component is divided up between the remaining three categories, and the percentages reported, with the exception of the amount attributed to the correlation, (ie. the 109% and the 53%) are not comparable with the other samples.

[9]These results use 1979 as the base year. When 1987 is the base year, the corresponding percentages are 58% (husband), -38% (wife), 7% (changes in shares), and 51% (correlation).

[10]Note that the higher absolute values for both of these effects found by Cancian, Danziger and Gottschalk occur because, in their study, these numbers represent, not only the impact of the wives' CV^2, for instance, but also the impact of the wife's share change.

income and that the magnitude is 32% of the actual increase observed which is the figure found using the PSID data. Third, the increased correlation of spousal incomes appears to have had a major impact on the increased inequality in family incomes. The difference between the Meyer findings and the other two papers with respect to the percent associated with increased correlation (column 4) is not due to larger increases in correlations in the PSID sample.[11] On the other hand, it is due to the smaller increase in inequality seen in the PSID sample, which is due, at least in part, to the previously noted top-coding issue. Therefore, for the remainder of this analysis, it is assumed that 44% of the increase in inequality can be attributed to increases in correlation.

With respect to the impact of share changes, the difference between the results based on the PSID sample and the Blackburn and Bloom results is most likely a result of the differences in income measures used. The PSID calculations only include husband and wife earnings in family income, while Blackburn and Bloom also include interest and dividend income in total family income. In their paper, Blackburn and Bloom conclude that most of the effect of share changes they find is due to the rise of the interest and dividend share. For consistency with the previous assumptions on the effect of each source on the increase in family income inequality, and to ensure that the sum of the effects is equal to 100%, it will be assumed that the share changes observed accounted for 26%[12] of the increase in family income inequality.

III. Role of Increased Female Labor Force Participation Rates

When considering the causes of the increase in family income inequality, one issue which is often examined is the impact of increased female labor force participation on family income inequality over this time. In 1978, 47.5% of married women held jobs outside the

---

[11]As shown in Table 3, the increase in the correlation of spousal incomes in the PSID is quite comparable to the CPS data (B&B and CD&G).

[12]This is 100% - 62% (effect of increased inequality of male earnings) + 32% (effect of decreased inequality of female earnings) - 44% (effect of increased correlation of spousal earnings).

home. By 1988, this number had increased to 56.6%. (U.S. Bureau of the Census, 1992) This could explain changes family income inequality through three channels. First, the squared coefficient of variation for women could fall as fewer women had zero earnings. In the PSID sample, for example, the CV^2 for all wives was 1.500 while for wives in the dual-earner group, the CV^2 was 0.6379.[13] The number of dual-earner couples increased from 63.6% in 1978 to 69.5% in 1986 in the PSID data. This effect alone accounts for 112% of the total decrease in the CV^2 of women's earnings over the period.[14]

The second potential effect of increased labor force participation of women on family income inequality is an increase in the share of family income accounted for by women's earnings.[15] Blackburn and Bloom estimate that approximately half of the increase in the share of family income attributed to the wife is linked to higher female labor force participation; the rest is caused by the increase in the relative earnings of women vs. men.

Lastly, this participation increase could lead to an increase in the correlation of male and female earnings.[16] Using the PSID data, the impact of the rising share of all families who are dual earners, accounts for 18% of the increase in the correlation of spousal incomes.[17] The increase in the interspousal income correlation within the dual-earner group accounts for 86% of the increase in correlation of husband and wife incomes for all couples.

---

[13]Cancian, Danziger and Gottschalk also find that the squared coefficient of variation is considerably lower for couples in which the wife works as opposed to all couples (0.702 and 1.347 respectively in 1988).

[14]At the same time, the CV^2 of women's earnings was positively affected by the increase in the CV^2 of women's earnings among the dual-earner group.

[15]In 1978, women contributed, on average 20.8% of the family's income; by 1988, that number was 25.8%.

[16]The largest increases in labor force participation rates during the 1978-1988 time period occurred for those women married to high income husbands (Cancian, et al, 1993).

[17]This calculation is done using the individual method.

Combining the effects of increased female labor force participation on the three channel with the assumptions about the effects of each source on the total family income inequality results in a rough estimate which suggests that the increased labor force participation of women alone would have decreased income inequality. The magnitude of the decrease would have been approximately 15% of the actual increase observed.[18] The impact of the first channel (decreased CV^2 of female earnings) outweighs the impact of the other two channels (wives' increased share of family income and increased correlation).

Table 3 - Correlation of Spousal Earnings

	1978/1980	1986/1988	Increase
Meyer: All couples	.0291	.1169	.088
Meyer: Dual-Earners	.1605	.2063	.046
CD&G: All Couples	-.012	.091	.103
CD&G: Dual Earners	.085	.155	.070
B&B: All Couples	.01	.11	.10
B&B: Dual-Earners	.10	.18	.08

IV. Role of Rising Age at Marriage

The final step in determining how much of this total increase in correlations for the dual-earners is due to changes in family structure is to estimate the effect of the increased age at marriage on the correlation of incomes for this group.[19] The results of the regression used to generate this estimate is found in Table 4.[20]

---

[18]This conclusion that women's labor force participation increases led to small decrease in family income inequality, despite the effect on increased correlation, is consistent with the analysis of Cancian, Danziger and Gottschalk (1993).

[19]The dual-earner group is examined here because age at marriage had insignificant effects on the correlation of participation probabilities (Meyer, 1995).

[20]It is analogous to the analysis in "Age at Marriage and the Correlation of Husband and Wife Earnings" (Meyer, 1995) with the exception that here the age at marriage variable is not entered as a set of dummies, rather as the mean age at marriage of the cell and its squared value.

Table 4 - CORRELATION OF SPOUSAL EARNINGS - DUAL-EARNERS

The dependent variable is the correlation of the earnings of the husband and wife within the cell.

Standard errors are in parentheses.

Constant	-.9109	(.8486)
Age at Marriage - Husband	.0415	(.0139)
Age at Marriage Squared - Husband	-.0004	(.0002)
Current Year = 1972-1975	.0746	(.1680)
Current Year = 1976-1979	.1316	(.2279)
Current Year = 1980-1983	.1577	(.2224)
Current Year = 1984-1986	.2046	(.2513)
Current Age = 20-29	-.2108	(.1317)
Current Age = 30-39	-.2206	(.1444)
Current Age = 40-49	-.2629	(.1403)
Current Age = 50-59	-.1786	(.1349)
Current Age = 60-64	-.1095	(.1477)
Mean Predicted Length of Marriage	.0257	(.0240)
Number of Blacks in Cell	-.2711	(.2205)
Mean Number of Children	-.0412	(.0385)
R-squared	.3419	
Number of observations	127	

The coefficients presented in Table 4 indicate that an increase in the age at marriage of the husband from 25.09 to 25.99 (the increase seen in the PSID sample from 1978 to 1986) would have resulted in an increase of 0.0175 in the correlation of husband and wife earnings. This is 38% of the total increase in spousal income correlation experienced by the dual-earner group (0.46, as reported in Table 3). Because both the mean age and the correlation of incomes is higher for remarried couples in this sample, the 0.0175 increase in the correlation of interspousal earnings for all dual-earner marriages attributed to the rising age at marriage is the sum of two factors. First, within each group of marriages (first

marriages and remarriages), the correlation of incomes has increased because the mean age within each group has risen. Second, the correlation of incomes for all marriages has also increased because the share of all marriages which are remarriages has increased. Disaggregating the spousal income correlation for all dual-earner couples suggests that changes within the first marriage group account for 65% of the increase in the correlation of spousal incomes, that changes within the remarried group account for 28% of the increase, and that the increase in the share of marriages which are remarriages account for 1% of the increase in the correlation of spousal incomes within the dual-earner group. Table 5 presents the correlation of spousal incomes in 1978 and 1986 for three groups: all couples, couples in which the head of the household is in his first marriage, and couples in which the head of the household is remarried. The last column displays the percent of the within group increase due to rising age at marriage within the group.

Table 5 - Correlation of Spousal Income and Mean Ages at Marriage for Dual-Earners

	1978	1988	% Accounted for by Rising Age at Marriage within the Group
Correlation of Incomes (All Dual-Earners)	.1605	.2063	38%
Mean Age at Marriage (All Dual-Earners)	25.09	25.99	
Correlation of Incomes (First Marriages)	.1381	.1528	24%
Mean Age at Marriage (First Marriages)	23.23	23.42	
Correlation of Incomes (Remarriages)	.3013	.3389	49%
Mean Age at Marriage (Remarriages)	33.50	34.19	

V. Integrating Previous Results

Using all of the above estimates, the total increase in family income inequality can be disaggregated in the following way, as illustrated in Figure 1. First, the increase in the inequality of male wages, the decrease in the inequality of female wages, and the change in the share of family income attributed to each of these two sources, together, account for 56% of the overall increase in family income inequality. The remaining 44% is accounted for by the increased correlation of male and female earnings. Based on computations made above, the increase in labor force participation among women accounts for approximately 18% of the increased correlation of husband and wife earnings, while the increased age at marriage accounts for around 38%. The remaining 47% of the increase in the correlation of male and female earnings not explained by the participation or age effects and will be referred to as the residual time effect. The results in "Age at Marriage and the Correlation of Husband and Wife Earnings" (Meyer, 1995) suggest that this residual time effect may be a result of the increased correlation of education levels between spouses and the increased correlation of occupations as occupations and advanced schooling become less gender segregated.

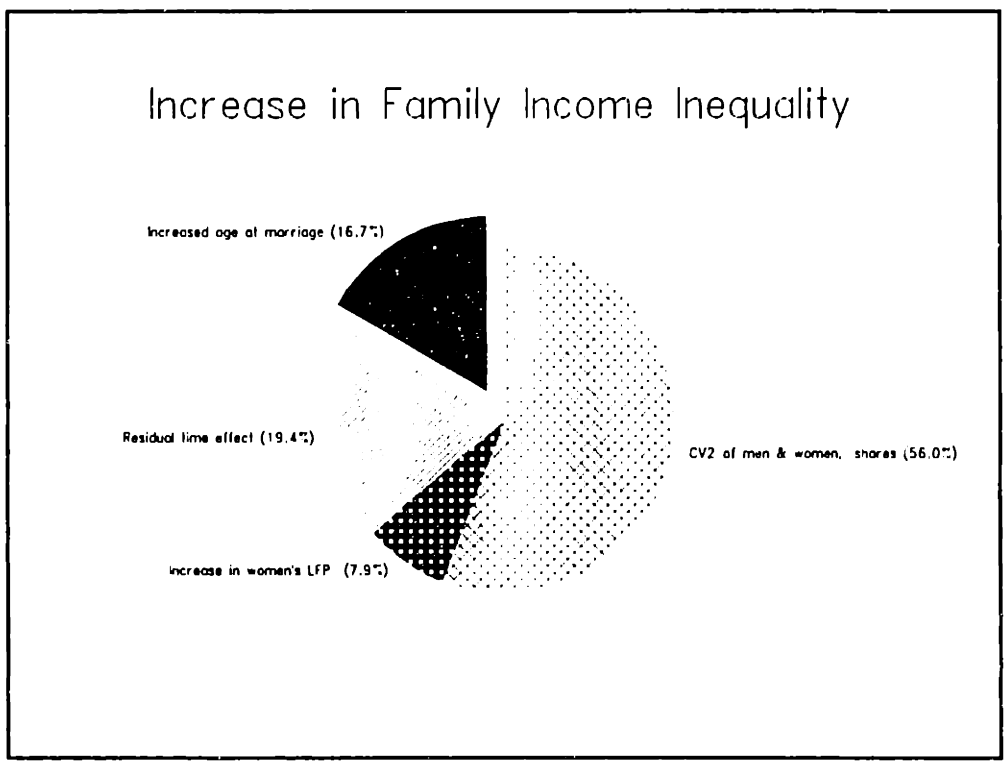

Figure 1

BIBLIOGRAPHY

Blackburn, McKinley L. and David E. Bloom. "Changes in the Structure of Family Income Inequality in the United States and Other Industrial Nations during the 1980s", NBER working paper No. 4754, May 1994.

Cancian, Maria, Sheldon Danziger, and Peter Gottschalk. "Working Wives and Family Income Inequality Among Married Couples", in Danziger and Gottschalk (eds.), Uneven Tides, New York: Russell Sage Foundation, 1993.

Karoly, Lynn A. "The Trend in Inequality among Families, Individuals, and Workers in the United States: A Twenty Year Perspective", in Danziger and Gottschalk (eds.) Uneven Tides, New York: Russell Sage Foundation, 1993.

Katz, Lawrence F. and Kevin M. Murphy. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors", Quarterly Journal of Economics 107 (1992): 35-78.

Meyer, Christine S. "Age at Marriage and the Correlation of Husband and Wife Earnings.", mimeo. (included as chapter 3 of this thesis)

U.S. Bureau of the Census, Statistical Abstract of the United States: 1992 (112th ed). Washington DC: 1992.

CHAPTER 1 - REMARRIAGE AND FAMILY INCOME INEQUALITY

Family income inequality has risen in the United States from 1960 to the present (see figure 1). Labor economists have worked to explain the distribution of wages. The distribution of family income depends not only on the distributions of male and female earnings, but also on how families form. Of the 15% increase of inequality from 1979 - 1987 among married couples, only 42% can be explained by male and female wage changes (Blackburn and Bloom, 1994). The remaining 58% is a result of an increase in the correlation of husbands and wives incomes and a change in the share of family income attributed to each source. Furthermore, analysis of the Census Public-Use Microsamples indicate that the variance of log income for divorced and separated persons has risen 19% during this time, while single individuals, on the whole, experienced a 14% increase. Clearly, wage distributions do not explain the whole story behind the increase in family income inequality.

The largest contributing factor to the increase in correlation of husband and wife incomes has been the increase in women's labor force participation during the 1980's. In 1973, only 54% of wives worked outside the home, and these women were most likely to be married to relatively low income husbands. By 1988, 72.5% of women participated in the labor force, and the largest increase in participation was seen among women married to relatively high income men.[21] However, this increased participation cannot fully explain the rising correlation of interspousal earnings. While the correlation of earnings for all white couples increased by 0.135 from 1968 to 1988, the correlation for dual-earner couples rose 0.054, 40% of rise seen by all families.

One of the most fundamental changes in the formation of the American family since 1960 has been the increase in the rate of marital separation and remarriage, due in most part

[21]Shaw (1992) finds that the elasticity of women's labor supply with respect to their husbands' incomes has fallen significantly from 1968-1981, which also widens the distribution of family income. One cause of this trend may be that women who face a higher probability of divorcing may increase their labor force participation in order to raise their human and firm-specific capital.

to the dramatic increase in the divorce rate (see figure 2). This paper focuses on the implications for income inequality of increased divorce and remarriage.[22] It looks at two related questions.

First, who remarries and who remains divorced? In other words, does the probability of remarriage change with income? Second, do people remarry in patterns that mirror those of the original marriage process, or does the remarriage market differ from the first marriage market?

If more information about income is known before remarriage than before first marriages, then correlation of incomes may be higher in second than in first marriages. Furthermore, if the expected value of all the non-pecuniary inputs to marriage of a potential spouse varies conditional on income, and if income is observable before remarriage but non-pecuniary inputs are not, then very low or very high income agents may remarry with lower probability than agents with average incomes. Lastly, this leads to higher inequality of divorced persons than of all single individuals, because, after these remarriages occur, only the extremes of the income distribution will be left in the divorced pool.

I assume that the divorce rate does not depend on the level of inequality. It is possible that increased inequality through increased female labor force participation has led to higher divorce rates. However, Johnson and Skinner (1986) show in a simultaneous equations model of the probability of divorce and female labor supply that this is not the case. Other channels besides the female labor market through which increased inequality would lead to increased divorce rate will be left unmodelled.

One effect of the increased divorce rate on inequality which I will not model in this paper is the effect of the increased divorce rate on a woman's investment in human capital through schooling or on-the-job training and hence on her wage. This change in the wage

[22]Another channel through which the increased divorce rate would positively influence income inequality is that divorced agents lose the insurance effect of marriage.

distribution of women might also affect the male wage distribution depending on the elasticity of total labor income in the economy to increased participation. In order to highlight the effects of divorce on inequality through the remarriage market, I will ignore this effect.

The story I have in mind proceeds as follows. I am looking at potential spouses in the remarriage market. I would like to know about my future spouse's non-pecuniary inputs to marriage, for instance his ability to compromise or how quarrelsome he is, but I can only observe his income by looking at his standard of living. Some men that I observe have high incomes and some have low incomes after divorce.[23] Because these men are divorced, I know that either they or their ex-wives had a lower expected value of marriage than of divorce. The following equation must hold for at least one spouse:

$$Utility_{marriage} < Utility_{divorce} \quad (1)$$

or, equivalently

$$PV_{divorce} - PV_{marriage} > Nonpec_{marriage} - Nonpec_{divorce} \quad (2)$$

where PV stands for the present value of income staying in the marriage or divorcing and Nonpec stands for nonpecuniary benefits received in each state. Assuming that the utility of marriage depends on monetary factors as well as the ability to compromise, and that both spouses contribute to this non-monetary part of the marriage, I can form expectations on his non pecuniary inputs to marriage.

This model will lead to two separate results. The first result is that, if there is more information available at later ages, and if individuals prefer high income to low income spouses, agents can match better with respect to income in their second than in their first marriages. Thus, the correlation of spousal incomes increases with age at marriage and is higher in second than in first marriages.

The second effect involves who remarries and who stays single after divorce. There

[23]I will assume the divorce law is unilateral, ie. that either party can choose to divorce and that income must be divided equally within marriage.

are four separate sets of assumptions which lead to different conclusions. Outcomes will be analyzed under the four sets of assumptions in order to better isolate the forces that lead to a lower probability of remarriage for poor agents. First, if agents consider their expected income in the event of remarriage when making a divorce decision, multiple equilibria will arise because these expectations on future family income will drive the divorce decision. Even with a particular wage distribution, divorce and remarriage patterns will vary based on the expectation of remarriage outcomes.

In the second, third, and fourth set of assumptions, agents compare only their utility in marriage to their expected utility in the single, divorced state. If family income in the first marriage is a known function of the partners' individual incomes (most generally, the sum), symmetric equilibria will arise in which either the wealthiest or the poorest extremes of the population do not remarry, depending on the distributions of income and non-pecuniary marital inputs.

The intuition for this conclusion is as follows. Imagine again that I am searching for a potential remarriage partner, and I am forming expectations on a man's non-pecuniary inputs to marriage based on his observable income. If the man's income after divorce is high, and I believe that he left the marriage, then divorce is not such a bad situation for him financially. Maybe his marriage was only mediocre in terms of non-pecuniary happiness. However, if his income is low after divorce, and he still chose to leave, the marriage must have been unbearable. Because I cannot separate his and his ex-wife's abilities to compromise, in expected terms, low income implies low total non-pecuniary rewards from marriage and hence I expect him to be a quarrelsome person.

On the other hand, I could look at this from the ex-wife's point of view. If the man had high income in marriage, then the ex-wife would have had to give up a lot in terms of pecuniary benefits in order to divorce him, if she made the decision to divorce. Therefore, they must have had a terrible marriage. This implies that high income implies a bad marriage partner. Therefore, depending on who I thought initiated the divorce, it is possible for high or low income individuals to have low expected non-pecuniary inputs to marriage.

Symmetric equilibria must result because I cannot deduce whether he or she initiated the divorce.

A third set of possible assumptions is that agents again do not consider expected remarriage outcomes when making a divorce decision, and that family income in marriage is never related to an individual's income in the divorced state. In this case, symmetric equilibria with poor or rich agents being left out of the remarriage market will also arise.

Recall that in forming expectations on a prospective spouse's non-pecuniary inputs, I had two possible thoughts. The first thought is that if his income in divorce is low and he initiated the divorce decision, he must have had very low non-pecuniary rewards from marriage. The second possible thought is that if his income in divorce is high and his ex-wife initiated the divorce decision, she must have had very low non-pecuniary rewards from marriage. The important link in the situation where the ex-wife initiated the divorce is that the husband's high income in divorce indicates that his total family income in marriage was also high. If family marital income is not a function of the single incomes of the spouses, the link between the husband's income and the ex-wife's decision equation is broken. The only expectation that can be formed is that high income individuals have higher expected compatibility.

Even though the only rational expectation for the effect of income on non-pecuniary inputs is that high income agents have high non-pecuniary inputs, it is still possible for wealthy agents to be left out of the remarriage process when income in marriage is not related to income when single. The reason for this is that the rich give up more in terms of expected pecuniary benefits when entering a marriage. Therefore, if the expected non-pecuniary benefits, although higher for a rich than for a poor remarrier, do not offset the income loss, the rich may not remarry.

The fourth set of assumptions leads to an asymmetric outcome in the remarriage market. Again, agents deciding whether or not to divorce compare expected utilities in the married and the single (not remarried) states. If family income in the first marriage is not

related to the individual's income in the divorced state, but the family income in remarriage is, equilibria for all possible distributions of income and non-pecuniary marital inputs have the property that the poor are "lemons" in the remarriage market. The intuition is that the expectation of non-monetary benefits is a positive function of income because there is no link between divorced income and income in the first marriage. However, when choosing whether or not to remarry, high income agents do not forfeit their income, as in the previous case. Therefore, only poor agents are the "lemons".

The series of events described above predicts that the increased information available in remarriage leads to increased correlation of incomes in second marriages[24]. In addition, if married income is a function of income while divorced, symmetric equilibria with either poor or rich remarrying with lower probability must result. If, however, married and divorced incomes are not related, the expectation compatibility must rise with income, potentially leaving poor agents out of the remarriage market.

Both of these effects lead to an increase in inequality when divorce increases. Higher correlation of incomes means that marital income magnifies the wage inequality of men. Furthermore, if wealthier women find it easier to remarry, either by marrying sooner or by having a higher probability of getting remarried, this would leave the poorest women (those that would benefit most from the additional, higher income of a spouse) potentially out of the remarriage process.

The paper is organized as follows. Section I sets up the model in which information about wages and non-pecuniary benefits of marriage are revealed slowly and discusses the assumptions. Section II solves the model in two distinct cases. First, the model is solved assuming that non-pecuniary inputs to marriage are identical and positive across individuals. This is referred to as the baseline case. Second, heterogeneity of non-pecuniary inputs to marriage are added. Section III summarizes the theoretical analysis and develops a set of

[24]Actually, the model predicts perfect correlation of incomes in remarriage. However, when the potential spouse gets an imperfect signal of income by observing the future spouse, the correlation will not be perfect.

testable outcomes. Section IV concludes.

I. ASSUMPTIONS

There are two distinct parts of the economy: men and women. Each is a continuum of size 1. Any matches that are formed must be of one man and one woman. Each person has a potential income, w, and is described by a scalar, e which encompasses all inputs to marital specific capital.

w, which is the income when the person is single, is exogenous and constant for each individual. The distribution is identical for the two genders. w may take on one of two values: w_H or w_L where $w_H > w_L > 0$. The economy-wide proportion of people of type w_H is q. W_{self} is ones own income, w* is the income of the spouse in the first marriage and w' is the income of the spouse in remarriage.

When a person marries, two extreme assumptions can be made about the income the family receives. On one hand, total family income can be a function of the individual's single income, most generally, the sum of the two partners' incomes. This represents the case of the married couple where both partners work, and represents the experience of men who work both when married and when single. This will be referred to as the additive income case, although the only necessary condition is that income in marriage is a function of single income for the individual.

On the other hand, family income may be some other value, not a function of individual income before marriage. This will be called the random income case. As a simplification, I will assume that marital income is M, which is constant for all couples regardless of the incomes of the partners when single. The purpose of this assumption is for marital income to be independent of single income. A more realistic assumption would be random marital income; however, a constant M only serves to simplify the analysis without loss of generality. This most clearly represents the experience of women who don't work outside the home while married or those who receive substantial alimony, child support, or

AFDC payments when unmarried. Their contribution to family income is not a function of the income they received when divorced. It will be assumed that family income is divided equally between the two partners, with no bribes possible. This assumption will later be relaxed.

e, which is the input by a person into marital specific capital may take on one of two values: e_H or e_L. This is an exogenous variable for each person. The economy-wide proportion of people of type e_H is p. The following conditions will be imposed on e_H and e_L: $e_H > 0$ and $e_L < 0$.

The one-period utility function is:

$$U_t = c_t + d * f(e, e^*_t) \tag{3}$$

where c is consumption, e is your own marital specific capital, and e* is that of your spouse (if you have one). f(e,e*) is the production function for marital specific capital. There is only one consumption good available with price = 1; therefore c = income. d is the relative weighting between non-pecuniary and pecuniary factors which will be set to 1 without loss of generality. Let f(e,e*) = e + e* when married and 0 when single. Because the model has three periods, the lifetime utility is:

$$U = \sum_{t=1}^{3} b^{t-1} * U_t \tag{4}$$

In the first period, the model assumes no information is known about w or e, either by the agent or his prospective spouse. At the beginning of the period, people randomly match and marry if it is optimal. Agents marry if the expected lifetime utility of marrying is higher than the expected lifetime utility of remaining single or the expected lifetime utility of remaining single for two periods and then marrying after income is revealed. I will assume that no one has any children.

In the second period, all information about the agent and the spouse is revealed to the couple. The couple decides whether to stay together or divorce. I will assume that the

divorce law is unilateral, ie. that either party can choose to dissolve the marriage.[25] I will also discuss the implication of mutual agreement laws.

In the third period, the divorced or previously unmarried people choose whether or not to remarry. These agents can observe the income of the potential mate through observation of the consumption level, but can not observe the marital-specific capital. The matching process in the third period follows the Gale-Shapely algorithm (Gale and Shapely, 1962). In the Gale-Shapely algorithm, each agent ranks his preferences for remarriage (w_H, w_L, or don't remarry). Each woman, for instance, then proposes to her preferred man. Each man who receives more than one proposal rejects all but his favorite among those who have proposed. In the second stage, the rejected women propose to their second choices. Again, each man with more than one proposal, including the one he has as yet not rejected, chooses his favorite and rejects the rest. After two rounds, the remarriage process is over.[26]

The assumptions about the information structure reflect the limited information available to individuals when they first marry. Most participants are very young. Many have lived away from their families for only a few years. They don't know their own earning potential or their value as a marriage partner. It is only after agents have been married that they discover their own inputs to marital specific capital. Furthermore, it is only with age that agents accumulate human capital and hence learn of their earning potential. This follows the spirit of Bergstrom and Bagnoli (1993) in which increased information is obtained with age. The assumption that divorce is the result of uncertainty about certain traits at the time of the marriage and increased information during marriage follows the work of Becker, Landes and Michael (1977). The ability to observe income in the third period reflects the courtship which occurs before remarriage. Potential spouses can

---

[25]This follows the spirit of Lam (1988) in which there are some public goods within marriage which are non-excludable.

[26] This algorithm always results in a stable set of matches. In other words, there are no two agents a and b, married to c and d respectively, where a prefers d to c and d prefers a to b.

deduce the level of income through observation of the person's standard of living. However, all agents trying to remarry would lie when asked about their quality as a marriage partner.

II. SOLVING THE MODEL

A. Baseline Case: $w_H > w_L > 0$ and $e_H = e_L = e > 0$

The baseline case, in which $w_H > w_L > 0$, and $e_H = e_L = e > 0$ illustrates only the increased information available in the remarriage market because of the higher age of the participants and does not include any signalling issues. I will set $b = 1$. Both the additive and random income cases will be addressed, and all family income is equally divided. Backward induction will be used to analyze this model; therefore, agents' actions in the third period will first be examined.

Lemma 1: The number of divorced w_H men equals the number of divorced w_H women at the beginning of period three. The number of divorced w_L men equals the number of divorced w_L women at the beginning of period three.

Proof: Because there is a continuum of women and men, women and men are assumed to have identical distributions on w and e, and w and e are independent, random matching in the first period will result in identical distributions of spouses for each gender. Therefore, when couples divorce in the second period, an identical number of men and women of each type will divorce.

Lemma 2: If all agents have the same preferences over (w_H, w_L, single) in the third period and are not indifferent between any two of the choices, the Gale-Shapely algorithm will result in perfect assortative matching among those who match. If all agents prefer either level of income to remaining single, all divorced agents will remarry.

Proof: Suppose all agents have the following preferences: $w_H \succ w_L \succ single$. Suppose men are the ones who propose. Following the Gale-Shapely algorithm, all men will propose to a woman of type w_H. The w_H women will accept proposals from the w_H men and reject those from the w_L men. The w_L men then propose to their next preferred woman, one of type w_L. These woman accept the proposals, and all

agents match. Suppose all agents have these new preferences: $w_H \succ single \succ w_L$. All men will propose to a w_H woman. The w_H women will accept proposals from the w_H men and reject those from the w_L men. The w_L men then following their second choice of action which is to stay single. Therefore, w_L agents will not remarry.

Proposition 1: In the additive income case, the only equilibria will be those in which perfect assortative matching occurs in remarriage, and all divorced agents remarry.[27]

Proof: With additive income, all agents prefer w_H to w_L agents in remarriage when $(\frac{w_H+w_{self}}{2})+2e > (\frac{w_L+w_{self}}{2})+2e$ or equivalently, when $w_H > w_L$. Agents prefer remarrying someone of their income type to remaining single if $e>0$, which is assumed to be true. Therefore, the preference ordering for each agent is $w_H \succ w_L \succ single$. Under Lemmas 1 and 2, the agents will have perfect correlations of income in remarriage, and all divorced agents will remarry.

Agents remarry with perfect correlations of income because this information is now known to them, and they are not indifferent between levels of income. Next, period two will be analyzed to see how this affects divorce.

Proposition 2: In the additive income case, divorce increases with inequality and decreases with the average level of marital specific capital.

Proof: (w_H,w_L) couples divorce if $w0-w1>2e$ which becomes more likely as inequality (w_H-w_L) increases and e decreases.

Corollary 1: In the additive income case, given the third period outcome, agents

[27]Note that in the random income case, no one will remarry in the third period. Agents divorce if $w > M + 2e$. This inequality is also the condition for agents preferring to stay single once divorced. Because M and e are identical for each agent, individuals who divorce will not remarry.

whose incomes are less correlated in the first marriage are more likely to divorce.[28]

Proof: Divorce occurs when $(w_{self}+w*)+4e < 2w_{self}+2e$ holds for one member of the couple. This equation may be true for the wealthy mate in the (w_H,w_L) pair but will not be true for any other agent. Therefore, the only couple with a positive probability of divorce is the (w_H,w_L) pair, ie. the one with the lowest correlation of incomes.

Increased information in the remarriage market leads to the conclusions that the probability of divorce falls with the correlation of incomes, increases with inequality and decreases with the average level of e. In the first period, the number of marriages is positively related to the level of marital specific capital, e, of each agent.

Lemma 3: There exists a threshold level of E(e), $\bar{e}$ such that, if $e>\bar{e}$, everybody marries and if $e<\bar{e}$, nobody marries in the first period.

Proof: No information is known in period 1, so agents marry in the additive income case if

$$\max\ [\ \sum_{t=1}^{3} b^{t-1}(E(\frac{w_{self}+w*}{2}+e+e*))\ \ ,\ \ (1+b)(E(w_{self}))+b^2(E(\frac{w_{self}+\dot{w}}{2}+e+\dot{e})\ ]$$

$$> \sum_{t=1}^{3} b^{t-1}(E(w_{self}))$$

or equivalently if $E(e)>0$, when $b>0$. This condition is identical for every agent.

---

[28] If income need not be divided equally within the marriage, and all bribes are feasible, no matter whether the divorce law is unilateral or mutual consent, no one will ever divorce. Since e is always positive and no income is forfeited by staying married, there is no incentive to give up one period of marital happiness. Additionally, if mutual agreement was required for divorce and bribes were infeasible or sufficiently costly, no one would divorce. Since non-pecuniary benefits are always positive, the low income spouse in the (w_H,w_L) pair would not agree to divorce.

Similarly, in the random income case, all agents marry if $E(e) > \frac{E(w) - M}{2}$. Again, this condition is identical for every agent.

B. Signalling Case: $w_H > w_L > 0$ and $e_H > 0 > e_L$

When agents are heterogeneous with respect to e, there will be uncertainty about marital specific capital of the potential spouse. Recall that p is the economy-wide probability of being of type e_H. Now the variables of interest are p_H and p_L where

$$p_H = Prob(e_H | w_H) \quad , \quad p_L = Prob(e_H | w_L)$$

P_{self} equals p_H if the agent is type w_H and p_L if the agent is type w_L.

1. Third Period

Using backward induction, the analysis of the equilibria in the signalling case will begin in the third period. Both the additive and random income cases will be analyzed. Income will be divided equally in marriage and bribes are not feasible.[29]

<u>Proposition 3:</u> Except in knife-edged cases of random matching, agents will remarry with perfect correlation of incomes in the third period, if they choose to remarry.

Proof: In the additive income case, agents prefer w_H to w_L agents in remarriage if $\frac{w_H + w_{self}}{2} + p_H e_H + (1 - p_H) e_L > \frac{w_L + w_{self}}{2} + p_L e_H + (1 - p_L) e_L$, or, in other words,

[29]In the case of bribes, in all cases, rich and poor may have a lower probability of remarriage, and the number of equilibria will, in general, be less than in the no bribes case because the condition of divorce considers the sum of both partners' utilities in the married and the divorced states.

$(e_H - e_L)(p_H - p_L) = -(\frac{w_H - w_L}{2})$, and prefer w_L to w_H if $(e_H - e_L)(p_H - p_L) < (\frac{w_H - w_L}{2})$. In the random income case, agents prefer w_H to w_L agents in remarriage if $p_H e_H + (1-p_H)e_L > p_L e_H + (1-p_L)e_L$, ie. $p_H > p_L$, and prefer w_L to w_H agents if $p_L > p_H$. These conditions are identical for all agents. By Lemmas 1 and 2, perfect assortative matching occurs if one of the four above equations hold. Random matching only occurs if the above equations are equalities, a knife-edged case.

Lemma 4: In the additive income case, Prob(remarriage) is an increasing function of e_{self}. When $p_H > p_L$, Prob(remarriage) is an increasing function of w_{self}. When $p_L > p_H$, Prob(remarriage) is a decreasing function of w_{self}.

Proof: Agents prefer remarrying an agent of their income level to not remarrying if

$$E(e \mid w_{self}) + e_{self} > 0 \tag{5}$$

The left-hand side is increasing in e_{self} always and in w_{self} if $p_H > p_L$. It is decreasing in w_{self} if $p_L > p_H$.

Lemma 5: In the random income case, Prob(remarriage) is an increasing function of e_{self} and, when $p_L > p_H$, a decreasing function of w_{self}. When $p_H > p_L$, the effect of w_{self} on Prob(remarriage) is ambiguous.

Proof: Agents prefer remarrying an agent of their income level to not remarrying if

$$M > w_{self} - E(e \mid w_{self}) - e_{self}. \tag{6}$$

When $p_H > p_L$, an increase in w_{self} increases both the first and second terms on the right-hand side. The total effect is ambiguous.

This occurs because the high income divorced agent has to give up more in terms of income in remarrying than does the poor agent. If this income difference is not offset by a larger expectation of marital specific capital, the high income agent is less likely to marry,

even if $p_H > p_L$.

The important difference in third period outcomes between the two assumptions is that in the additive income case, poor agents will have a lower probability of remarriage if $p_H > p_L$. That may not be the case if income in remarriage is not a function of the income of the partners when single.

2. Second Period

The next step in isolating equilibria is looking at the divorce decision. Given that incomes are perfectly correlated in remarriage, in the unilateral divorce, no bribes case, couples divorce if

$$(1+b)\left[\frac{(w+w*)}{2}+(e+e*)\right] < w+b[\max(w+e+E(\acute{e}|w) \quad , \quad w)] \tag{5}$$

is true for at least one marital partner. Three different factors influence the divorce decision: elements of the current marriage, income while single, and remarriage possibilities. The relative effects of the factors depends on b, the discount rate. Two extreme values for b, zero and one, will be examined.

First, the case of b=0 will be examined. Under this assumption, agents are myopic and look only at the trade-off between remaining married and being in the divorced state.

Proposition 4: When income is either always additive or always random, and b=0, the probability of remarriage may increase of decrease with income, and all equilibria are unique. When income is random in the first two periods and additive in the third period, the probability of remarriage can only increase with income.

Proof: Appendix 1 outlines the conditions necessary for each equilibrium.

In the additive income case, since marital income is a function of single income, p_H may be greater or less than p_L. High or low income agents may be seen as better marital partners. Therefore, by Lemma 4, high or low income agents may be left out of the remarriage market.

In the random income case, because marital income is not a function of single income, w will only give information about the divorce decision of the agent one observes, and not the decision of the former spouse. Therefore, p_H is always greater than p_L. However, as Lemma 5 shows, the effect of w_{self} on the probability of remarriage is ambiguous; either high or low income agents may be left out of the remarriage process.

The mixed case, in which random income holds in the first marriage, but additive income holds in the second marriage, is the only instance in which wealthy agents cannot have a lower remarriage rate than do poor agents, if the numbers of both types of agents are the same. This occurs because the single income of the agent does not give any information about the former spouse's divorce decision, and wealthy agents do not forfeit their single income when remarrying. The mixed case represents the woman who worked in the home during the first marriage, but, after her exposure to the job market while divorced, chose to work outside the home during any subsequent marriages. This also represents a woman who receives significant child support, something she wouldn't get if she stayed married to the father, but something she might still get if remarried. As before, marital income is equally split between the spouses, and bribes are infeasible.

Corollary 2: As the divorce rate increases, the fraction of divorced agents who remarry also increases.

Proof: (e_L,e_L) couples will always divorce since

$(1+b)(w_{self}+2e_L) < w_{self}+b(\max[w_{self}+e_L+\dot{e} \quad , \quad w_{self}])$. When only (e_L,e_L) couples divorce, no one remarries since $p_H=p_L=0<\frac{2e_L}{e_L-e_H}$. In the random income case, when everyone divorces, everyone remarries in the third period.

Corollary 3: In the additive income case, the divorce rate increases with inequality.

Proof: When $w_H - w_L < 4(e_H+e_L)$, the divorce rate is $(1-p)^2$.

When $4(e_H+e_L) < w_H - w_L < 4e_H$, the divorce rate is $(1-p)^2+4pq(1-p)(1-q)$.

When $w_H - w_L > 4e_H$, the divorce rate is at its highest possible level, $(1-p)^2+4pq(1-p)(1-q)+2p^2q(1-q)$.

Next, the case of b=1 will be examined. In general, the equilibria will not be unique. One example in which a given set of parameter values may result in more than one equilibrium is discussed below.

Assumption: $3e_H - e_L > \dfrac{2-p-3pq}{(1-pq)(1-p-2pq)}$, $p(1-q) < 1$

The above assumption gives conditions under which a w_He_H agent would choose to divorce a w_Le_L agent only when $p_H > p_L$. In other words, the w_He_H would give up non-pecuniary benefits in period two in exchange for a high income spouse in period three only if this resulted in a sufficiently large probability of getting an e_H spouse in remarriage. Assumption 1 also guarantees that a w_Le_H agent would choose to divorce a w_Le_L agent only when $p_L > p_H$. P_L would have to be sufficiently large to induce the w_Le_H to give up marital benefits for one period in return for a high expected benefit in period three.

Proposition 5: Under assumption 1, when b=1, the equilibria are not unique. There are two possible symmetric equilibria; one in which Prob(remarriage$|w_H$) > Prob(remarriage$|w_L$) and one in which the reverse is true.

Proof: As outlined in Appendix 1, assumption 1 ensures that couples 2,4,7,9 divorce when $p_H > p_L$ and that couples 2,4,9,10 divorce when $p_L > p_H$. If couples 2,4,7,9 divorce, w_Le_L agents never remarry. If couples 2,4,9,10 divorce, w_He_L agents never remarry.

In fact, there are additional parameter values for which the equilibria not only lack uniqueness, but for which either rich or poor agents may be left out of the remarriage

process. This is because of the added effect of the expected remarriage utility in the divorce decision. If everyone believes that poor agents will be better remarriage partners and that matching in remarriage will be perfectly assortative, this will give a larger incentive to poor agents to divorce. Whereas when p_L was low, only poor e_L might divorce, a high p_L would induce $w_L e_H$ agents to divorce. At the same time, high income agents will have a lower incentive to divorce. Under various parameter values, this effect will be large enough so that third period expectations will determine who divorces in period two.

3. First Period

As in the baseline case, all agents will marry in the first period if no information is known about w or e and e is above the necessary threshold level.

The following chart shows what equilibria are possible for which parameter values, and the relative probabilities of remarriage based on income.

	Family Income		
	(w_H+w_L) always	M always	M, then (w_H+w_L)
$p_H > p_L$ b=0	unique equilibria, $prob(rem\|w_H) > prob(rem\|w_L)$	unique equilibria, $prob(rem\|w_H) \gtrless prob(rem\|w_L)$	unique equilibria, $prob(rem\|w_H) > prob(rem\|w_L)$
$p_L > p_H$ b=0	unique equilibria, $prob(rem\|w_H) < prob(rem\|w_L)$	no equilibria	no equilibria
b=1	equilibria not unique, $prob(rem\|w_H) \gtrless prob(rem\|w_L)$		

III. Summary of Theoretical Analysis

To summarize, the following are four of the implications of the model which are related to the link between divorce and remarriage and income inequality.

1. Correlation of husbands' and wives' incomes should be higher in second than in first marriages as a result of Proposition 1. This increased correlation must only hold true for those individuals who divorce and remarry. In the baseline model under Corollary 1, couples who are highly correlated with respect to income will divorce less.[30] Furthermore, correlation of incomes in first marriage should increase with age.

2. If men are best represented by the additive income case, the remarriage market for men would tend to be characterized by the additive income case, which under Proposition 4 means that very high or very low income agents were left out of the remarriage market.[31]

3. If women are best represented by a combination of the additive income case (women who work outside the home), the random income case (women who work in the home or who receive substantial alimony), and the mixed case (women who switch from working in the home to working outside the home, or women who receive substantial child support), then as a result of Proposition 4, although one would expect to find high and low incomes resulting in a lower probability of remarriage, the impact of high income levels would be expected to be smaller than that for males.

4. The combination of these factors leads to greater inequality in a world with divorce than in a world where first marriages are permanent. Remarried couples will have higher inequality than couples who are still with their first mate. Also, because high and low income agents remarry with lower probabilities than middle income agents, divorced agents who have been divorced for a long time will have higher inequality than those who are recently divorced.

---

[30] Becker, Landes and Michael (1985) show that, in fact, couples in which husbands and wives are very different with respect to income are most likely to divorce. This is also true in the data analyzed below.

[31] This can be thought of as a collection of geographically separated markets, each of which have unique equilibria with $b=0$, some with $p_H > p_L$ and some with $p_L > p_H$. On the other hand, this could also be thought of a situation in which the country-wide equilibrium switches from $p_H > p_L$ to $p_L > p_H$ with $b=1$ because of the non-uniqueness of the equilibrium.

IV. CONCLUSION

This paper proposed a model which can explain the link between the increased divorce and remarriage rates and increased income inequality. An informational structure in which knowledge about ones own wage and marital specific capital is only revealed after the first marriages have occurred can lead to an equilibrium in which the correlation of spousal incomes is higher in first than in second marriages and where the probability of remarriage is influenced by the income level.

If increased inequality is indeed a negative influence on growth, then the increase of divorce has negative externalities on the economy in aggregate. Furthermore, as this model demonstrates, remarriage will not eliminate this externality because the remarriage market is fundamentally different from the original marriage market. Not only do agents match more closely with respect to income, but those who are most in need of the insurance effect of marriage are "lemons" in this market.

The welfare implications of this model are less clear. Society's increased acceptance of divorce, although ex post not beneficial to everyone, increases the choices that agents can make therefore increasing their expected utility, pre-marriage. With Becker's assumption of all bribes between spouses being feasible, in fact, utility is always increased if divorce is allowed. The magnitudes of the two effects: increased utility for couples and externalities for the economy, are not known. Therefore, calling for legislation or social barriers restricting divorce may not by welfare improving. On the other hand, additional income given to those divorced individuals at the bottom of the income ladder may not only help them in the short run, but also improve their long run welfare through their increased probability of remarriage.

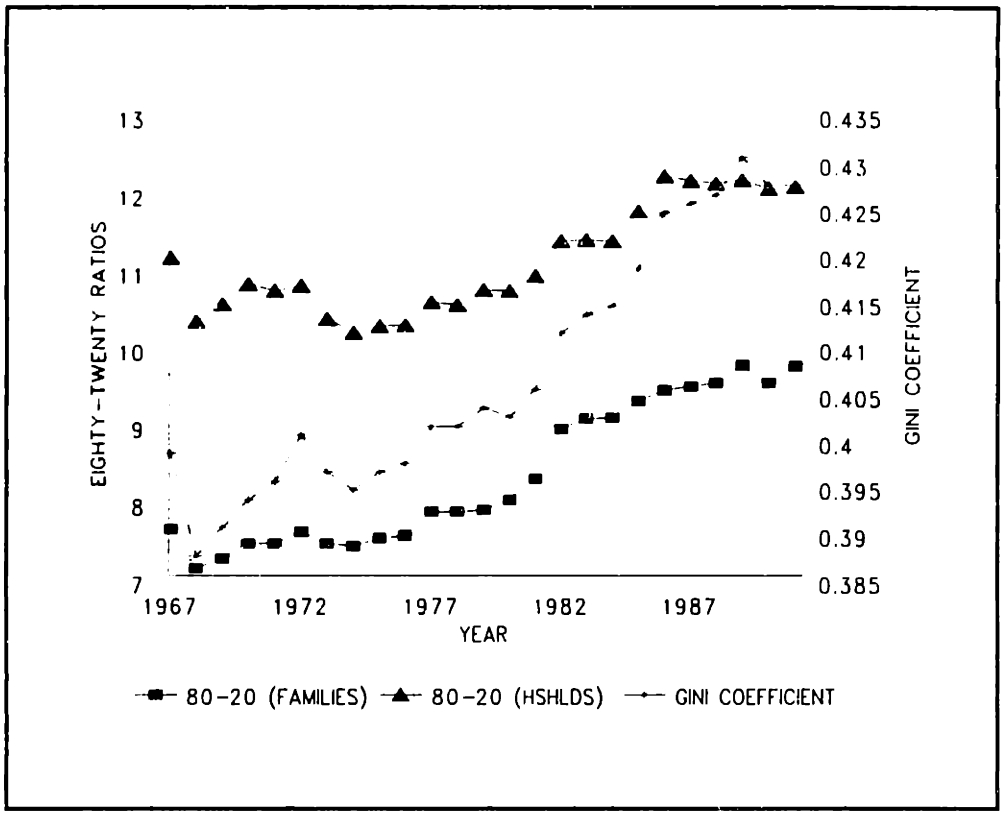

Figure 1 - Income Inequality in the United States

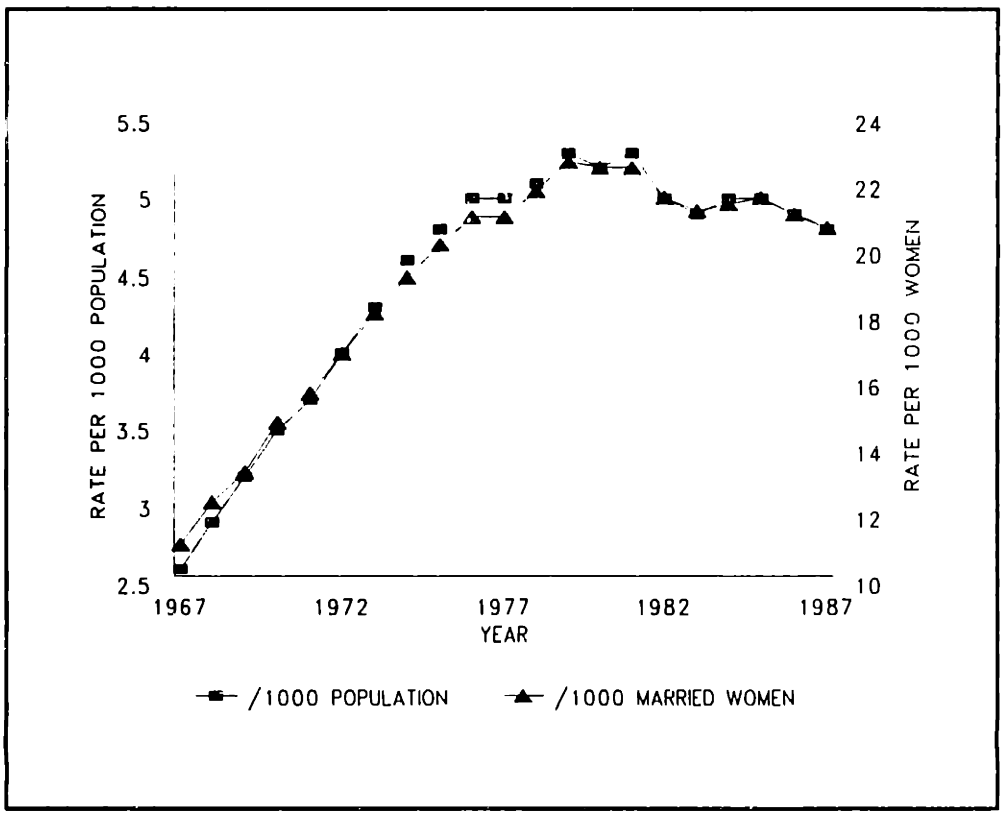

Figure 3: Divorce Rate in the United States

APPENDIX

In this appendix, I will outline the conditions necessary for each of the equilibria. The analysis will be divided into three sections: additive income, random income, and mixed. The b=0 case will be examined for all assumptions on family income and the b=1 case will be examined for the additive income hypothesis. Within each section, a table will list the conditions necessary and the values of p_H and p_L for each equilibrium.

For simplification of notation, I will number the couples as follows:

1 - (w_He_H, w_He_H)	5 - (w_He_H, w_He_L)	8 - (w_He_L, w_Le_H)
2 - (w_He_L, w_He_L)	6 - (w_He_H, w_Le_H)	9 - (w_He_L, w_Le_L)
3 - (w_Le_H, w_Le_H)	7 -(w_He_H, w_Le_L)	10 - (w_Le_H, w_Le_L)
4 - (w_Le_L, w_Le_L)		

I. Additive income

A. B=0 (infinite discounting)

When b=0, expectations on remarriage do not matter. Couples will divorce if

$$\frac{(w_{self}+w^*)}{2} + (e_{self}+e^*) < w_{self} \tag{1-1}$$

holds for at least one spouse. Agents prefer w_H to w_L in remarriage if

$$\frac{w_H+w_{self}}{2}+e_{self}+E(e|w_H) > \frac{w_L+w_{self}}{2}+e_{self}+E(e|w_L) \tag{1-2}$$

or equivalently, $w_H-w_L > 2(e_H-e_L)(p_L-p_H)$.

Agents will remarry another agent of their income rather than stay single if

$$w_{self}+e_{self}+E(e|w_{self}) > w_{self} \tag{1-3}$$

or equivalently, $p_{self}e_H+(1-p_{self})e_L > -e_{self}$.

Couples which divorce	Conditions for equilibrium	P_H	P_L	P_H and p_L in equilibrium
2,4,9	$w_H - w_L < 4(e_H + e_L)$	0	0	N/A
2,4,7,8,9	$4(e_H + e_L) < w_H - w_L < 4e_H$	$\frac{p(1-q)}{1+p-2pq}$	$\frac{pq}{1-p+2pq}$	$q < \frac{1}{2}$
2,4,6,7,8,9	$w_H - w_L > 4e_H$	$\frac{p(1-q)}{1-pq(2-p)}$	$\frac{pq}{1-p(1-q)(1-p)}$	$q < \frac{1}{2}$

B. B=1

When b=1, expectations on remarriage matter for the divorce decision. Couples divorce if

$$(w_{self} + w^*) + 2(e_{self} + e^*) < w_{self} + \max[E(\frac{w_{self} + \acute{w}}{2} + e_{self} + \acute{e}), w_{self}] \qquad (1\text{-}4)$$

holds for at least one spouse. Equations 1-2 and 1-3 continue to determine remarriage patterns.

Who div-orces ?	Conditions for equilibrium	P_H	P_L	P_H & P_L in equi-librium
2,4,9	$w_H - w_L > e_H + e_L$	0	0	N/A
2,4,5,7,8,9,10	$w_H - w_L > 3e_H - e_L - p_H(e_H - e_L)$	$\frac{p}{p+1}$	$\frac{p}{p+1}$	$p_H = p_L$
2,4,7,9	$2e_H - p_H(e_H - e_L) > w_H - w_L > e_H + e_L - p_H(e_H - e_L) > 0$	$\frac{p(1-q)}{1-pq}$	0	$p_H > p_L$ always
2,4,5,7,9	$w_H - w_L < 2e_H - p_H(e_H - e_L)$, $e_H + e_L < p_H(e_H - e_L)$	$\frac{p}{1+pq}$	0	$p_H > p_L$ always

2,4,7,8,9	$3e_H-e_L-p_H(e_H-e_L)>w_H-w_L>2e_H-p_H(e_H-e_L)$, $e_H+e_L>p_H(e_H-e_L)$	$\frac{p}{p+1}$	$\frac{pq}{2pq+1-p}$	$p_H>p_L$ always
2,4,5,7,8,9	$3e_H-e_L-p_H(e_H-e_L)>w_H-w_L>2e_H-p_H(e_H-e_L)$, $p_H(e_H-e_L)>e_H+e_L>p_L(e_H-e_L)$	$\frac{p}{p+1}$	$\frac{pq}{2pq+1-p}$	$p_H>p_L$ always
2,4,5,7,9,10	$2e_H-p_H(e_H-e_L)>w_H-w_L>p_L(e_H-e_L)-(e_H+e_L)>0$	$\frac{p}{1+pq}$	$\frac{p(1-q)}{1+p(1-q)}$	$p_H>p_L$ always
2,4,6,7,8,9	$w_H-w_L>3e_H-e_L-p_H(e_H-e_L)$, $e_H+e_L>p_H(e_H-e_L)$	$\frac{p(1-q)}{1-2pq+p^2q}$	$\frac{pq}{1+p(p+2)(1-q)}$	$p_H>p_L$ if $q<\frac{1}{2}$, $p_L>p_H$ if $q>\frac{1}{2}$
2,4,5,6,7,8,9	$w_H-w_L>3e_H-e_L-p_H(e_H-e_L)$, $p_H(e_H-e_L)>e_H+e_L>p_L(e_H-e_L)$	$\frac{p-p^2q}{1-p^2q}$	$\frac{pq}{1+p(p+2)(1-q)}$	$p_H>p_L$ (p and q suff. small)
2,4,9,10	$e_H+e_L>w_H-w_L>p_L(e_H-e_L)-(e_H+e_L)>0$	0	$\frac{p(1-q)}{1+p-2pq}$	$p_L>p_H$ always
2,4,8,9,10	$p_L(e_H-e_L)-(e_H+e_L)>w_H-w_L$, $e_H+e_L>w_H-w_L$	0	$\frac{p}{1+p(1-q)}$	$p_L>p_H$ always
2,4,6,7,9	$2(e_H-e_L)>w_H-w_L>3e_H-e_L-p_H(e_H-e_L)$, $e_H+e_L>p_H(e_H-e_L)$	$\frac{p^2(1-q)}{1-2p-p^2(q-2}$	$\frac{p^2q}{1-p(q-2)+p^2}$	$p_L>p_H$ (p suff. small, q suff. large)
2,4,6,7,9,10	$2(e_H+e_L)>w_H-w_L>3e_H-e_L-p_H(e_H-e_L)$, $w_H-w_L>p_L(e_H-e_L)-(e_H+e_L)$, $p_L(e_H-e_L>e_H+e_L>p_H(e_H-e_L)$	$\frac{p(1-q)}{p(1-q)+(1-p)}$	$\frac{p-p^2-pq(1-2p)}{1-p^2-pq(1-2p)}$	$p_L>p_H$ (p suff. small, q suff. large)

2,4,7,8,9,10	$3e_H-e_L-p_H(e_H-e_L)>w_H-w_L>2(e_H+e_L)$, $e_H+e_L>p_H(e_H-e_L)$ and one of the following: (a) $e_H+e_L-p_L(e_H-e_L)>w_H-w_L$ or(b) $e_H+e_L-p_L(e_H-e_L)<0$	$\frac{p(1-q)}{1+p-2pq}$	$\frac{p}{p+1}$	$p_L > p_H$ always
2,4,6,7,8,9,10	$3e_H-e_L-p_H(e_H-e_L)<w_H-w_L$, $p_H(e_H-e_L)<e_H+e_L$ and one of the following:(a) $w_H-w_L<p_L(e_H-e_L)-(e_H+e_L)$ or (b) $p_L(e_H-e_L)-(e_H+e_L)>0$, $w_H-w_L>2(e_H+e_L)$	$\frac{p(1-q)}{1-2pq+p^2q}$	$\frac{p-p^2(1-q)}{1-p^2(1-q)}$	$p_L > p_H$ (p suff. small, q suff. large)
2,4,5,6,7,8,9,10	$w_H-w_L>3e_H-e_L-p_H(e_H-e_L)$, $p_H(e_H-e_L)>e_H+e_L$ and one of the following: (a) $w_H-w_L>2(e_H+e_L)$ or (b) $p_L(e_H-e_L)-(e_H+e_L)>w_H-w_L$	$\frac{p(1-pq)}{1-p^2q}$	$\frac{p-p^2(1-q)}{1-p^2(1-q)}$	$p_L > p_H$ always

II. Random income (b=0)

When marital income=M and is independent of individual incomes when single, couples divorce if

$$M+(e_{self}+e^*) < w_{self} \tag{1-5}$$

holds for at least one spouse. Agents prefer w_H to w_L in remarriage if

$$M+e_{self}+E(e|w_H) > M+e_{self}+E(e|w_L) \tag{1-6}$$

or, equivalently, if $E(e|w0) > E(e|w1)$. Agents will remarry another agent of their income level rather than stay single if

$$M+e_{self}+E(e|w_{self}) > w_{self} \tag{1-7}$$

Who divorces?	Conditions for equilibrium	P_H	P_L	P_H & P_L in equilibrium
2,9	$w_H-(e_H+e_L) < M < w_H-2e_L$, $w_L-2e_L < M$	0	0	$p_H=p_L$
2,4,9	$w_H-(e_H+e_L) < M < w_L-2e_L$	0	0	$p_H=p_L$
2,5,7,8,9	$w_H-2e_H < M < w_H-(e_H+e_L)$, $w_L-2e_L < M$	$\frac{p}{1+p}$	$\frac{p}{1+p}$	$p_H=p_L$
2,4,5,7,8, 9,10	$w_H-2e_H < M < w_L-(e_H+e_L)$	$\frac{p}{1+p}$	$\frac{p}{1+p}$	$p_H=p_L$
1,2,5,6,7, 8,9	$w_L-2e_L < M < w_H-2e_H$	p	p	$p_H=p_L$
1,2,3,4,5, 6,7,8,9,10	$M < w_L-2e_H$	p	p	$p_H=p_L$
2,4,5,7,8, 9	$w_L-(e_H+e_L) < M < w_L-2e_L$, $w_H-2e_H < M$	$\frac{p}{1+p}$	$\frac{pq}{1-p+2pq}$	$p_H>p_L$ always
1,2,4,5,6, 7,8,9,10	$w_L-2e_H < M < w_L-(e_H+e_L)$, $M < w_H-2e_H$	p	$\frac{p-p^2(1-q)}{1-p^2(1-q)}$	$p_H>p_L$ always

III. Mixed Case (b=0)

When family income in the first marriage is M and in the first marriage is the sum of the two agents' single incomes, couples divorce if equation 1-5 holds. The equilibria are the same as for the random income case. Agents prefer w_H to w_L in remarriage if equation 1-2 holds. Agents will remarry another agent of their income level rather than stay single if equation 1-3 holds.

BIBLIOGRAPHY

Becker, Gary S., Elizabeth M. Landes and Robert T. Michael. "An Economic Analysis of Marital Instability." Journal of Political Economy 85 (1977): 1141-1187.

Bergstrom, Theodore and Mark Bagnoli. "Courtship as a Waiting Game." Journal of Political Economy 1101 (1993): 185-202.

Blackburn, McKinley L. and David E. Bloom. "Changes in the Structure of Family Income Inequality in the United States and Other Industrial Nations During the 1980s." NBER Working Paper No.4754, 1994.

Breslow, N. "Covariance Analysis of Censored Survival Data." Biometrics 30(1974): 89-99.

Bourguinon, F. and C. Morrison. "The Kuznets Curve and the Recent Evolution of Income Inequality in Developed Countries," mimeo.

Cherlin, Andrew J. Marriage, Divorce, Remarriage. Cambridge: Harvard University Press, 1992.

Danziger, Sheldon and Peter Gottschalk, eds. Uneven Tides: Rising Inequality in America. New York: Russell Sage Foundation, 1993.

Edward, Allen L. An Introduction to Linear Regression and Correlation. New York: W.H. Freeman and Company, 1976.

Ermisch, John F. Lone Parenthood: An Economic Analysis. Cambridge: Cambridge University Press, 1991.

Furstenberg, Frank F. Jr. and Graham B. Spanier. Recycling the Family: Remarriage after Divorce. Beverly Hills: Sage Publications, 1984.

Gale, D. and L.S. Shapely. "College Admissions and the Stability of Marriage." American Mathematics Monthly 69 (1962):9-15.

Galor, Oded and Joseph Zeira. "Income Distribution and Macroeconomics." Review of Economic Studies 60(1993): 35-52.

Johnson, William R. and Jonathan Skinner. "Labor Supply and Marital Separation." American Economic Review 76 (1986): 455-469.

Kalbfleisch, John D. and Ross L. Prentice. The Statistical Analysis of Failure Time Data. New York: John Wiley and Sons, 1980.

Katz, Lawrence F. and Kevin M. Murphy. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors." Quarterly Journal of Economics 107 (1992): 35-78.

Lam, David. "Marriage Markets and Assortative Mating with Household Public Goods." Journal

of Human Resources 23 (1988): 462-487.

Mott, Frank L. and Sylvia F. Moore. "Marital Transitions and Employment." in The Employment Revolution edited by Frank L. Mott. Cambridge: MIT Press, 1982.

Murphy, Kevin M. and Finis Welch. "Inequality and Relative Wages." American Economic Association Papers and Proceedings 83 (1993): 104-109.

Perotti, Roberto. "Income Distribution, Politics and Growth." American Economics Association Papers and Proceedings 82(1992):311-316.

Peters, H. Elizabeth. "Marriage and Divorce: Informational Constraints and Private Contracting." American Economic Review 76 (1986): 437-454.

Shaw, Kathryn. "The Life-Cycle Labor Supply of Married Women and its Implications for Household Income Inequality." Economic Inquiry 30(1992):659-672.

Sprague, Alison. "The Duration to Marriage: An Empirical Analysis." Oxford Applied Economics Discussion Paper 104, 1990.

U.S. Bureau of Census, Statistical Abstract of the United States: 1992 (112th ed). Washington DC: 1992.

CHAPTER 2 - REMARRIAGE AND FAMILY INCOME INEQUALITY AN EMPIRICAL ANALYSIS

In "Remarriage and Income Distribution", a model is developed in which an increase in the divorce and remarriage rates implies an increase in family income inequality. Information about an individual's wage and non-monetary marital inputs is revealed slowly over time. In the first marriage, this information is unavailable, both to the individual and to the prospective spouse. Couples who marry discover this information about themselves and their partner, and based on that information, they decide whether or not to remain married. In the remarriage market, individuals know their own characteristics and can observe the wage of all potential remarriage partners. Income is then used as a signal about the non-monetary marital inputs.

This model develops four testable conclusions which will be the focus of this paper. First, the correlation of interspousal earnings should be higher in second than in first marriages because more information on earnings is available. Second, for men, the extremes of the income distribution would have lower probabilities of remarriage due to this signalling effect. Third, for women, signalling causes income to have a positive effect on the probability of remarriage. These conditions result in the final conclusion that as the divorce rate increases, family income inequality would rise.

The analysis is broken down into three parts. First the conclusion of increased correlation of interspousal incomes in remarriage is tested. Correlation of incomes is, in fact, higher in remarriage than in first marriages.[32] Second, the hypothesis that the probability of remarriage is low at the extremes of the income distribution is tested. For both men and women, the lowest income quintile has a significantly lower probability of remarriage then does any other quintile. For men, there is additionally some evidence of a negative effect of very high income on the probability of remarriage. These findings, together with the fact that divorced agents lose the insurance effect of marriage, suggest that family

[32]In fact, since increased correlation only occurs because older marriage partners have more information on income, the correlation of incomes in first marriages should also vary positively with the ages of the partners.

income inequality would have been lower had there been no divorce. An estimation of the impact of this effect on family income inequality conservatively estimates that the presence of divorce can explain 8.9% of the increase from 1980 to 1990.

The paper is organized as follows. Section I discusses the data used in this analysis. Section II tests the implication that the correlation of incomes is higher in remarriage than in first marriages, analyzes the effects of income on remarriage probabilities, and calculates the effect of divorce on family income inequality within the sample. Section III applies the findings in the previous section to predict the impact of the increased divorce rate on the entire US population, and section IV concludes.

I. DATA

In testing the implications of this model with regards to correlation of incomes and the effect of income on remarriage probabilities, I have used the National Longitudinal Survey of Youth (NLSY). This survey is a sample of 12686 men and women who were between the ages of 14 and 22 in 1979. The data used in this analysis spans from 1979 to 1991. This data set is particularly good for the questions raised by this model because it focuses on the time during which most people marry and divorce. Furthermore, because it is a panel study, it reports an individual's complete marital history which is necessary to analyze determinants of remarriage. Among the available panel surveys, it has a low attrition rate, which gives a rather large sample even looking at only previously married agents who survived until 1991. The one major weakness of the survey is the limited age group of those sampled. The analysis of remarriage presented in this paper, therefore, is only applicable to those under 34 years of age.[33]

Since the micro-data only covers a limited range of ages, I have used the NLSY as well as the Census Public Use Microsamples from 1980 and 1990 in order to expand these

[33]Other panel data sets were considered, but these were not used because of the high attrition which frequently occurred just as families were divorcing or remarrying. Further work on this topic will expand the analysis to other age groups using the NLS mature men and mature women surveys.

findings to the economy as a whole and predict inequality in a theoretical world without divorce. As will be fully explained later, I estimate family income inequality for families in which the head of household is in the 26-34 year old cohort with NLSY data and calculate inequality for all other households using the Census data. The NLSY cohort can be analyzed to estimate what percent of the increased inequality of this group was caused by divorce. The Census data is used to estimate how this translates into the impact of divorce on the family income inequality of the entire population.

The variables used along with their mean values and standard deviations are defined in Appendix 1. One set of variables which was constructed will be explained here.

The most important variable for my analysis is income. Because I am analyzing the remarriage process, it is imperative to separate the income of the spouses. In order to do this, I could only look at the measures of income which are not reported as combined family variables in the data or which can be attributed to one spouse such as child support. The measures of income which I do use in the calculation of husbands' and wives' incomes are wages, salary, tips and commissions including military income; farm or business income; unemployment benefits; alimony and child support payments; AFDC benefits; and educational benefits. The categories which are not included are food stamps, and other welfare benefits; and gifts or other sources of unlisted income.

Because income acts as a signal in the marriage and remarriage markets, I would like to know the incomes of both individuals one period before they married. However, I cannot observe the income of the future spouse before the marriage. Therefore, I use incomes of both for one year following the marriage to calculate correlation of incomes.[34] In predicting the probability of remarriage, income one period after the divorce is used.

---

[34]This would not be valid if a significant percentage of my sample had children within one year of marriage, and women with children had a much larger probability of earning no income than those without children. However, this effect only affects 5% of my sample.

In this model, income is used as a signal during the courtship process. Additionally, income typically is a noisy variable in the NLSY, and averaging income over several periods therefore reduces any measurement error. For these two reasons, I wanted a measure of income which spanned over one year's time. Because income was reported on a calendar year basis, I constructed a weighted average of the annual incomes in the year of the marital transition and the following year weighted by the month in which the marital transition occurred. For instance, for a divorce which occurred in November of 1986, income one period after the divorce would equal $(\frac{1}{12})\ (Income_{1986}) + (\frac{11}{12})\ (Income_{1987})$.

II. ANALYSIS

A. Correlation of Husbands' and Wives' Incomes

The model predicts that the correlation of husbands' and wives' incomes are higher for individuals who marry later in life. This leads to two implications. First, the correlation of incomes in remarriage should be higher than the correlation those remarried individuals had in their first marriages. Second, the correlation of incomes in first marriages should rise with the age at marriage. The variables I test are real income of husbands and wives as constructed above and adjusted by the CPI. The statistic computed is the correlation coefficient $\rho_{xy}=\frac{\sigma_{xy}}{\sigma_x\sigma_y}$ which necessarily lies between -1 and 1. Results are shown in Table 1.[35]

As the table shows, the couples that do remarry do so with correlations higher than in their first marriages, although this difference is not statistically significant due to the low

[35]Unconditional correlation coefficients are computed because any observable characteristics would be used by the potential marriage partner to determine expected pecuniary and non-pecuniary benefits from marrying the agent.

number of remarried agents in the sample.[36] The important columns on which to focus for the impact on family income inequality are the last two, since this increase in correlation among the same group of individuals will lead to higher inequality of family income. The table also points out another trend which is consistent with a model of positive assortative mating. Those couples with the lowest correlation of incomes in marriage are most likely to divorce.[37] The difference between the correlations in columns two and four are significantly different.

Table 1 - Correlation Coefficients

	First Marriage					Second marriage
	All married agents	Agents who stayed married	All divorced agents	Agents who stayed divorced	**All remarried agents**	**All remarried agents**
ρ	.2506	.2462	.1616	.1524	**.1771**	**.1963**
Standard Error	.0123	.0141	.0261	.0356	.0383	.0381
# of obs	6160	4725	1435	772	663	663

As the model predicts, if the correlation of incomes in marriage is only a function of the amount of information known to the agents, then correlation of incomes in first marriage is expected to be an increasing function of age of the respondent. As Table 2 and Figure 1 show, this is, in fact, the case. The correlation of incomes among those younger than 25 is

[36]The model does compare all first marriages to all remarriages and predict higher correlations among remarriages. However, the model assumes that all agents marrying for the fist time are of the same age, something which, of course, is not true.

[37]Lam (1988) develops a model in which rewards from marriage include some joint consumption of public goods. This feature of his model predicts positive assortative mating and the highest level of divorce among those whose incomes are the least correlated.

significantly lower than that of couples in which the respondent is 25 years of age or older.

The estimated coefficient of a regression of interspousal correlation of incomes on the age of respondent is .0152 with a standard error of .0054.[38] This result further strengthens the hypothesis that the increased correlation of incomes observed with remarried agents comes from the increased information agents acquire about themselves with age.[39]

Table 2 - Correlation of Incomes in First Marriage by Age

	Respondent Under 25 Years of Age	Respondent 25 or Older
ρ	.1720	.4083
Standard Error	.0141	.0257
Number of Observations	4893	1267

B. Effect of Income on Remarriage Probability

The model implies that the probability of remarriage is lowest at very high and very low levels of income.[40] Because men and women face different remarriage markets, I will analyze the genders separately.

The statistical method used in this analysis is a Cox proportional hazard model. This model is most appropriate for the data set used because it uses all the data available including

[38]See Figure 1 for a graph of this trend.

[39]This effect is further studied in "Correlation of Incomes and Age at Marriage".

[40] In the model, either high or low income agents were left out of the remarriage market. Thinking of the United States as a series of geographically distinct remarriage markets will lead to findings of low probabilities of remarriage at very high and very low levels of income.

those individuals who had not remarried by the time the last survey was conducted.

The Cox continuous time proportional hazard model specifies a hazard function, $\lambda(t;z)=\lambda_0(t)e^{z\beta}$ where $\lambda_0(t)$ is an arbitrary base-line hazard function which can vary with t, z is a vector of covariates and β is a vector of unknown coefficients. The model is estimated using partial likelihood (Kalbfleisch and Prentice, 1980). In case of ties at failure times, the Breslow approximation is used (Breslow, 1974).

A "failure" is defined in my model as a remarriage. Divorced individuals who do not remarry before the survey ends are treated as censored observations. The estimated equations use variables frequently found to be significant in the estimation of remarriage probabilities. All variables have the appropriate sign although not all are significant at the 5 percent level.

Table 3 shows the results from the female proportional hazard rate of remarriage. The socioeconomic variables in this regression agree in sign with the results of Becker et al (1977) and Peters (1986). Black women and those living in the northeast had a significantly lower probability of remarriage. Women who were in the military at the time of their divorce had much higher chances of remarriage. This probably reflects the larger pool of males with whom they have contact. Older women are less likely to remarry as are those with many children. The length of the first marriage is most likely acting as a proxy for unobservable non-pecuniary inputs to marriage which are expected to increase the probability of remarriage.[41]

[41] Although the coefficients on the number of children and the length of the first marriage are insignificantly different from zero, a likelihood-ratio test rejects the joint hypothesis that both are zero.

Table 3 - Cox Proportional Hazard Model for Females
using Quintiles
(Standard Errors in Parentheses)

Black	-.683 (.153)	-.665 (.139)
Northeast	-.320 (.186)	-.424 (.177)
North-Central	-.057 (.137)	-.178 (.124)
South	.188 (.123)	.105 (.103)
In military	1.18 (.325)	1.15 (.323)
Age at divorce	-.055 (.022)	-.040 (.014)
Number of children	-.016 (.060)	–
Length of first marriage	.0028 (.0021)	–
Alimony/AFDC	-.276 (.135)	-.168 (.117)
First quintile	-.402 (.159)	-.289 (.142)
Second quintile	-.110 (.143)	-.010 (.128)
Third quintile	-.263 (.140)	-.194 (.128)
Fifth quintile	-.141 (.143)	-.107 (.136)
Number of observations	970	1067
Chi^2	67.93	70.76
Degrees of freedom	13	11

In order to examine the effect of income on remarriage probabilities, dummy variables of income quintiles are created using income one period after divorce. The fourth quintile is omitted, because individuals in this quintile have the highest probability of remarriage. As the model predicted, women in the lowest income quintile have a significantly lower probability of remarriage than women in any other quintile. This is consistent with a remarriage market in which $p_H > p_L$. Additionally, a dummy variable for receipt of alimony or AFDC income has a negative effect on remarriage. This is consistent with the random income case in which women who would lose more when they would remarry as less likely to do so.[42]

Another way to look at these results is to calculate the probability of remarriage within seven years for different values of the regressors. Table 4 displays these calculations for women. The baseline woman against which these changes in the left-hand side variable are analyzed are a white woman, living in the west, not in the military, age 23.8 when divorced, and with one child. She has been married 56 months (4.7 years), is not on AFDC, and is in the third income quintile. The age at divorce, number of children, and marriage length used are equal to the sample means for these variables. These probabilities are calculated using the coefficients in Table 3, so the conclusions about the sign of the impact of the variables remains the same. However, the magnitude of the impact can be seen in Table 4. Most striking are the low probabilities of remarriage for blacks and the very high probability for military women. The income quintile dummies do show that the lowest quintile has a lower remarriage rate than any of the other quintiles. Recall that Table 3 showed that only the first quintile had a coefficient significantly different from zero.

[42]Sprague (1990) finds that high potential earnings lowers the risk of first marriage. Bergstrom and Schoeni (1992) also find that individuals who marry at earlier ages have lower permanent incomes. These can be seen as rejections of an alternative hypothesis that income positively affects all the risk of all marriages.

Table 4 - Probability of Remarriage within Seven Years
Women with Selected Characteristics

Characteristic	Probability of Remarriage within 7 Years
Black	.3920
White	.6266
Living in Northeast	.5110
Living in North-Central	.6057
Living in South	.6955
Living in West	.6266
In the Military	.9594
Not in the Military	.6266
Age at Divorce = 23.8	.6266
Age at Divorce = 24.8	.6066
Length of Marriage = 56 months (4.7 years)	.6266
Length of Marriage = 68 months (5.7 years)	.7498
Number of Children = 1	.6266
Number of Children = 2	.6326
On AFDC	.6266
Not on AFDC	.5265
First Income Quintile	.5755
Second Income Quintile	.6827
Third Income Quintile	.6266
Fourth Income Quintile	.7222
Fifth Income Quintile	.6713

One last way to look at the impact of income on remarriage probabilities is to plot the probability of remarriage within seven years as a function of income. This is found in Figure 2. In this case, the regression that is used to make this graph is found in Appendix 2. It differs from the previously reported results in that income and income squared are used as regressors instead of income quintiles. Therefore, the magnitudes of the probabilities will not correspond directly to Table 4. However, the general trend is the same.

The results of the Cox proportional hazard model for male remarriage is shown in Table 4. Again, the socioeconomic variables have the expected signs. Black men are less likely to remarry, as are older men. Increased duration of the first marriage increases remarriage probability. As with females, northeastern men had lower probabilities of remarriage.[43]

As with the women, income is entered as a series of dummy variables corresponding to income quintiles, and the fourth quintile is omitted. Men in the lowest quintile of income have a significantly lower probability of remarriage than those in the fourth quintile. A negative effect on remarriage for very high income men does not appear in this specification. However, appendix 2 uses income and income squared terms in lieu of the quintiles and finds a small but significant negative effect of income at high levels.

[43] A likelihood-ratio tests fails to reject the joint hypothesis that the coefficients on length of first marriage and region dummies are significantly different from zero.

Table 5 - Cox Proportional Hazard Model for Males
using Quintiles
(Standard Errors in Parentheses)

Black	-.549 (.183)	-.547 (.181)
Age at divorce	-.062 (.027)	-.054 (.022)
Length of first marriage	-.0015 (.0027)	–
Northeast	-.168 (.225)	–
North-Central	-.042 (.169)	–
South	.046 (.145)	–
First quintile	-.868 (.192)	-.878 (.192)
Second quintile	-.385 (.176)	-.386 (.175)
Third quintile	-.082 (.168)	-.093 (.167)
Fifth quintile	-.061 (.179)	-.068 (.179)
Number of observations	661	662
Chi^2	44.61	43.54
Degrees of freedom	10	6

Table 6 shows the probabilities of remarriage within seven years for men with various characteristics. As with the women, the baseline man has the mean characteristics of the sample: he is white, lives in the west, was 24.2 when he divorced and had been married 54 months (4.5 years). He is also in the third income quintile. In comparing Tables 4 and 6, the most noticeable difference between men and women is that the average man has a higher probability of remarriage than does the average woman. The trends, however, are similar

for men and women. Blacks have significantly lower probabilities of remarriage. For men, the income effect is even stronger than for women: the difference between the probabilities of the first and fourth quintiles for men is 0.3082 vs. 0.1467 for women.

Table 6 - Probability of Remarriage within Seven Years
Men with Selected Characteristics

Characteristic	Probability of Remarriage within 7 Years
Black	.5282
White	.7277
Living in Northeast	.6671
Living in North-Central	.7129
Living in South	.7438
Living in West	.7277
Age at Divorce = 24.2	.7277
Age at Divorce = 25.2	.7056
Length of Marriage = 54 months (4.5 years)	.7277
Length of Marriage = 66 months (5.5 years)	.7342
First Income Quintile	.4323
Second Income Quintile	.6005
Third Income Quintile	.7277
Fourth Income Quintile	.7405
Fifth Income Quintile	.7188

Figure 3 graphs the probability of remarriage within seven years as a function of the man's income. This plot has a maximum at $45000. Note, however, that 99% of this sample of men has an annual income of less than $45000. Because of the limited number of observations at high incomes (6), the probability of remarriage most likely, does not go

to zero in the entire population.

C. Effect of the Presence of Divorce on Family Income Inequality

One implication of the model for divorced persons is that inequality should be lower for those divorced persons who have been divorced for a short period of time than those who have been divorced longer, because individuals in the middle of the income distribution marry sooner than those at the extremes. Table 7 illustrates this point. This result is significant in spite of the fact that women who have been divorced longer generally begin to experience rising incomes as their time in the job market increases.

Table 7 - Inequality by Time Since Divorce[44]

	Time since divorce less than 42 months	Time since divorce greater than or equal to 42 months
Gini coefficient	.5872	.6018
Variance of log income	1.0221	1.2996

The model predicts that due to the combination of increased correlation of incomes in remarriage and a significant impact of income on the probability of remarriage, remarried couples will have higher measures of inequality than do couples who stay in first marriages. Table 8 depicts two measures of inequality of family income: the Gini coefficient and the variance of log income. These statistics are computed for three mutually exclusive groups of individuals: those who are in their first marriages in 1991, those who have divorced and not remarried in 1991, and those who have remarried in 1991. The differences in both statistics within a given year cannot be attributed to age or education differences because these factors are not significantly different for the three groups within this survey. However, the decreases in the measures for all agents from 1979 to 1991 are the result of the maturing of the cohort.

[44]Note that the median time since divorce is 42 months for those still divorced in 1991.

As rows 2 and 5 of Table 8 show, inequality is higher among divorced agents than among either group of married agents. This demonstrates the insurance effect of marriage. In my model, income is a certain event. However, in a world where income could be zero for one period through unemployment, inequality will decrease simply by increasing the number of random marriages where two individuals pool their income and share the risk. Another component of the high inequality among divorced agents is the lower probability of very high and very low income agents remarrying. Furthermore, inequality of agents in their second marriages is higher than those in first marriages, as the model predicts.

Table 8 - Measures of inequality

		All agents in first marriages in 1991	All agents divorced in 1991	All agents remarried in 1991	All agents
(1)	Gini coefficient - 1979	.3461	.3633	.3584	.3489
(2)	Gini coefficient - 1991	.3474	.4629	.3644	.3398
(3)	% Change	0.4 %	27.4 %	1.7 %	-2.6 %
(4)	Variance of log income - 1979	.8450	.7517	.7141	.8192
(5)	Variance of log income - 1991	.5763	.8384	.8291	.6828
(6)	% Change	-31.8 %	11.5 %	16.1 %	-16.6 %

III. APPLICATIONS

In order to answer the question of the effect of divorce on inequality, a measure of predicted inequality had divorce not existed must be calculated. This was done as follows. First, a regression of family income in 1991 on factors observable in 1979 was run on respondents who remained married throughout the sample. Because this sample is not

representative of all couples married in 1979, a Heckman two-step procedure was used. The identifying variables used in the first stage are religious variables and the state divorce rate. Then, using the coefficients from this regression, family income in 1991 was predicted for all respondents married in 1979, including those who divorced or remarried during the survey period. This gives predicted 1991 family incomes for all individuals who were married in 1979, whether they were still married, divorced or remarried in 1991. The results from the probit and Heckman-corrected prediction regression can be found in Appendix 3. The variance of predicted log income was then computed and is used as the measure of inequality.[45] In order to then determine the effect on the entire economy, the 1990 Census Public Use Microsample is used. The variance of the 26-34 year old divorced and remarried group is taken from the NLSY estimates. The variance of all other groups is taken from the Census data.[46]

The predicted variance of log income for the whole economy in 1990 if there were no divorce is calculated as follows:

$$\sigma^2 = \frac{1}{N}\left[N_A E(Y_A^2) + N_B E(Y_B^2) - \frac{(N_A\overline{Y}_A + N_B\overline{Y}_B)^2}{N}\right]$$

where N is the total number of families in the 1990 Census data set, N_A is the number of families in the 1990 Census in which the head of household was age 26-34, and N_B is the number of families in the 1990 Census in which the head of household was not 26-34. Y_A is the log of family income for those families with heads of household 26-34, and Y_B is the corresponding variable for all other families. $E(Y_A^2)$ and the mean of Y_A were calculated using the predicted family income from the NLSY. The corresponding values for those families in which the head of household was not 26-34 were calculated using Census data.

---

[45] The variance of the predicted incomes described above clearly understates the true variance. In order to correct for this, the assumption is made that the continuously married, divorced and remarried groups have equal variances of the error term in the prediction equation. The variances of the three groups are adjusted upward by the actual variance of the error for the continuously married group.

[46] In order to determine if the NLSY sample is representative of the 26-34 year olds in the census, the actual variances are compared. The NLSY measure is .5641, while the Census estimate is .5603.

The following table depicts the actual variances in 1980 and 1990 and the predicted 1990 variance for both the 26-34 year old subsample and the population as a whole.

Table 9 - Actual and Predicted Variances of Log Income

	1980 (actual)	1990 (actual)	1990 (predicted - no divorce)
NLSY subsample (26-34)	.6460	.5641	.4802
Entire population	.4552	.7804	.7514

The presence of divorce led to a 17.5% increase in the variance within the 26-34 year old group. When taken to the population as a whole, this translates into an increase of 3.9%. Alternatively, the presence of divorce can explain 8.9% of the increase in family income inequality.

Although small, this is certainly the most conservative estimate of the impact of divorce. This estimate assumes that only the 26-34 year old group is affected. Clearly if all age groups are similarly affected, the impact increases. Also, because the fraction of people divorced and remarried increases with age, and because the income distribution of people who have been divorced longer is more unequal, the impact will rise even more.

On the other hand, divorce has always been present, although in much smaller numbers. This analysis compares the present situation to one in which the divorce rate is zero. Decreasing the divorce rate to the 1980 level would decrease family inequality, though not by amount calculated above.

IV. CONCLUSION

This paper tests four implications of the model in which information about agents' wage and non-pecuniary inputs into marriage are revealed after agents marry for the first

time. Divorce occurs if, after discovering the actual values of these two variables, expected utility in marriage is lower than expected utility in divorce. Divorced agents may seek a remarriage partner in a market in which wage is observable but non-pecuniary characteristics are not.

This model makes three predictions which are tested in this paper. The correlation of incomes should be higher in second than in first marriages, the extremes of the income distribution should have significantly lower probabilities of remarriage, and these factors will lead to greater inequality in a world with rather than without divorce.

The analysis presented here finds no evidence against the conclusions of the theory. The increased divorce and remarriage rate in the United States since 1960 certainly has been a contributing factor for the increase in income inequality of families through the remarriage channel. Correlation of incomes in remarriage is higher than in first marriages and the probability of remarriage depends negatively in the income level. A conservative estimate of the effect of divorce on the income inequality of families shows that the effect of divorce accounts for 8.9% of the increase in inequality from 1980 - 1990.

FIGURES

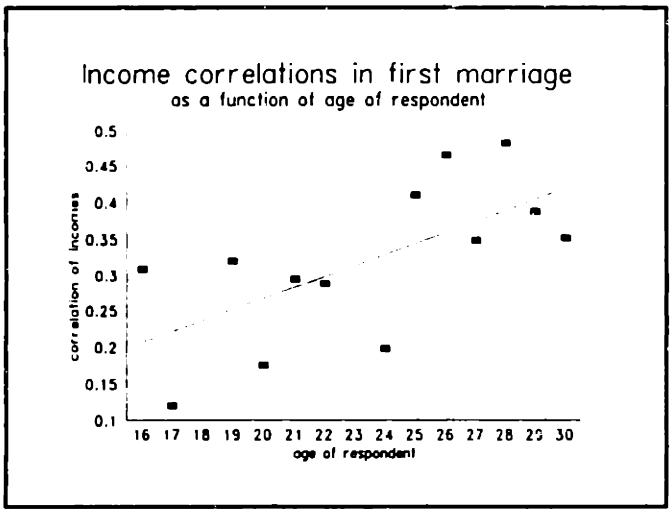

Figure 4- Correlation of Incomes in First Marriage by Age

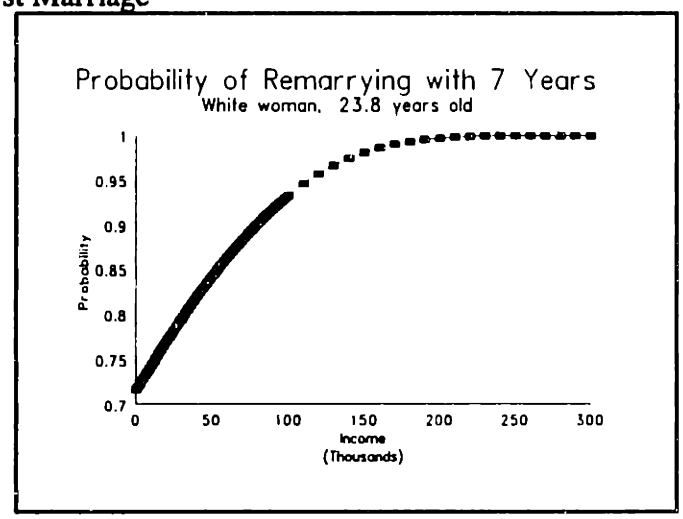

Figure 5

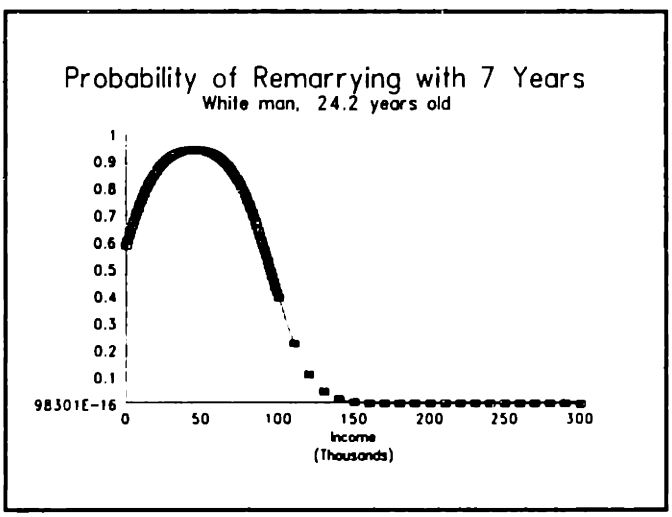

Figure 6

APPENDIX I

This appendix defines the variables as used in all regressions in this paper. It also provides tables of variable means and standard deviations by gender.

Black	=	1 if respondent is black.
Length of Marriage	=	number of months from first marriage to first divorce.
Number of Children	=	number of children under 18 in household at time of divorce. This does not indicate custody of the children because this information is not available.
Northeast time	=	1 if respondent lived in the northeastern United States at the of the divorce.
In Military time	=	1 if respondent reported to be a member of the military at the of the divorce.
Age at Divorce	=	age of respondent at the time of divorce in years.
Alimony/AFDC	=	1 if respondent received alimony or AFDC income in the year following divorce.
Real income real took income.	=	estimate of the real income of respondent in the twelve months following the divorce. Computed as a weighted average of the incomes in the year in which the divorce took place and the following year, weighted by the month in which the divorce place. The annual CPI is used to convert nominal to real
Income squared	=	real income X real income
First (second, third, fourth, fifth) quintile quintile	=	1 if respondent was in the first (second, third, fourth, fifth) of his/her gender as ranked by real income at divorce.

Variable Means for Women
(Standard Deviations in Parentheses)

	All Divorced Women	All Remarried Women
Black	.165 (.371)	.110 (.313)
Length of Marriage	55.66 (35.45)	49.67 (31.36)
Number of Children	1.02 (1.02)	.893 (.939)
Northeast	.103 (.305)	.072 (.258)
In Military	.012 (.109)	.018 (.133)
Age at Divorce	23.77 (3.50)	22.55 (3.29)
Alimony/AFDC	.220 (.414)	.194 (.396)
Real Income	8681 (12506)	8783 (15105)
First Quintile		.172 (.378)
Second Quintile		.215 (.411)
Third Quintile		.213 (.410)
Fourth Quintile		.222 (.416)
Fifth Quintile		.178 (.383)
Number of Observations	1073	557

Variable Means for Men
(Standard Errors in Parentheses)

	All Divorced Men	All Remarried Men
Black	.180 (.385)	.117 (.322)
Length of Marriage	50.71 (30.80)	44.66 (27.65)
Northeast	.094 (.292)	.088 (.283)
Age at Divorce	24.83 (3.068)	23.71 (2.887)
Real Income	13554 (10780)	14394 (10576)
First Quintile		.143 (.351)
Second Quintile		.198 (.399)
Third Quintile		.232 (.423)
Fourth Quintile		.232 (.423)
Fifth Quintile		.191 (.394)
Number of Observations	671	308

APPENDIX 2 - Alternative Specification of Hazard Model

This appendix provides results on an alternative method of analyzing the effect of income on remarriage probabilities. Income and income squared terms are used instead of dummy variables for income quintiles. Table 2-1 shows results for females and table 2-2 for males.

Table 2-1 - Cox Proportional Hazard Model for Females
(Standard Errors in Parentheses)

Black	-.728 (.158)	-.728 (.157)	-.733 (.148)
Northeast	-.304 (.186)	-.304 (.186)	-.423 (.178)
North-Central	-.074 (.138)	-.074 (.138)	-.205 (.126)
South	.165 (.123)	.165 (.123)	.067 (.107)
In military	1.100 (.341)	1.100 (.341)	1.069 (.339)
Age at divorce	-.054 (.022)	-.054 (.022)	-.047 (.016)
Number of children	-.0020 (.0607)	-.0020 (.0606)	–
Length of 1st marriage	.0026 (.0021)	.0026 (.0021)	–
Alimony/AFDC	-.291 (.134)	-.291 (.131)	-.186 (.113)
Real income (x 10^-6)	7.66 (7.33)	7.65 (3.12)	7.18 (3.29)
Income sqrd (x 10^-12)	-.051 (26.3)	–	–
Number of observations	900	900	962
Chi^2	62.53	62.53	65.64
Degrees of Freedom	11	10	8

Table 2-2 - Cox Proportional Hazard Model for Males
(Standard Errors in Parentheses)

Black	-.583 (.189)	-.575 (.188)
Age at Divorce	-.079 (.028)	-.076 (.023)
Real income (x 10^-5)	5.15 (1.21)	5.17 (1.2)
Income squared (x 10^-10)	-5.72 (2.22)	-5.77 (2.19)
Length of first marriage	.0007 (.003)	–
Northeast	-.144 (.230)	–
North-Central	.016 (.172)	–
South	.067 (.147)	–
Number of observations	606	607
Chi^2	43.53	42.83
Degrees of Freedom	8	4

APPENDIX 3

This appendix reports the results of the probit and Heckman-corrected prediction regressions used to predict family income inequality in the presence of no divorce.

The probit is used to generate the inverse mill's ratio which is used in the prediction equation to correct for sample selection bias. The dependent variable is one if the couple is still married in 1991 given that they are married in 1979, and zero if they are no longer married to each other. All right hand side variables are measured in 1979. The variables which are included in the probit but not in the prediction equation are dummy variables for church attendance, dummy variables for religious upbringing, dummy variables for current religious affiliation, and the divorce rate in the state in which the respondent lived at age 14.

Table 3-1 - Probit to Generate Inverse Mill's Ratio
(Standard Errors in Parentheses)

Wife's Income (* 10^-5)	-2.67	(1.21)
Husband's Income (* 10^-6)	7.50	(7.80)
Other Income (*10^-6)	4.96	(1.74)
Number of children	.0251	(.101)
Black	.255	(.0593)
Other race	.128	(.106)
South	.0425	(.0610)
Northeast	.374	(.0864)
North-central	.0836	(.0697)
Church Attendance - Not at all	-.0411	(.0681)
Church Attendance - Infrequently	.0287	(.0904)
Church Attendance - Once per month	.131	(.0853)
Church Attendance - 2-3 Times Per Month	.154	(.0742)
Church Attendance - Once Per Week	.140	(.0895)
Upbringing - No religion	-.124	(.147)
Upbringing - Protestant	.00729	(.110)
Upbringing - Roman Catholic	.156	(.142)
Upbringing - Jewish	-.650	(.926)
Practicing - No religion	-.00525	(.121)
Practicing - Protestant	-.00781	(.110)

Practicing - Roman Catholic	.0430 (.143)
Practicing - Jewish	1.55 (.980)
State Divorce Rate	-.0371 (.0187)
Constant	.658 (.158)
Number of observations	4558
Chi squared	140.05
Degrees of freedom	23

The church attendance variables are jointly significant with a Chi-squared of 13.73 with 5 degrees of freedom in a likelihood ratio test. Neither group of religious dummy variables is jointly significant at the five percent level. However, together, all religious variables have a Chi-squared of 25.6 with 8 degrees of freedom.

The following table shows results form the regression which predicts married family income based on 1979 variables and the sample selection term calculated from the probit above. The dependent variable is married family income for those couples that stayed married from 1979 to 1991. Note that the bias correction term is insignificant, suggesting little if any sample selection bias. White's method was used to produce robust standard errors.

Table 3-2 - Predicting Married Family Income
(Standard Errors in Parentheses)

Wife's Income	2.25 (.397)
Husband's Income	1.42 (.231)
Other Income	.477 (.0534)
Number of children	-4228 (1619)
Black	-6910 (1476)
Other race	-7474 (2243)
South	-4170 (1638)
Northeast	-146 (2511)
North-central	-3181 (1793)
Inverse Mill's Ratio (* 10^5)	1.51 (.838)
Constant (* 10^4)	5.70 (1.35)
Number of observations	2681
R^2	.1234

BIBLIOGRAPHY

Becker, Gary S., Elizabeth M. Landes and Robert T. Michael. "An Economic Analysis of Marital Instability." Journal of Political Economy 85 (1977): 1141-1187.

Bergstrom, Theodore and Mark Bagnoli. "Courtship as a Waiting Game." Journal of Political Economy 1101 (1993): 185-202.

Bergstrom, Theodore and Robert Schoeni. "Income Prospects and the Age at Marriage." 1992, mimeo.

Blackburn, McKinley L. and David E. Bloom. "Changes in the Structure of Family Income Inequality in the United States and Other Industrial Nations During the 1980s." NBER Working Paper No.4754, 1994.

Breslow, N. "Covariance Analysis of Censored Survival Data." Biometrics 30(1974): 89-99.

Bourguinon, F. and C. Morrison. "The Kuznets Curve and the Recent Evolution of Income Inequality in Developed Countries," mimeo.

Cherlin, Andrew J. Marriage, Divorce, Remarriage. Cambridge: Harvard University Press, 1992.

Danziger, Sheldon and Peter Gottschalk, eds. Uneven Tides: Rising Inequality in America. New York: Russell Sage Foundation, 1993.

Edward, Allen L. An Introduction to Linear Regression and Correlation. New York: W.H. Freeman and Company, 1976.

Ermisch, John F. Lone Parenthood: An Economic Analysis. Cambridge: Cambridge University Press, 1991.

Furstenberg, Frank F. Jr. and Graham B. Spanier. Recycling the Family: Remarriage after Divorce. Beverly Hills: Sage Publications, 1984.

Gale, D. and L.S. Shapely. "College Admissions and the Stability of Marriage." American Mathematics Monthly 69 (1962):9-15.

Galor, Oded and Joseph Zeira. "Income Distribution and Macroeconomics." Review of Economic Studies 60(1993): 35-52.

Johnson, William R. and Jonathan Skinner. "Labor Supply and Marital Separation." American Economic Review 76 (1986): 455-469.

Kalbfleisch, John D. and Ross L. Prentice. The Statistical Analysis of Failure Time Data. New York: John Wiley and Sons, 1980.

Katz, Lawrence F. and Kevin M. Murphy. "Changes in Relative Wages, 1963-1987: Supply and

Demand Factors." Quarterly Journal of Economics 107 (1992): 35-78.

Lam, David. "Marriage Markets and Assortative Mating with Household Public Goods." Journal of Human Resources 23 (1988): 462-487.

Mott, Frank L. and Sylvia F. Moore. "Marital Transitions and Employment." in The Employment Revolution edited by Frank L. Mott. Cambridge: MIT Press, 1982.

Murphy, Kevin M. and Finis Welch. "Inequality and Relative Wages." American Economic Association Papers and Proceedings 83 (1993): 104-109.

Perotti, Roberto. "Income Distribution, Politics and Growth." American Economics Association Papers and Proceedings 82(1992):311-316.

Peters, H. Elizabeth. "Marriage and Divorce: Informational Constraints and Private Contracting." American Economic Review 76 (1986): 437-454.

Shaw, Kathryn. "The Life-Cycle Labor Supply of Married Women and its Implications for Household Income Inequality." Economic Inquiry 30(1992):659-672.

Sprague, Alison. "The Duration to Marriage: An Empirical Analysis." Oxford Applied Economics Discussion Paper 104, 1990.

U.S. Bureau of Census, Statistical Abstract of the United States: 1992 (112th ed). Washington DC: 1992.

CHAPTER 3 - AGE AT MARRIAGE AND THE CORRELATION OF HUSBAND AND WIFE EARNINGS

Nearly fifty percent of the increase in family income inequality among married couples from 1979 to the present can be explained by the increase in the correlation of husbands' and wives' incomes (Blackburn and Bloom, 1994).[47] Clearly, the single largest contributor to this increased correlation is the increase in the percentage of women who work outside the home, the largest increases in labor force participation being experienced by those women married to high income husbands (Cancian, et al, 1993). This increase in women's labor force participation means that even if couples aren't matching more closely in terms of observable characteristics or hours worked, conditional on working, the correlation of spousal incomes still increases. However, this increase in labor force participation only explains around 33% of the increased correlation of incomes (Cancian, et al, 1993). The remaining increase in correlation is described by Cancian, Danziger and Gottschalk as an "upward drift".

In studying trends in assortative matching among dual-earner couples, one possible contributing factor to the increase in correlation is the increase in the average age at marriage seen in the U.S. since the 1960's. The average age at marriage has increased by about 4 years for both females and males from 1970 to 1988. It is possible that individuals marrying at later ages have a greater attachment to the labor force and hence have a lower elasticity of hours worked or labor force participation probabilities to their spouse's income. Furthermore, if information about a person's earning ability is revealed slowly over her lifetime, then individuals who prefer positive assortative matching on incomes are better able to do so at higher ages, leading to higher correlation of incomes even among the couples in which both partners work outside the home. This paper looks at two links between age at marriage and increased correlation. First, is the increased age at marriage associated with greater labor market attachment of women? Second, can the timing of marriages shed light

[47]This is measured as the percent increase in the coefficient of variation that can be explained by the observed increase in the correlation coefficient between husband and wife earnings.

on the "upward drift" in the correlation of earnings for two-earner couples?

The remainder of the paper is organized in the following way. Section I discusses relevant facts about family income inequality, the correlation of interspousal earnings, and the trends in the age at marriage. Section II provides the theoretical background for the link between age at marriage and correlation of interspousal earnings. Section III discusses the data. Section IV presents descriptive statistics and results from regression of interspousal correlations on age at marriage as well as other factors and Section V concludes.

I. Facts on inequality, correlation and the age at marriage

A number of authors have documented the increase in family income inequality and have decomposed it. Blackburn and Bloom (1994) broke down the increase in family income inequality of married couples into the percent associated with changes in the husbands' income inequality, change in the wives' income inequality, and changes in the correlation of husband and wife incomes. Holding all factors but the increased correlation of interspousal earnings constant would have increased inequality of family income by approximately 50%. In a similar calculation, holding all factors but the change in the inequality of husbands' incomes constant would have increased inequality by roughly 60%. Lastly, had everything but the inequality of wives' earnings remained constant, the authors estimate that family income inequality would have decreased by 20-38%.

Cancian, Danziger and Gottshalk (1993) documented a significant increase in the correlation of spousal earnings from 1968-1988. For white couples, this correlation rose from -.044 to .091 during that time. Although much of the rise was due to the increased labor force participation of women, the correlation still increased 55% among those couples with working wives.[48] The authors refer to the increase in correlation which is not associated with increased participation of women as an "upward drift" in correlation.

[48]The correlation of spousal incomes rose from 0.101 to 0.155 for dual-earners.

Blackburn and Bloom (1994) focus further on the increased correlation of incomes between spouses and decompose the increase into changes in the husband and wife correlation for various components of earnings. These components are the log of wages, log of hours, and an indicator variable which is equal to one for individuals with positive earnings. From 1979 to 1987, the correlation of the log of husband's and the wife's wage and the corresponding correlation of the indicator variable rose 40% and 50% respectively. Blackburn and Bloom find no significant change in the correlation of the logs of the husband's and the wife's hours for those who did work. These results suggest that the "upward drift" in correlations is due to an increase in the correlation of wages, and that the additional increase in the correlation of all couples is due to an increase in the correlation of labor force participation between spouses.

A number of studies show that people are delaying marriage. Table 1 shows various statistics about the mean ages at marriage for different groups by previous marital status and breaks down the percent of all marriages by previous marital status (Vital Statistics, 1970-1987). The first row depicts the rising age at marriage for both women and men which increased 4.5 and 4.2 years respectively from 1970 to 1987. The second and third rows of Table 1 look separately at the mean age of first marriage and remarriage for women and men over time. The mean age of first marriage for women and men has increased 3.1 and 2.6 years respectively, which, although a significant increase, is not as large as the overall increase in the age at marriage. The mean age of remarriage has not shown continuous trends over this time period. The fourth and fifth rows look separately at the mean age of remarriage for those previously widowed and those previously divorced. The mean age of remarriage for those previously divorced shows first a decrease and then an increase since 1980. The mean age of remarriage for those previously widowed has shown a general increasing trend from 1970 to 1987.

Besides the rise in the age of first marriage, the second large component of the increased mean age at marriage is the changing composition of the group marrying in a given year. In 1970, approximately 78% of both men and women marrying were previously unmarried. By 1987, that figure had decreased to 65%. At the same time, the percent of

those marrying who were previously widowed also saw a steady decline. The percent of marriages in which the person was previously divorced rose from 16.9% to 27.2% for women and from 17.8% to 27.6% for men, a 61 and 55 percentage increase respectively. As the marrying population switched from being almost exclusively first marriages, with low mean ages at marriage, to being increasingly comprised of previously divorced persons, the mean age at marriage increased.

II. Theoretical Background

An increase in the mean age at marriage may increase the correlation of wages if better information about an individual's labor market potential is revealed slowly over time. Bergstrom and Bagnoli (1993) develop a model in which the age at first marriage depends positively on one's expected future earnings. If the relative desirability of an individual is revealed slowly, those who do not expect to have high future earnings marry young to enjoy the additional utility associated with marriage. If both men and women participate in the labor market and their desirability as a marriage partner is, in part, dependent on their wage, then both men and women behave in this way. Among the group marrying at a young age, matching on income is random since it is unobservable at this age, so the correlation of incomes is low. Those individuals who expect to earn high incomes delay marriage until the market is able to observe their high ability, either through many years of schooling or through excellent performance in the labor market. This delay is optimal if the additional utility gained by waiting and getting a higher quality spouse offsets the foregone utility of marriage. These men and women pair up perfectly with respect to income; thus the correlation is high. Therefore, this model clearly predicts that the correlation of the incomes of husband and wife rises as the age at marriage rises.[49]

It is also quite possible that the rising age at marriage is otherwise related to the increase in the correlation of incomes, independent of the increased information effect. An

[49]Of course, the most obvious conclusion of this model is that mean permanent income rises with age at marriage. This hypothesis is tested and not rejected in Bergstrom and Schoeni (1992).

increase in the mean age at marriage may also be associated with a decrease in the elasticity of women's labor supply with respect to their husband's income, in other words, with an increase in the correlation of hours worked. This hypothesis would hold if both the age at marriage and educational attainment are joint decisions, and the elasticity of the wife's labor supply with respect to her husband's income is a negative function of her education. Then, women who seek more education both marry later and are less responsive to other household income when making labor supply decisions. Furthermore, another reason this would hold is if women who marry at later ages have higher probabilities of participating in the labor force, regardless of their husband's employment status, because of their attachment to the labor force or previous human capital attainment.

Although Bergstrom and Bagnoli (1993) limit their predictions and empirical work to first marriages, remarriage has additional implications for the correlation of incomes, independent of the age effect. Meyer (1995) models the first marriage and remarriage processes which results in a correlation of incomes in remarriage that is higher than that in first marriages because information about wages is revealed slowly over time. Furthermore, in remarriage, high income may be a signal of high non-pecuniary inputs into in marriage. This may lead to increased correlation of incomes in remarriage, independent of the pure age effect.

III. Data

The data used for this study is from the Panel Study of Income Dynamics (PSID) from 1968-1986. In following many families with heads of household of all ages over time, this data set is ideal for this type of analysis. The only drawback of the PSID is limited marital history information. Questions about the individual's last and first marriage are only asked in 1986, and recurring marital history questions are only asked about the head of the household, who is not necessarily the same individual from year to year.

The income measure that is used for husbands and wives in this study is total real labor income (in 1983 dollars) which includes wages, bonuses, overtime and commissions,

as well as the labor part of farm, business, professional practice, rental and market gardening income. This is reported separately for heads of household[50] and wives in the PSID.

In order to look at long run trends as well as life-cycle and age at marriage effects, each head of household's last or current marriage was observed and his own earnings and his spouse's earnings were discerned for every year of that marriage that fell between 1968 and 1986. Each couple-year was treated as an observation. The sample was further restricted to those heads of household whose age at marriage and current age was between 18 and 64, because the focus of this paper is on families with prime age heads of household. This results in a sample of 34323 couple-year observations, with 21752 observations in which both spouses have positive labor income.[51]

This sample of couple-year observations is then broken down into cells. First, to find the univariate relationships between the correlation of spousal earnings and several explanatory variables, the sample is divided into cells, first by age at marriage, then by year, and subsequently by current age. Within cell correlations of earnings can then be calculated by age at marriage, by year, and by current age.

Following the univariate analysis, the original sample is divided into cells by three variables: age at marriage, current age and current year. Age at marriage is grouped into 6 categories: 18-21, 22-25, 26-29, 30-39, 40-49, and 50-64. The first several break points coincide with events which are indicators of the information available about a person's permanent income, including completion of high school, completion of college, and initial work experience. The older age at marriage groups cover a wider span of ages because of the limited number of observations available at those ages. Current age is also organized into six groups: 18-21, 21-30, 31-40, 41-50, 51-60 and 61-64. The current year is arranged in five groups: 1968-1971, 1972-1975, 1976-1979, 1980-1983, and 1984-1986. This, then results in 140 possible cells. However, some of the cells do not have sufficient observations

[50]In this study, for consistency, the husband will be called the head of the household.

[51]This corresponds to 3196 different couples. The average couple is observed 10 times.

to generate a sample correlation. The number of cells for which there is a sample correlation of earnings is 128.

The drawback of this sample of couple-years is that it is non-random with respect to length of marriage. The PSID asks individuals the following questions in 1986: (1) In which year did your current/last marriage begin? (2) In which year did your current/last marriage end? Data on earnings and other variables are available for the husband and the wife in each year of the sample (1968-1986). Therefore, looking only at the heads of household in 1986 results in a random sample. However, using observations from only one year precludes analysis of the effect of a time trend on the correlation of interspousal earnings. Looking at the heads of household in 1968 leaves out one group who was married in 1968 because the marital history question was only asked in 1986: those who have divorced and remarried between 1968 and 1986. Since those individuals who divorce have lower correlations of income than those who stay married (Meyer, 1995), the sample in 1968 displays a higher correlation than was actually the case in that year. In terms of the following figures, in which the correlation is computed by year for couples observed that year, this fact tends to understate the effect of the year of observation on correlation of spousal earnings. When using this data in regressions, the predicted length of the entire marriage is included as an additional explanatory variable to adjust for this.[52] The benefit of using the sample which is comprised of all couple-year observations is that there are enough observations in each age at marriage, current age, and year cell (as defined above) to have within cell correlations that are significantly different from zero. Additionally, the pure time trend can be separated from the age at marriage effect when using couple-years from 1968 to 1986.[53]

---

[52]Predicted length of marriage is used because the actual length of marriage may be a function of the correlation of incomes, thus making it an endogenous variable. Religious variables are the instruments in the first stage regression to predict marriage length. The hypothesis that all of the coefficients on the instruments are equal to zero is rejected (p-value $< 1 \times 10^{-31}$).

[53]An alternative strategy is to use each couple as an observation and look at the correlation of permanent incomes. However, in that case, the time trend in correlations cannot be estimated.

VI. Results

The results section is divided into five parts. First, descriptive statistics about the sample as a whole and by age at marriage are presented. Second, regressions are presented which shed light on which factors influenced the increasing correlation of interspousal earnings. Third, the correlation between spouses' labor force participation, wages, and hours is discussed. Next, the interspousal correlation of wages is further disaggregated into the correlation of predicted wages and wage residuals. Finally, the correlations between spouses of those variables used to predict wages (age, education, occupation and industry) are analyzed.

A. Descriptive Statistics

In order to get a broad perspective on characteristics by age at marriage, Tables 2 and 3 show the means of several important variables. The sample of all couples is summarized in Table 2, while Table 3 shows statistics for couples in which both members had positive labor income during the year (dual-earners). In each table, the first column of numbers shows means for the entire group, while the following six columns show within group means by the husbands' age at marriage.

Looking at Table 2, it must be the case that the husband's age at current marriage increases from left to right in the table because that is the variable by which the entire sample is grouped. The wife's age at current marriage also increases, but not by as much as that of the husband. This reflects the fact that men generally marry women who are younger than themselves, and that, as the husband's age at marriage increases, the age gap between husband and wife tends to increase. Alternatively, these trends can be seen in the mean values for current age of the husband and wife. Again, as the husband's age at marriage increases from left to right, the age gap widens.

With respect to earnings variables, Table 2 demonstrates that the real labor income and real wages of both the husband and the wife increase with husband's age at marriage up

to an age at marriage of 30 years. This is consistent with a model of marriage in which individuals who expect to have higher earnings marry later in life (Bergstrom and Bagnoli, 1993) and is consistent with the empirical results of Bergstrom and Schoeni (1992). The decreasing labor income of those who marry after the age of 30 is due partially to the fact that these cohorts are increasingly made up of remarriages in which this "lemons" effect in the first marriage market is not relevant. Furthermore, the level of education is generally decreasing with age for those over the age of 35. The hours variable for men, on the other hand, shows a steady decline with age at marriage while the hours variable for women exhibits a inverted u-shaped profile. This shape profile is also seem in wife's wages.

Demographic variables differ across cohorts by age at marriage as Table 2 shows. Blacks make up an increasingly large proportion of those marrying at later ages with the exception of the youngest cohort, who has an above-average proportion of blacks. "Other race" individuals are also least well represented in the 22-25 age group. This may be because these individuals are marrying shortly after college, many presumably to people they met while in college. Since blacks and hispanics tend to have lower college attendance than do whites, these types of "post-college" marriages would be less common. The large proportions of old-age marriages which are black suggest that blacks may remarry more often than do whites.

Variables relating to the marriage of the couple also vary across age at marriage groups. The length of the current marriage is naturally a decreasing function of age at marriage. The number of marriages variable suggests that the majority of those marrying in their twenties are marrying for the first time. Those people marrying in their forties and fifties are usually remarrying. The number of children in the household is highest for the youngest marrying group since early marriages are associated with a greater number of fertile years. For those marrying after the age of 30, often remarriages, children from a previous marriage are frequently in the household.

Lastly, Table 2 outlines the educational attainment of husbands and wives by age at marriage. Women marrying at later ages are more likely to have college degrees until the

age at marriage is above 30. Often, marriage is delayed until a certain educational goal is met. At marriage ages above 30, a large percentage of the cohort are in subsequent marriages, and thus education is not a reason for their late age at marriage. For men too, a similar pattern emerges for college graduates in which marriage is deferred until college is finished. In the last row of Table 2, the number of observations in each group shows that 82.1% of those married got married while in their 20s, 12% were in their 30s, and 6% were 40 and above.

Table 3 shows the equivalent means for those couples in which both members had positive labor income during the year. The patterns are similar to what was evident in the entire sample (Table 2) with the following exceptions. The difference between the mean ages of husband and wife are slightly higher in the dual-earner sample. The mean labor income of the wife is, of course, higher as are the hours worked. The real wage of husbands is lower in the dual earner sample for each age at marriage cohort, suggesting a significant elasticity of women's labor force participation with respect to her husband's wage. The marriage length is consistently lower in the dual-earner group, as are the number of children. Both variables, however, show trends similar to the whole sample.

Figures 1, 2 and 3 show the correlation of earnings by year, age at marriage and current age without controlling for other factors.[54] As Figure 1 clearly shows, the correlation of earnings has risen over time. Since the marriage length bias in the sample would tend to influence the results in the opposite direction, this result is even more striking. In Figure 2, it can be seen that the correlation of earnings also rises significantly with age at marriage. The correlation of earnings increases from .01 for those aged 18-20 to .1948 for those individuals who are 51-60. The largest correlation, seen in the 61-64 age group, is probably due to early retirements in which both individuals have low labor incomes, thus are highly correlated. The largest increase aside from this early retirement effect, both in percentage and absolute terms, occurs between the 21-30 and 31-40 age groups. This is consistent with an information story since this is the time period in which individuals learn

[54]At this point, those remarrying are not separated from those marrying for the first time.

the most about their future income streams. They not only complete their human capital accumulation, but also are able to observe the residual part of wages not explained by age, education or other demographic phenomena.

When looking at current age and the correlation of earnings in Figure 3, a life-cycle pattern emerges. When husbands are under 30, it is more likely that both husbands and wives work, and, as a result, have relatively high correlations of earnings. Women are most likely not to work when they are in their child-raising years. This is seen in this bar chart as a low correlation of husbands and wives' earnings when the heads of household are 31 - 40 years old. As children move out of the household, many women return to the labor force, and the correlation again rises.[55] Because of the baby boom generation, demographics alone would predict declining correlation when the baby boom women entered their 20s (1970 - 1985) with increasing correlation when they turned 40 (1990 and thereafter).

B. Correlation of Interspousal Earnings

To get a complete description of the trends in Figures 1 to 3 and their effects on the correlation of earnings, two things are done. First, the observations are grouped by the (current age, current year, age at marriage) cells described earlier and a within cell correlation is calculated. Second, regressions are run using the within cell correlation as the dependent variable.[56] In each case, the mean length of the current marriage in the cell is also included in the regression to control for the sampling bias explained earlier. To see whether the trends in correlation are a result of other demographic and marital trends, a second regression is run with the previously mentioned variables and two additional cell

[55]This is consistent with Lehrer and Nerlove(1981).

[56]To check that these results are not driven by the [0,1] support of the correlation coefficient, similar regressions were run with the log-odds ratio as the dependent variable (ln(c/(1-c))). In general, the results are robust to this specification. Where differences in sign or significance occur, they will be noted. An additional alternative is to use the individual level data and construct some measure of the distance of spousal incomes as the dependent variable. This has been done using the husband's income minus the wife's income divided by the average of their incomes as the dependent variable. The basic conclusions are also robust to this specification.

means. The mean number of children may shed light on whether or not the u-shaped age effect that is seen in Figure 3 is due to changing labor force decisions based on child-rearing. The proportion of the cell that is black indicates whether there are racial differences in the correlation of husband and wife earnings. Several authors have found that blacks have significantly different marital pattern than whites and generally have higher correlations of husband and wife incomes (Lehrer, Nerlove, 1981).

Because the dependent variable in the regressions is a sample estimate of within-cell correlation, the error of which varies across observations, heteroskedasticity is an issue in estimation.[57] However, since the sample variance of the dependent variable is known, weighted least squares can be used to produce efficient estimates.[58]

Table 4 presents the results of regressions in which the within cell correlation of earnings is the dependent variable. The first two columns show results from the full sample. The last two columns were calculated using only couples in which both spouses had positive labor income during the year in order to examine more closely the "upward drift" in the correlation of spousal incomes for dual-earner couples. For each sample, two specifications are used. In the first column, the only regressors are a set of dummy variables for age at marriage, current year, and current age along with the mean length of marriage. In the second column, the mean number of children per household and the percent black in the cell are included as additional variables.

As seen in Table 4, age at marriage has a significant positive influence on the correlation of spousal earnings in the entire sample in both specifications. An increase of the mean age at marriage for husbands from 24 to 28 years of age corresponds, in this sample, to an increase in correlation of between 0.04-0.06. This confirms the univariate

---

[57]The fact that some of the regressors are within-cell sample means also results in an errors-in-variables problem (Deaton, 1985). Because the average cell size is very large (202), however, the error in measuring the mean is very small, and will therefore not be corrected (see Verbeek, 1992).

[58]The sample variance of a correlation = $(1-\rho^2)/(n-2)$, where ρ is the correlation and n is the number of observations.

relationship between correlation of earnings and age at marriage found in Figure 2. One explanation for the effect of the age at marriage is that more information on income is available to older potential marriage partners. Controlling for age at marriage and current age, there is also a positive time trend in the correlation of earnings from 1968 to 1986. The estimates show that the time effect itself would have increased the correlation of incomes by 0.51-0.59. The current age dummies show that in the first specification, those heads of household who are 31-50 years old have significantly lower correlations than 18-21 year olds. This may be explained by the fact that couples in their child-raising years are more likely to have traditional divisions of labor in their marriages, leading to low correlations, and can be seen in the second specification in which the presence of children has a negative effect on the correlation of earnings. Furthermore, controlling for the mean number of children, the effect of current age is never significantly different from the omitted group, further strengthening the explanation that the age effect seen in Figure 3 is due to child-raising. Couples with children are more likely to have one person who does not work outside the home or who works reduced hours, thus lowering the interspousal correlation. The predicted value for the length of marriage has a positive coefficient. This is consistent with the hypothesis that higher correlations of labor income lead to longer marriages.

The last two columns in Table 4 present results from the dual-earner sample. This is the group which experienced the "upward drift" of correlations documented by Cancian, Danziger and Gottschalk (1993). The age at marriage is a positive and significant influence on the earnings correlation in the first specification (column 3). The point estimates imply that the increase in the age at marriage which was seen from 1968 to 1986 would have resulted in an increase of 0.12-0.13 in the correlation of earnings, a much higher value than in the whole sample. This suggests that the age at marriage is a factor in explaining the "upward drift" of correlations. The year dummies show a positive time trend in the correlation of earnings as in the full sample. In the dual-earner sample, the point estimates imply that correlations would have increased by 0.73-0.77 due to the time trend itself, again a slightly higher estimate than for the sample as a whole. The point estimates are not significantly different between the two samples. As in the entire sample, dual-earner couples in the child-raising years have lower correlations of labor income, and this effect can clearly

be seen by the negative coefficient on the mean number of children. However, in the dual-earner sample, the point estimate on the mean number of children variable is lower and not significantly different from zero, suggesting that the largest effect of children on the correlation of labor incomes may be through the participation decision. The mean length of marriage does have a larger effect in the dual-earner sample.

C. Correlation of Interspousal Participation Rates, Wages and Hours

The next level of the analysis investigates the effects of current age, age at marriage, or time trends on the correlations of the three components of total labor income: employment probabilities, hours and wages. In order to look at participation decisions, an employment indicator variable is generated which equals one if the person had positive labor income during the year. The correlation of interspousal participation rates and hours is examined for the entire sample. Then, to further analyze the "upward drift" in the correlation of earnings which cannot be associated with increased labor force participation of women, hours and wages are analyzed for the dual-earner sample.

Table 5 presents the results of regressions with the within cell correlations between spouses of the employment indicator and hours for all couples as dependent variables respectively. As in the previous two tables, results are shown for two specifications: one in which only sets of dummy variables for age at marriage, current year, and current age, as well as the mean length of marriage within the cell are regressors, and another in which cell means of demographic and marital history variables are also included. For the hours regression, an additional specification is included in the last two columns to address the observed time trend. In the regressions in which the correlation between spouses of the employment indicator variable is the dependent variable, only the percent black in the cell is significant in either specification. The sign is negative indicating that blacks have a

significantly lower correlation of the participation decision than do whites.[59]

Columns 3 and 4 in Table 5 present the results of regressions with the interspousal correlation of hours worked as the dependent variable. Age at marriage has a positive and significant effect in both specifications. The effect of the increased age at marriage is estimated to have increased the correlation of husband and wife hours by 0.09-0.11. This is consistent with the theory that those marrying at later ages have more information on the potential partner's earnings specifically with respect to information that could not have been discerned at a younger age, which includes hours worked.

In the first specification for hours worked (column 3), the dummies for the 1972-1975 and 1976-1979 periods (relative to 1968-1971) are significant and negative. Dummy variables for later year periods are insignificant. A similar effect is seen in the second specification (column 4) with only the 1972-1975 dummy being significantly different from the omitted years (1968-1971).[60] One possible explanation is that macroeconomic differences between the years, particularly variations in the unemployment rate, could be driving these results.[61] In order to test the possibility that changes in the national unemployment rate were the root cause of this time trend, the mean male and female unemployment rates during the cell time period were added as regressors. Since time dummies would be collinear with these mean unemployment rates, the mean year of the cell, as well as the squared and cubic of the mean year were entered as regressors instead of the set of year dummies. The results of these regressions can be found in columns 5 and 6 of

---

[59]The coefficient on black in the employment indicator regression is significant and negative in spite of the fact that generally, the correlation of spousal earnings among blacks is significantly higher than among whites (Lehrer and Nerlove, 1981). In my sample, the percent black is insignificant in explaining the correlation of interspousal incomes.

[60]Note that in the log-odds ratio specification discussed previously, the year dummies were insignificant (not reported).

[61]When looking at these time periods, two unemployment trends emerge. First, the unemployment rate was higher during 1972-1975 than in the omitted years (6.2% vs 4.5%). Furthermore, until 1981, the female unemployment rate was consistently higher than the national rate. After 1981, this is no longer the case.

Table 5. All year variables in this regression were insignificant when unemployment rates were added. The coefficient on the male and female unemployment rates were jointly significant (p-value=.0057). The trends in age at marriage and current age were robust to these specification changes.

Current age has no significant effect on the correlation of hours in either specification (columns 3 and 4). As in the correlation of employment indicator variables, the percent black in the cell has a negative and significant effect on the correlation of husband and wife hours.

Table 6 presents the results of the regressions of the correlations of interspousal wages and hours within the dual-earner group. In this analysis, the main focus is on explaining the "upward drift" in the correlations of husband and wife earnings that cannot be explained by the increase in women's labor force participation. In the dual-earner sample, age at marriage does not have significant effects on the correlation of wages of husband and wife in either specification. As section IV part E shows, one reason for this is because the age at marriage has opposing effects on the correlation of predicted wages and the wage residual.[62] Age at marriage negatively affects the correlation of predicted wages, but positively affects the correlation of wage residuals. Current age, as well, shows no effect in either specification.

Column 1 of Table 6 shows that the current year has negative and significant effects for 1972-1975 and 1976-1979 relative to the omitted years (1968-1971). All other year periods show insignificant effects in the first specification, and all year periods are individually insignificant in the second specification.[63]

---

[62]In the log-odds ratio specification, the age at marriage had a significant and positive impact on the correlation of interspousal wages. The point estimate indicates that the increase in the mean age of marriage seen in the population would have resulted in an increase of 0.02 in the correlation of spousal wages.

[63]The unemployment rates for males and females cannot explain this time trend.

As in the analysis of the correlation of hours in the entire sample, the correlation of hours within the dual-earner group is positively and significantly affected by the age at marriage, when looking at the full specification. The included years have a negative effect on the correlation of hours when compared with the omitted years, 1968-1971. As in the entire sample, the unemployment rates for males and females are added in columns 5 and 6, and their addition makes the year variables insignificant.[64]

D. Correlation of Interspousal Predicted Wages and Wage Residuals

In order to analyze the effect of the age at marriage on the correlation of the observable and unobservable parts of the wage, a wage equation was estimated for both husbands and wives, in which the individual's wage was regressed on observable variables.[65] Correlations of the predicted wages and the wages residuals were then calculated within each cell for dual-earner couples, and these correlations were regressed first only on dummy variables for age at marriage, current age and current year, and also on the mean marriage length, and then on these variables plus the demographic and marital history cell mean variables (Table 7). These results are useful because they further break down the correlation of wages into the correlations of observable and unobservable characteristics. The wage residual provides a measure of unobservable characteristics which influence the wage, such as effort and personality traits. If this is better estimated at higher ages by potential marriage partners, then the largest effect of age at marriage on the correlation of spousal earnings should be seen here. In fact, the results show that while marital age positively affects the correlation of the wage residual, it has a negative impact on the

[64]An alternative specification (not reported), in which the individual data is used and the dependent variable is a measure of the distance between spousal incomes shows one interesting result which is different from the cell method. A dummy variable which equals one if the head of the household is in his first marriage is has a positive and significant effect on the correlation of wages. This is consistent with the theory that couples are more highly correlated with respect to earnings in remarriage than in the first marriage, not only because of the higher age, but also because the potential remarriage partner receives some information about the person's non-pecuniary inputs to marriage, conditional on his or her income. This effect, independent of the age effect, would cause increased assortative matching in remarriage (Meyer, 1995).

[65]Results of the estimation can be found in Appendix 1.

correlation of the predicted wage. This is likely due mostly to a decrease in the correlation of spousal ages as the age at marriage increases, as the next section shows. This result provides support for the hypothesis that the age at marriage positively affects the correlation of earnings because more information on labor income, besides that which can be observed quickly such as age and race, is observed as the person's age increases.

Neither the correlation of predicted wages nor the correlation of the wages residuals show significant time trends in the dual-earner sample. Current age has a positive effect on the correlation of predicted wages but no effect on the correlation of residuals. The number of blacks in the cell negatively affects the correlation of predicted wages but positively affects the correlation of residuals. Results from section E indicate that the negative impact on predicted wages may be due to the fact that blacks have a lower probability of being in the same occupation as their spouse than do whites. A large number of children predicts increased correlation of predicted wages but is insignificant in predicting the correlation of residuals. Lastly, the predicted length of marriage has a positive impact on the wage residual correlation, suggesting that the most successful marriages are not those in which observable characteristics are most closely matched, but those in which effort and other unobservables are similar between the spouses. This further supports the Becker (1981) theory that divorce occurs because of information gathering about unobservables in marriage.

E. Correlations of Characteristics

In order to look more closely at the interspousal correlation of predicted wages, correlations of the various regressors in the wage equation are analyzed. Table 8 shows the results of regressions in which the interspousal correlation of ages and years of education, respectively, is the dependent variable.

The correlation of husband and wife ages is significantly influenced by the age at which they marry. Men who marry later in life have significantly lower correlations of ages with their spouses. The point estimates imply that a man marrying in his forties has a correlation of ages which is 0.28-0.61 lower than a similar man marrying when he is 18-21.

This happens because men generally marry women who are younger than themselves and the difference in ages between the husband and the wife rises by age at marriage (see Table 2). The effect of current age on the correlation of ages is positive.[66] This is most likely because older individuals married at a time when people married at closer ages.

With the correlation of the education as the dependent variable, dummy variables for 1972-1975, 1976-1979, and 1980-1983 have a positive effect with respect to the omitted year period (1968-1971), in the first specification. Additionally, those who marry at the ages of 22-25 have significantly higher correlations of education than do those marrying at the ages of 18-21. Presumably, this is because the 22-25 year group met while in college, and thus both have similar education levels. In both specifications, those aged 41-50, 51-60 and 61-64 each have significantly higher correlations of education than those aged 18-21. This is likely because the older age groups have been able to complete their desired level of human capital. The presence of children has a positive and significant effect on the correlation of education. It is not clear from this analysis whether couples who are more highly correlated with respect to education have more children or that those couples who have many children increase their human capital accumulation.

Lastly, the occupations and industries of the two partners were examined to see what variables affected the similarity of occupational and industry choice between two marriage partners. Since it does not make sense to think about a correlation of occupations in the same way as a correlation of earnings, a variable was created in the complete sample (each observation is now a couple-year as opposed to a cell) which equalled one if both partners were in the same industry and zero if not. Similarly, another variable was generated which was equal to one if both partners were in the same occupation and zero if not. The effects of the age at marriage, age of the head of household, year, race dummies, the number of children, the predicted marriage length and the number of marriages of the husband were then estimated using probit for each of these two variables. Results of these estimations are found in Table 9.

---

[66]Note that this is not a statistical artifact since $Corr(x,y)=Corr(x+n,y+n)$.

The husband's age at marriage has a positive effect on both the probabilities of being in the same industry and in the same occupation. This, in turn, should increase the correlation of wages since dummy variables for the industry and occupation significantly influenced wages in the wage prediction equation (Appendix 1). Recall however, that the correlation of ages fell dramatically by age of the husband, and thus, the correlation of predicted wages also fell with higher marital age. This positive occupation and industry effect was not sufficient to overcome the age effect.

The current age of the husband has a positive effect on the probability of the partners being in the same industry. This suggests that as people grow older, they are more likely to switch into their spouse's industry than to leave. The time trend, as measured by the current year, only affects the probability of being in the same occupation, but not the same industry. The effect on occupation is not surprising since there has been an increase over time in women entering traditionally male occupations. The two race variables have opposite effects. Relative to whites, blacks are more likely to be in the same occupation, while hispanics and other minorities are more likely to be in the same industry. This latter result is probably because of the large concentrations of new immigrants in particular industries.

The results suggest that couples with long marriages are more likely to be in the same industry but in different occupations. Furthermore, couples with children are less likely to be in the same occupation. This is probably because, as couples have children, one often looks for a part-time or otherwise more flexible job. Lastly, as the number of marriages increased, couples are less likely to be in the same occupation, but more likely to be in the same industry. This may be because later marriages occur at a time when one's social life may revolve around the people with whom one works, who are definitely in the same industry but not necessarily in the same occupation. On the contrary, people who meet in college, whose social life may revolve around the people in their classes, may be more likely to meet someone who is later in the same field or occupation, as opposed to the same industry.

Lastly, Table 10 shows the mean effects of the changes in time and in age at marriage that society has seen from 1968 to 1986 on the probabilities of being in the same occupation and the same industry. Holding all other factors constant, going from 1968 to 1986 and increasing the age at marriage from 23.8 to 28.0, results in an increase in the probabilities of being in the same occupation and industry of .21 and .01 respectively. However, breaking this down into the year and age at marriage effects separately shows clearly that the rising age at marriage has had virtually the same effect on both probabilities. Table 10 also documents that the larger impact, by far, on the probability of being in the same occupation is seen in the time trend, which is most likely due to the decreased segregation of occupations by gender.

V. Conclusion

This paper has provided evidence that the demographic trend of a rising age at marriage does have an impact on the increased observed family income inequality through the increased correlation of husband and wife earnings. When looking at all couples, the age at marriage positively and significantly affects the spousal correlation of hours worked, suggesting that those individuals who marry at higher ages are not as responsive to their spouse's labor income when making their labor supply decision. Perhaps they have a greater attachment to the labor force, since most of them worked during their single years and their delay of marriage enabled them to complete a large amount of schooling before entering marriage.

In the case of dual-earner couples, the impact of age at marriage on the correlation of interspousal earnings is seen mainly in the correlation of hours worked and in the increased correlation of wage residuals. This finding supports the hypothesis that individuals prefer positive assortative matching on wages and receive better information about the unobservable component of the wage over time. More information about this residual is obtained at later ages because a potential spouse is able to observe the person's effort and personality traits associated with higher wage residuals.

Taken together, the results obtained in this analysis clearly show, however, that the age at marriage does not completely explain the increase in correlations that we see. There is still a significant effect of a time trend on the correlation of interspousal earnings, both for all couples and for the dual-earners. Further work, careful to look at the joint educational and marriage decisions of women as a function of macroeconomic variables and expected income streams may be able to shed some light on the remaining increases in correlation that we observe.

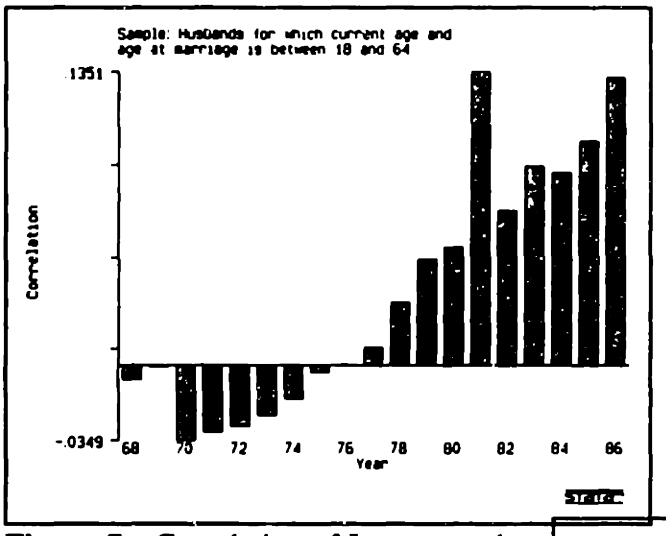

Figure 7 - Correlation of Interspousal Earnings by Current Year

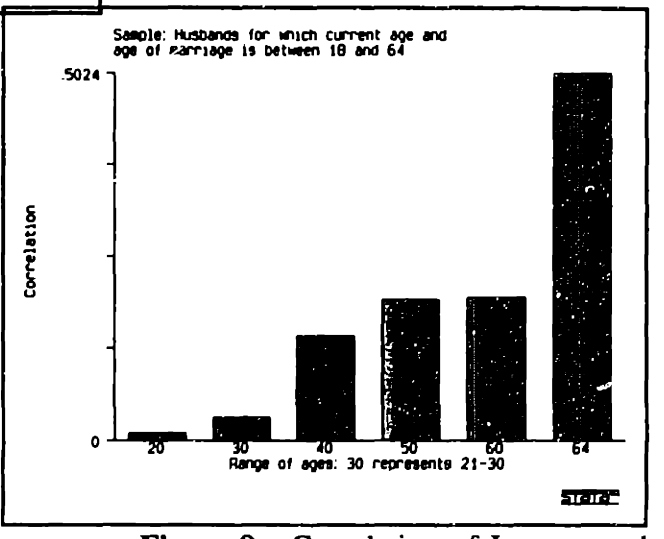

Figure 8 - Correlation of Interspousal Earnings by Age of Marriage

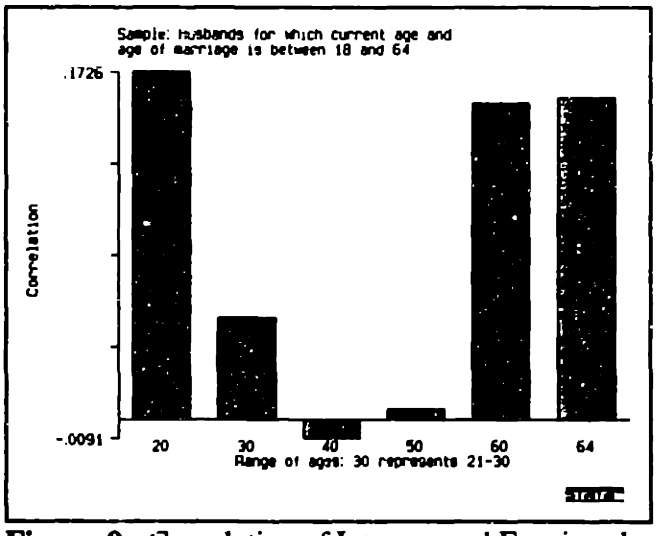

Figure 9 - Correlation of Interspousal Earnings by Current Age

TABLE 1 - Marriage Facts, United States, 1970 - 1987[67]

		Women					Men				
		1970	1975	1980	1983	1987	1970	1975	1980	1983	1987
1	Mean Age at marriage	21.4	21.7	22.9	24.4	25.9	23.8	23.8	25.2	26.2	28.0
2	Mean Age at First Marriage	20.5	20.5	21.1	22.3	23.6	22.6	22.4	23.0	24.1	25.3
3	Mean Age at Remarriage	35.0	32.8	31.4	32.5	34.1	39.1	36.5	34.9	35.7	37.7
4	Mean Age at Remarriage-Previously Divorced	31.3	30.3	30.2	31.6	33.3	35.5	34.0	33.6	34.9	36.7
5	Mean Age at Remarriage-Previously Widowed	50.0	51.4	53.1	54.1	53.9	57.7	59.1	60.1	61.7	62.8
6	Percent of Marriages that are First Marriages	78.4	73.3	70.7	65.9	65.2	78.1	72.0	69.3	64.8	65.2
7	Percent of Marriages in which the Person was Previously Divorced	16.9	22.5	25.9	27.6	27.2	17.8	24.1	27.6	29.0	27.6
8	Percent of Marriages in which the Person was Previously Widowed	4.7	4.2	3.4	3.2	2.8	4.1	3.8	3.1	2.9	2.6

(Vital Statistics, 1970-1987)

[67]Note that the percent of marriages by previous marital status may not add up to 100% because some states did not require reporting of whether the individual was widowed or divorced.

TABLE 2 - VARIABLE MEANS - ALL COUPLES

The following table shows the means and standard deviations for all couples and for all couples by age at marriage.

(Standard deviations are in parentheses.)

The sample used was heads of household who were between 18 and 64 and whose age at last marriage was between 18 and 64.

	All Couples	Husband's Age at Marriage					
		18-21	22-25	26-29	30-39	40-49	50-64
Age at Current Marriage - Wife	23.05 (6.09)	19.49 (1.53)	21.32 (2.49)	23.90 (3.72)	28.03 (5.94)	37.25 (7.75)	44.73 (8.02)
Age at Current Marriage - Husband	25.52 (6.95)	20.02 (.971)	23.26 (1.09)	27.24 (1.11)	33.44 (2.79)	43.95 (2.73)	53.75 (3.16)
Current Age - Wife	36.86 (11.30)	34.46 (11.30)	36.04 (11.33)	37.75 (10.71)	39.67 (9.96)	44.68 (9.23)	49.35 (8.25)
Current Age - Husband	39.33 (11.72)	34.99 (11.34)	37.98 (11.30)	41.09 (10.64)	45.10 (9.29)	51.39 (5.55)	58.37 (3.68)
Real Labor Income (1983 $) - Wife	6020.6 (7373.1)	5215.4 (6588.4)	5937.3 (7046.2)	6868.6 (7841.1)	6840.6 (8242.0)	6758.2 (8821.0)	6376.7 (10285.2)
Real Labor Income (1983 $) -Husband	22383.9 (17667.2)	21057.2 (15683.0)	23134.8 (18923.2)	24421.1 (18936.7)	22459.5 (17427.9)	19936.6 (13503.2)	15940.7 (18535.0)
Real Wage (1983 $) - Wife	7.40 (12.18)	6.32 (9.75)	7.38 (12.10)	8.49 (13.92)	8.45 (13.50)	7.26 (9.18)	8.27 (25.55)
Real Wage (1983 $) - Husband	16.10 (29.01)	14.68 (27.29)	16.56 (30.66)	18.30 (31.29)	16.72 (28.81)	13.09 (16.25)	12.26 (17.72)
Hours Worked - Wife (per week)	19.49 (19.12)	18.80 (18.98)	19.59 (18.98)	20.07 (19.04)	20.37 (19.57)	19.65 (19.81)	17.61 (19.90)
Hours Worked - Husband (per week)	38.62 (17.78)	39.49 (17.44)	39.11 (17.22)	38.20 (17.35)	37.94 (18.93)	35.74 (18.76)	28.24 (24.03)
Black	.2255 (.4179)	.2367 (.4251)	.1961 (.3970)	.2238 (.4168)	.2373 (.4255)	.3168 (.4654)	.3580 (.4799)
Other Race (Non-white)	.0286 (.1666)	.0248 (.1555)	.0193 (.1378)	.0412 (.1988)	.0507 (.2194)	.0202 (.1419)	.0389 (.1936)
Length of Marriage	21.14 (12.21)	22.36 (12.08)	22.19 (12.52)	21.17 (12.52)	18.88 (11.39)	13.81 (8.25)	10.76 (5.22)
Number of Marriages	1.223 (.4980)	1.014 (.1185)	1.080 (.2850)	1.255 (.4756)	1.672 (.6426)	2.067 (.7247)	2.383 (.7590)
Number of Children	1.666 (1.739)	1.792 (1.696)	1.656 (1.735)	1.625 (1.736)	1.662 (1.801)	1.411 (1.891)	.6245 (1.213)

No H.S. Diploma - Wife	.1685 (.3743)	.1572 (.3640)	.1272 (.3332)	.1797 (.3840)	.2186 (.4133)	.3266 (.4691)	.3930 (.4889)
H.S. Diploma - Wife	.2955 (.4562)	.3645 (.4813)	.2881 (.4529)	.2627 (.4401)	.2280 (.4196)	.2391 (.4266)	.1440 (.3514)
Some College - Wife	.2929 (.4551)	.2958 (.4564)	.2982 (.4575)	.2678 (.4428)	.3180 (.4658)	.2528 (.4347)	.2938 (.4559)
College Degree - Wife	.2432 (.4290)	.1825 (.3863)	.2865 (.4521)	.2899 (.4538)	.2353 (.4243)	.1816 (.3856)	.1693 (.3753)
No H.S. Diploma - Husband	.2583 (.4377)	.2425 (.4286)	.2064 (.4048)	.2636 (.4406)	.3297 (.4702)	.4997 (.5002)	.4728 (.4997)
H.S. Diploma - Husband	.2010 (.4008)	.2747 (.4464)	.1852 (.3886)	.1733 (.3785)	.1315 (.3380)	.1411 (.3482)	.1323 (.3391)
Some College - Husband	.3290 (.4698)	.3580 (.4794)	.3466 (.4759)	.2860 (.4519)	.3059 (.4609)	.2449 (.4302)	.2160 (.4119)
College Degree - Husband	.2117 (.4085)	.1249 (.3306)	.2617 (.4396)	.2771 (.4476)	.2329 (.4227)	.1143 (.3183)	.1790 (.3837)
Observations	34323 (100%)	10322 (30.1%)	12352 (36.0%)	5482 (16.0%)	4122 (12.0%)	1531 (4.5%)	514 (1.5%)

TABLE 3 - VARIABLE MEANS - DUAL-EARNERS

The following table shows the means and standard deviations for the dual-earner couples and for the dual-earner couples by age at marriage. (Standard deviations are in parentheses.)

The sample used was heads of household who were between 18 and 64 and whose age at last marriage was between 18 and 64.

	All	Husband's Age at Marriage					
	Dual-Earner Couples	18-21	22-25	26-29	30-39	40-49	50-64
Age at Current Marriage - Wife	22.92 (5.70)	19.51 (1.53)	21.33 (2.43)	23.91 (3.70)	28.33 (5.94)	36.93 (7.31)	43.61 (7.57)
Age at Current Marriage - Husband	25.30 (6.50)	20.05 (.973)	23.23 (1.08)	27.23 (1.12)	33.36 (2.83)	43.76 (2.70)	53.22 (3.00)
Current Age - Wife	35.32 (10.61)	32.83 (10.29)	34.38 (10.65)	36.52 (10.14)	38.89 (9.58)	43.27 (8.32)	47.87 (7.43)
Current Age - Husband	37.71 (11.14)	33.37 (10.35)	36.28 (10.65)	39.84 (10.28)	43.95 (9.07)	50.12 (5.18)	57.49 (3.56)
Real Labor Income (1983 dollars) - Wife	9173.5 (7326.6)	8124.5 (6641.4)	8931.7 (6922.2)	10276.0 (7566.0)	10116.9 (8242.1)	11160.4 (8506.1)	11531.8 (12241.1)
Real Labor Income (1983 dollars) -Husband	22047.2 (15765.0)	20129.9 (13600.2)	22492.2 (17992.0)	23432.9 (15341.2)	22937.2 (14120.9)	23754.1 (12768.0)	22033.4 (18304.5)
Real Wage (1983 dollars) - Wife	7.46 (12.27)	6.36 (9.85)	7.42 (12.18)	8.62 (14.12)	8.49 (13.23)	7.32 (9.45)	9.15 (28.90)
Real Wage (1983 dollars) - Husband	13.86 (22.28)	12.14 (18.33)	14.19 (23.72)	15.80 (27.21)	14.76 (21.24)	13.41 (15.81)	11.60 (11.79)
Hours Worked - Wife (per week)	29.73 (15.86)	29.33 (15.89)	29.49 (15.79)	29.96 (15.63)	30.09 (16.50)	32.86 (14.40)	30.12 (17.24)
Hours Worked - Husband (per week)	40.37 (15.41)	40.68 (15.30)	40.44 (15.16)	39.90 (15.43)	40.25 (16.30)	40.44 (14.16)	37.53 (19.92)
Black	.2309 (.4214)	.2447 (.4299)	.2119 (.4087)	.2428 (.4289)	.2273 (.4192)	.2399 (.4273)	.3263 (.4698)
Other Race (non-white)	.0273 (.1628)	.0229 (.1495)	.0187 (.1355)	.0312 (.1738)	.0596 (.2367)	.0273 (.1631)	.0127 (.1123)
Length of Marriage	19.29 (11.51)	20.27 (10.93)	20.09 (11.79)	19.41 (12.19)	17.34 (11.30)	12.29 (7.02)	10.27 (5.42)
Number of Marriages	1.215 (.4828)	1.017 (.1286)	1.076 (.2785)	1.259 (.4715)	1.671 (.6270)	2.116 (.7128)	2.352 (.7080)

Number of Children	1.498 (1.601)	1.621 (1.558)	1.461 (1.567)	1.469 (1.640)	1.526 (1.734)	1.192 (1.604)	.6102 (1.185)
No High School Diploma - Wife	.1260 (.3319)	.1066 (.3087)	.1009 (.3012)	.1409 (.3480)	.1787 (.3831)	.2411 (.4280)	.2754 (.4477)
High School Diploma - Wife	.2873 (.4525)	.3657 (.4817)	.2755 (.4468)	.2543 (.4356)	.2097 (.4072)	.2387 (.4266)	.1017 (.3029)
Some College - Wife	.3258 (.4687)	.3356 (.4722)	.3232 (.4677)	.2860 (.4520)	.3637 (.4811)	.3076 (.4618)	.3856 (.4878)
College Degree - Wife	.2609 (.4391)	.1921 (.3940)	.3004 (.4584)	.3188 (.4661)	.2479 (.4319)	.2126 (.4094)	.2373 (.4263)
No High School Diploma - Husband	.2265 (.4186)	.2081 (.4060)	.1892 (.3917)	.2310 (.4215)	.3015 (.4590)	.4192 (.4937)	.3856 (.4878)
High School Diploma - Husband	.1958 (.3968)	.2735 (.4458)	.1801 (.3843)	.1704 (.3760)	.1210 (.3262)	.1295 (.3359)	.0805 (.2727)
Some College - Husband	.3491 (.4767)	.3884 (.4874)	.3551 (.4786)	.2950 (.4561)	.3326 (.4712)	.3052 (.4608)	.2373 (.4263)
College Degree - Husband	.2286 (.4200)	.1300 (.3363)	.2755 (.4468)	.3037 (.4599)	.2449 (.4301)	.1461 (.3534)	.2966 (.4577)
Observations	21752 (100%)	6424 (29.5%)	8017 (36.9%)	3563 (16.4%)	2670 (12.3%)	842 (3.9%)	236 (1.1%)

TABLE 4 - CORRELATION OF SPOUSAL EARNINGS

The dependent variable is the correlation of the earnings of the husband and wife within the cell.
Standard errors are in parentheses.

	(1)	(2)	(3)	(4)
	All Couples	All Couples	Dual-Earners	Dual-Earners
Constant	-1.049 (.8275)	-1.702 (.8384)	-1.890 (.9117)	-1.917 (.9105)
Age at marriage = 22 - 25	.0635 (.0239)	.0516 (.0249)	.0628 (.0309)	.0431 (.0319)
Age at marriage = 26 - 29	.1050 (.0432)	.1074 (.0420)	.1822 (.0503)	.1731 (.0500)
Age at marriage = 30 - 39	.2556 (.0925)	.3125 (.0923)	.4089 (.1028)	.4069 (.1018)
Age at marriage = 40 - 49	.3723 (.1544)	.5062 (.1588)	.5959 (.1790)	.6223 (.1788)
Age at marriage = 50 - 64	.4376 (.2000)	.5923 (.2040)	.5787 (.2293)	.6424 (.2287)
Current year = 1972-1975	.2587 (.1763)	.2671 (.1717)	.4539 (.1963)	.3948 (.1963)
Current year = 1976-1979	.4080 (.2517)	.4797 (.2464)	.6501 (.2761)	.6010 (.2739)
Current year = 1980-1983	.4439 (.2442)	.4952 (.2385)	.6625 (.2677)	.6101 (.2658)
Current year = 1984-1986	.5094 (.2785)	.5949 (.2729)	.7725 (.3060)	.7283 (.3032)
Current age = 21 - 30	-.1833 (.1179)	-.0963 (.1200)	-.1893 (.1289)	-.1268 (.1307)
Current age = 31 - 40	-.2637 (.1189)	-.0684 (.1348)	-.2258 (.1311)	-.1012 (.1454)
Current age = 41 - 50	-.2308 (.1187)	-.0842 (.1267)	-.2747 (.1303)	-.1809 (.1378)
Current age = 51 - 60	-.1597 (.1192)	-.1145 (.1174)	-.1572 (.1317)	-.1275 (.1310)
Current age = 61 - 64	-.1499 (.1258)	-.1459 (.1230)	-.0977 (.1450)	-.0894 (.1434)
Mean predicted Length of Marriage	.0400 (.0274)	.0694 (.0286)	.0744 (.0301)	.0816 (.0304)
Percent Black		.0790 (.2093)		-.2704 (.2248)
Mean Number of Children		-.0989 (.0347)		-.0596 (.0394)
R-squared	.4157	.4560	.3546	.3807
F-test: Demographic/Marital History Variables (p-value)		4.07 (.0197)		2.30 (.1049)
Number of observations	128	128	127	127

TABLE 5 - CORRELATION OF SPOUSAL PARTICIPATION AND HOURS - ALL COUPLES

The dependent variables are the correlation of the employment indicator variable (columns 1 and 2) and the hours worked (columns 3-6) of the husband and wife within the cell. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Employment Indicator	Employment Indicator	Hours	Hours	Hours	Hours
Constant	-.0440 (.6321)	.1908 (.6419)	-.6128 (.8324)	-.9027 (.8380)	438.5 (103.1)	314.0 (565.5)
Age at marriage = 22 - 25	.0333 (.0181)	.0194 (.0187)	.0304 (.0241)	.0029 (.0249)	-.0053 (.0261)	.0018 (.0252)
Age at marriage = 26 - 29	.0340 (.0328)	.0314 (.0318)	.1159 (.0435)	.1136 (.0420)	.0494 (.0414)	.1053 (.0434)
Age at marriage = 30 - 39	.0824 (.0705)	.0751 (.0705)	.1861 (.0930)	.2263 (.0920)	.0335 (.0813)	.2036 (.0944)
Age at marriage = 40 - 49	.1272 (.1181)	.1386 (.1217)	.2964 (.1564)	.4276 (.1592)	.0914 (.1358)	.3875 (.1602)
Age at marriage = 50 - 64	.0056 (.1544)	.0264 (.1578)	.5739 (.1937)	.7126 (.1944)	.3183 (.1721)	.6640 (.1976)
Current year = 1972-1975	-.0026 (.1347)	-.0016 (.1308)	-.2891 (.1772)	-.2862 (.1712)		
Current year = 1976-1979	.0048 (.1923)	-.0090 (.1881)	-.1691 (.2527)	-.1301 (.2454)		
Current year = 1980-1983	.0639 (.1866)	.0626 (.1820)	-.1538 (.2456)	-.1167 (.2379)		
Current year = 1984-1986	.0660 (.2129)	.0541 (.2085)	-.0946 (.2804)	-.0394 (.2725)		
Current age = 21 - 30	.0113 (.0914)	.0282 (.0926)	-.0119 (.1224)	.0866 (.1231)	.0497 (.1277)	.0825 (.1234)
Current age = 31 - 40	.0060 (.0921)	-.0168 (.1038)	-.0281 (.1233)	.1233 (.1376)	.0180 (.1396)	.1180 (.1377)
Current age = 41 - 50	.0268 (.0920)	.0097 (.0977)	-.0219 (.1232)	.0906 (.1297)	.0341 (.1341)	.0923 (.1303)
Current age = 51 - 60	.0343 (.0924)	.0385 (.0907)	-.0030 (.1238)	.0462 (.1209)	.0440 (.1263)	.0477 (.1216)
Current age = 61 - 64	.1094 (.0973)	.1322 (.0948)	.0426 (.1303)	.0767 (.1264)	.1085 (.1319)	.0823 (.1272)
Mean Predicted Length of Marriage	-.0004 (.0209)	-.0079 (.0219)	.0351 (.0276)	.0522 (.0286)	-.0154 (.0235)	.0448 (.0293)

Number of Blacks in Cell		-.4598 (.1577)		-.4720 (.2092)	-.6190 (.2155)	-.4774 (.2164)
Mean Number of Children		.0251 (.0263)		-.0610 (.0349)	-.0154 (.0332)	-.0594 (.0348)
Mean Year					-16.55 (3.873)	-12.44 (21.79)
Mean Year Squared					.2080 (.0487)	.1639 (.2783)
Mean Year Cubed					-.0009 (.0002)	-.0007 (.0011)
Mean Female Unemployment Rate						.0260 (.2091)
Mean Male Unemployment Rate						-.2404 (.2915)
R-squared	.3464	.3956	.7716	.7907	.7698	.7906
F-test: Demographic/Marital History Variables (p-value)		4.35 (.0152)		5.02 (.0082)	4.49 (.0134)	5.13 (.0008) (includes unemployment rates)
Number of observations	125	125	128	128	128	128

TABLE 6 - CORRELATION OF SPOUSAL WAGES AND HOURS - DUAL-EARNER COUPLES

The dependent variables are the correlation of the wages (columns 1 and 2) and the hours worked (columns 3-6) of the husband and wife within the cell. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Wages	Wages	Hours	Hours	Hours	Hours
Constant	.7271 (.7978)	.5019 (.8065)	1.405 (.7137)	1.743 (.7145)	727.2 (166.5)	-310.7 (846.0)
Age at marriage = 22 - 25	0414 (.0312)	.0434 (.0327)	.0046 (.0302)	-.0096 (.0312)	.0223 (.0409)	.0289 (.407)
Age at marriage = 26 - 29	.0728 (.0470)	.0684 (.0472)	.0172 (.0441)	.0138 (.0439)	-.0293 (.0592)	.0072 (.0621)
Age at marriage = 30 - 39	.1093 (.0912)	.1229 (.0912)	-.0142 (.0826)	-.0319 (.0816)	-.1235 (.1155)	-.0146 (.1286)
Age at marriage = 40 - 49	-.1151 (.1556)	-.0833 (.1562)	.0266 (.1429)	-.0270 (.1426)	-.3521 (.2138)	-.1379 (.2415)
Age at marriage = 50 - 64	-.0580 (.2005)	-.0721 (.2013)	.1852 (.1824)	.2020 (.1793)	.2278 (.2667)	-.3861 (.2793)
Current year = 1972-1975	-.4142 (.1725)	-.4436 (.1750)	-.9477 (.1543)	-.9765 (.1575)		
Current year = 1976-1979	-.4667 (.2419)	-.4740 (.2427)	-.9978 (.2156)	-1.051 (.2161)		
Current year = 1980-1983	-.3686 (.2357)	-.3875 (.2369)	-1.010 (.2084)	-1.053 (.2095)		
Current year = 1984-1986	-.3957 (.2691)	-.3999 (.2695)	-1.028 (.2385)	-1.087 (.2384)		
Current age = 21 - 30	.0555 (.1506)	.0674 (.1530)	.0404 (.1422)	.0691 (.1423)	.0038 (.2118)	-.0088 (.2097)
Current age = 31 - 40	-.0204 (.1520)	.0532 (.1671)	.0220 (.1439)	.3031 (.1563)	-.1059 (.2200)	-.0572 (.2208)
Current age = 41 - 50	.0867 (.1519)	.1428 (.1606)	.0357 (.1437)	.0385 (.1496)	-.0170 (.2170)	.0046 (.2161)
Current age = 51 - 60	.1724 (.1533)	.1919 (.1541)	.0838 (.1450)	.0909 (.1439)	.0648 (.2112)	.0585 (.2087)
Current age = 61 - 64	.0563 (.1675)	.0542 (.1670)	.2708 (.1570)	.2683 (.1545)	.2228 (.2370)	.1522 (.2368)
Mean Predicted Length of Marriage	-.0073 (.0263)	.0028 (.0269)	-.0230 (.0234)	-.0331 (.0236)	-.0769 (.0340)	-.0368 (.0402)

Number of Blacks in Cell		.2866 (.2252)		-.5217 (.2127)	-.3527 (.3265)	-.0910 (.3551)
Mean Number of Children		-.0550 (.0406)		.0211 (.0383)	.0837 (.0543)	.0511 (.0623)
Mean Year					-27.37 (6.261)	12.13 (32.47)
Mean Year Squared					.3438 (.0787)	-.1547 (.4136)
Mean Year Cubed					-.0014 (.0003)	.0007 (.0017)
Mean Female Unemployment Rate						-.6621 (.4203)
Mean Male Unemployment Rate						.3728 (.2862)
R-squared	.6281	.6375	.8904	.8962	.9037	.9103
F-test: Demographic/Marital History Variables (p-value)		1.40 (.2508)		3.02 (.0530)	1.34 (.2714)	1.69 (.1955)
Number of observations	126	126	126	126	128	126

TABLE 7 - CORRELATION OF PREDICTED SPOUSAL WAGES AND WAGE RESIDUALS - DUAL-EARNER COUPLES

The dependent variables are the correlation of the predicted wages (columns 1 and 2) and the wage residuals (columns 3 and 4) of the husband and wife within the cell. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)
	Predicted Wages	Predicted Wages	Wage Residuals	Wage Residuals
Constant	.6221 (.4391)	.9815 (.4461)	-1.104 (.7596)	-1.220 (.7670)
Age at marriage = 22 - 25	-.0430 (.0139)	-.0415 (.0142)	-.0026 (.0286)	.0131 (.0299)
Age at marriage = 26 - 29	-.0689 (.0235)	-.0695 (.0230)	.0137 (.0443)	.0194 (.0443)
Age at marriage = 30 - 39	-.0804 (.0493)	-.1066 (.0490)	.2401 (.0860)	.2490 (.0859)
Age at marriage = 40 - 49	-.0999 (.0838)	-.1561 (.0838)	.3943 (.1494)	.3987 (.1499)
Age at marriage = 50 - 64	-.2561 (.1178)	-.3047 (.1161)	.2925 (.1901)	.2416 (.1909)
Current year = 1972-1975	-.0454 (.0930)	-.0480 (.0914)	.1058 (.1640)	.1294 (.1650)
Current year = 1976-1979	-.0109 (.1315)	-.0496 (.1296)	.2323 (.2305)	.2619 (.2298)
Current year = 1980-1983	.0446 (.1275)	.0171 (.1254)	.3254 (.2242)	.3508 (.2238)
Current year = 1984-1986	.0327 (.1461)	-.0158 (.1440)	.3182 (.2558)	.3472 (.2547)
Current age = 21 - 30	.1047 (.0723)	.0782 (.0721)	.1210 (.1405)	.0820 (.1425)
Current age = 31 - 40	.1062 (.0732)	.0216 (.0798)	.0442 (.1420)	-.0054 (.1561)
Current age = 41 - 50	.1546 (.0728)	.0908 (.0760)	.0453 (.1419)	.0078 (.1498)
Current age = 51 - 60	.1638 (.0731)	.1398 (.0718)	.0336 (.1433)	.0159 (.1438)
Current age = 61 - 64	.2475 (.0779)	.2484 (.0757)	-.0463 (.1569)	-.0638 (.1561)
Mean Predicted Length of Marriage	.0005 (.0144)	-.0142 (.0149)	.0563 (.0250)	.0574 (.0257)
Number of Blacks in Cell		-.2019 (.1057)		.3620 (.2106)
Mean Number of Children		.0518 (.0196)		.0100 (.0379)
R-squared	.4327	.4734	.4680	.4844
F-test: Demographic/ Marital History Variables (p-value)		4.22 (.0172)		1.71 (.1849)
Number of observations	127	127	126	126

TABLE 8 - CORRELATION OF SPOUSAL AGES AND EDUCATION
DUAL-EARNER COUPLES

The dependent variables are the correlation of the ages (columns 1 and 2) and years of education (columns 3 and 4) of the husband and wife within the cell. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)
	Age	Age	Education	Education
Constant	.6739 (.5741)	.7760 (.5986)	-.1669 (.6233)	.1229 (.6285)
Age at marriage = 22 - 25	-.1561 (.0153)	-.1613 (.0164)	.0397 (.0200)	.0545 (.0213)
Age at marriage = 26 - 29	-.3452 (.0308)	-.3480 (.0311)	.0378 (.0327)	.0444 (.0318)
Age at marriage = 30 - 39	-.5215 (.0649)	-.5313 (.0667)	-.0251 (.0696)	-.0476 (.0687)
Age at marriage = 40 - 49	-.6133 (.1148)	-.6260 (.1193)	-.1050 (.1209)	-.1609 (.1201)
Age at marriage = 50 - 64	-.6895 (.1539)	-.6888 (.1571)	-.1141 (.1566)	-.1899 (.1540)
Current year = 1972-1975	-.0955 (.1208)	-.1151 (.1226)	.4251 (.1340)	.4561 (.1309)
Current year = 1976-1979	-.1106 (.1716)	-.1359 (.1747)	.4747 (.1893)	.4750 (.1853)
Current year = 1980-1983	-.1319 (.1664)	-.1543 (.1689)	.4078 (.1839)	.4188 (.1795)
Current year = 1984-1986	-.1719 (.1913)	-.1984 (.1946)	.3719 (.2103)	.3622 (.2059)
Current age = 21 - 30	.5083 (.1104)	.5198 (.1127)	.1175 (.0994)	.0545 (.0986)
Current age = 31 - 40	.6119 (.1110)	.6224 (.1198)	.1765 (.1004)	.0291 (.1089)
Current age = 41 - 50	.6275 (.1106)	.6369 (.1145)	.2018 (.1004)	.0875 (.1044)
Current age = 51 - 60	.6434 (.1113)	.6477 (.1123)	.2795 (.1011)	.2367 (.0989)
Current age = 61 - 64	.4599 (.1243)	.4668 (.1251)	.4324 (.1061)	.4225 (.1033)
Mean Predicted Length of Marriage	-.0125 (.0189)	-.0152 (.0199)	.0043 (.0206)	-.0113 (.0212)
Number of Blacks in Cell		-.1352 (.1441)		.0303 (.1449)
Mean Number of Children		-.0002 (.0225)		.0766 (.0269)
R-squared	.8430	.8443	.7420	.7626
F-test: Demographic/ Marital History Variables (p-value)		0.45 (.6385)		4.61 (.0121)
Number of observations	127	127	127	124

TABLE 9 - PROBIT ESTIMATIONS - DUAL-EARNER COUPLES
The dependent variables are 1 if the partners are in the same occupation or industry and zero otherwise.

	Same Occupation		Same Industry	
Constant	-5.846	(.4073)	-3.313	(.2766)
Age at Marriage	.0065	(.0024)	.0047	(.0020)
Current Age	-.0017	(.0012)	.0051	(.0010)
Current Year	.0768	(.0034)	.0002	(.0026)
Black	-.0832	(.0300)	.0052	(.0240)
Other (non-white)	-.0225	(.0708)	.2014	(.0590)
Number of Marriages	-.3222	(.0461)	.4030	(.0306)
Number of Children	-.0798	(.0097)	.0117	(.0061)
Predicted Length of Marriage	-.0521	(.0073)	.0832	(.0034)
F-test of regression (p-value)	1432.9	(0.0000)	1348.7	(0.0000)
Observations	21729		21729	

TABLE 10 - Predicted Changes in Probabilities of Being in the Same Occupation or Industry: 1968-1986
Effects of Time Trend and Rising Age at Marriage

	Same Occupation	Same Industry
Total Effect: 1968-1986	.2104	.0072
Time Trend only: Year=68 -> Year=86	.2052	.0013
Age at Marriage Effect only: Age=23.8 -> Age=28	.0054	.0059

APPENDIX 1 - RESULTS OF WAGE ESTIMATION EQUATION[68]

The dependent variable is the individual's real wage.

	Wife's Wage	Husband's Wage
Constant	1.183 (1.184)	-4.803 (1.315)
Age	.2821 (.0291)	.6252 (.0384)
Age squared	-.0031 (.0004)	-.0061 (.0005)
Northeast	-2.713 (.7028)	1.208 (.9892)
North Central	-3.264 (.7019)	.6309 (.9879)
South	-3.282 (.7001)	-.4588 (.9863)
West	-2.804 (.7035)	.8096 (.9900)
No High School Diploma	-1.789 (.1639)	-5.510 (.1959)
High School Diploma	-1.312 (.1264)	-3.843 (.1854)
Some College	-.8912 (.1140)	-3.031 (.1569)
Number of Children	-.2579 (.0353)	.1228 (.0349)
County Unemployment Rate	.0018 (.0014)	.0106 (.0023)
Industry: Agriculture, Forestry and Fisheries (Omitted)	-	-
Industry: Mining	2.566 (.7956)	4.382 (.5801)
Industry: Construction	2.830 (.5974)	1.800 (.4297)
Industry: Manufacturing	2.746 (.4978)	2.444 (.4034)
Industry: Transportation, Communication, and Public Utilities	3.828 (.5128)	2.825 (.4231)
Industry: Wholesale and Retail Trade	.9520 (.4913)	.7693 (.4143)
Industry: Finance, Insurance, and Real Estate	2.237 (.5021)	2.384 (.4764)
Industry: Business and Repair Services	1.482 (.5297)	-.0771 (.4690)
Industry: Personal Services	.4791 (.5149)	-.8338 (.6153)
Industry: Entertainment and Recreation Services	-.3402 (.8113)	2.809 (.8185)
Industry: Professional and Related Services	1.759 (.4918)	.7778 (.4274)
Industry: Public Administration	3.147 (.5119)	1.689 (.4386)
Occupation: Professional and Technical Workers (Omitted)	-	-
Occupation: Managers and Administrators	.2034 (.1652)	3.099 (.2717)

[68]Only those with positive labor income were included. Therefore, the interspousal correlations of predicted wages and wage residuals will only be used to examine the upward drift of income correlations among dual-earner couples.

Occupation: Sales and Clerical Workers	-1.511 (.1261)	3.722 (.2652)
Occupation: Craftsmen	-1.171 (.2894)	1.957 (.2784)
Occupation: Operatives, including Transportation	-3.008 (.1893)	1.663 (.2513)
Occupation: Laborers	-2.350 (.4367)	.4939 (.2650)
Occupation: Farmers and Farm Managers	-1.913 (1.330)	.0974 (.3116)
Occupation: Service Workers	-2.602 (.1414)	-2.114 (.5468)
R-squared	.2172	.1923
Number of Observations	9631	20002

BIBLIOGRAPHY

Becker, Gary S. "Imperfect Information, Marriage and Divorce", in A Treatise on the Family, Cambridge: Harvard University Press, 1981.

Bergstrom, Theodore C. and Mark Bagnoli. "Courtship as a Waiting Game", Journal of Political Economy 101 (1993): 185-202.

Bergstrom, Theodore C. and Robert Schoeni. "Income Prospects and Age at Marriage", March 1992, mimeo.

Blackburn, McKinley L. and David E. Bloom. "Changes in the Structure of Family Income Inequality in the United States and Other Industrial Nations during the 1980s", NBER working paper No. 4754, May 1994.

Cancian, Maria, Sheldon Danziger, and Peter Gottschalk. "Working Wives and Family Income Inequality Among Married Couples", in Danziger and Gottschalk (eds.), Uneven Tides, New York: Russell Sage Foundation, 1993.

Deaton, Angus. "Panel Data From Time Series of Cross-Sections", Journal of Econometrics 30 (1985): 109-126.

Lehrer, Evelyn and Marc Nerlove. "The Impact of Female Work on Family Income Distribution in the United States: Black and White Differentials", Review of Income and Wealth 27 (1981): 423-431.

Matsushita, Keiichiro. "Economic Analysis of Age at First Marriage", Journal of Population Economics 2 (1989): 103-119.

National Center for Health Statistics: Vital Statistics of the United States 1970 Volume III Marriage and Divorce, DHHS Publication Number (PHS) 75-1103. Public Health Service, Washington D.C.: U.S. Government Printing Office, 1975.

National Center for Health Statistics: Vital Statistics of the United States 1975 Volume III Marriage and Divorce, DHHS Publication Number (PHS) 79-1103. Public Health Service, Washington D.C.: U.S. Government Printing Office, 1979.

National Center for Health Statistics: Vital Statistics of the United States 1980 Volume III Marriage and Divorce, DHHS Publication Number (PHS) 84-1103. Public Health Service, Washington D.C.: U.S. Government Printing Office, 1984.

National Center for Health Statistics: Vital Statistics of the United States 1983 Volume III Marriage and Divorce, DHHS Publication Number (PHS) 87-1103. Public Health Service, Washington D.C.: U.S. Government Printing Office, 1987.

National Center for Health Statistics: Vital Statistics of the United States 1987 Volume III Marriage and Divorce, DHHS Publication Number (PHS) 91-1103. Public Health Service, Washington D.C.: U.S. Government Printing Office, 1991.

Schoen, Robert and Robin M. Weinick. "The Slowing Metabolism of Marriage: Figures from the 1988 U.S. Marital Status Life Tables", Demography 30 (Nov 1993): 737-746.

Verbeek, Marno. "Pseudo Panel Data", in Mátyás and Sevestre (eds.), The Econometrics of Panel Data, New York: Kluwer Academic Publishers, 1992.