CHANGES IN WEALTH DISTRIBUTION IN THE U.S. 1992-1998: IMPLICATIONS FOR RISK AVERSION

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ABSTRACT

This paper utilizes nonparametric tests to investigate the following hypotheses: One, that there is no difference in household wealth distributions derived from the Survey of Consumer Finances for three survey years during the 1990s, namely, 1992, 1995, and 1998. Two, that there is consistency between households attitudes to taking financial risk and their financial risk taking behavior. Three that there are no differences in financial risk taking behavior between households that have low and high levels of wealth. Four, that the attitudes towards taking financial risk have no influence on the distribution of wealth. Our findings reject the first, third and fourth hypotheses.

INTRODUCTION

The issue of wealth inequality among households is a discernible theme in the recent literature on the distribution of wealth in the United States. This may be explained in part by the ongoing debate about whether wealth inequality among U.S. households has increased over the past few decades. Wolff (1998) for example, contend that wealth inequality has increased based on the rising proportion of total wealth held by households in the upper tail of the wealth distribution in 1998 compared to 1989. Weicher (1997), however, posits that the wealth distribution exhibits cyclical patterns over the course of business cycles rather than a trend of increased inequality. Theoretical issues surrounding the relation between wealth and risk tolerance have also played a critical role in focusing attention on the distribution of wealth. Gollier (2001), for instance shows that if risk tolerance is concave, wealth inequality may help to explain the risk premium puzzle. Furthermore, Kapetyn et al., (1997) show that changes in the distribution of wealth influences the risk attitudes of individuals and consequently affects the demand for risky assets.

There is a lack of consensus, however, about the sign and curvature of the relationship between the changes in wealth and the risk attitude of households. The aim of this paper is twofold: first, to test the hypothesis that there has been no change in the distribution of household wealth and second, to investigate the nature of the relationship between empirical wealth distributions and the risk attitude of households. These hypotheses are tested using data on household wealth obtained from the Survey of Consumer Finances (SCF) for 1992, 1995, and 1998. The empirical analysis of the relationship between wealth and risk attitudes of households is also based on data obtained from this survey. The main findings of the paper are as follows: (1) we fail to reject the null hypothesis of no change in the wealth distributions between 1992 and 1995, but reject the hypothesis of no change between 1995 and 1998, and between 1992 and 1998; (2) households' behavior in terms of the proportion of assets held as risky assets is consistent with their reported attitudes to risk; (3) nonparametric tests reject the hypotheses that networth does not affect the distributions of the risk behavior and risk attitude variables, and (4) nonparametric tests reject the hypothesis that attitudes to risk do not influence the distribution of networth.

The remainder of the paper is structured as follows. Section II provides a brief discussion of the dataset, unresolved conceptual and empirical issues in the related literature, and the non-parametric tests used to test the hypotheses of the paper. Section III discusses the empirical results and highlights the relationship between risk behavior and risk attitudes. Section IV considers some implications of the findings and suggests directions for future research.

DATA

The data used in this paper is obtained from the 1992, 1995, and 1998 Surveys of Consumer Finances (SCF) for the United States. The SCF is known as a comprehensive source of household-level balance sheet, income, and socio-economic information for a representative sample[1] of the U.S. population. Since

[1]The database over-samples wealthy households in order to provide a larger basis for estimates of assets held by such households since they tend to underreport compared to other households. Sample weights are provided with the database to

1983, the Federal Reserve Board, in cooperation with the Statistics of Income Division of the Internal Revenue Service, has conducted the SCF every three years. A total of 3,906, 4,299,and 4,305 households were interviewed in 1992, 1995, and 1998 respectively. (All dollar values were converted to 1998 dollars, using the CPI, for this study.) The wealth variable is defined as net worth, which is the difference between total asset holdings and total indebtedness. Since the networth variable can have negative values, only households with non-negative wealth are included when conducting some of the tests used in this paper.

Examination of summary statistics for households surveyed in 1992, 1995, and 1998 indicate a coefficient of skewness that is positive and considerably above zero indicates a non-symmetric distribution with a long tail to the right. This is supported by the median being to the right of the mean. In addition, the relatively high coefficient of kurtosis suggests an extremely peaked distribution. Histogram plots also indicate positively skewed distributions of the wealth data. Testing the equality of these distributions provides the basis for determining whether there has been increased polarization of wealth in the U.S. during the 1990s.

Testing Equality of Probability Distributions

Consider the following statistical problem. Given two samples of independent observations $X_1, X_2, \ldots, X_{n_1}$ taken from a population with distribution function $F(x) = P(X \le x)$ and $Y_1, Y_2, \ldots, Y_{n_2}$ taken from a population with distribution function

$$G(y) = P(Y \le y),$$

test the hypothesis $H_0 : F(x) = G(x)$ for all x. Vs. $H_0 : F(x) \neq G(x)$ for some x. In our analysis, we utilize two non-parametric tests in this setting: the Mann-Whitney and the Kolmogorov-Smirnov. Below is a brief description of each.[2]

The Mann-Whitney test is designed to detect shifts in the central tendency of distributions. If $F(x)$ and $G(x)$ are related in that both have the same shape but they have unequal medians (ie $F(x) = G(x+c)$ for $c \neq 0$), the Mann-Whitney test is powerful at detecting this difference. To perform the test, the two samples are pooled together, ordered from smallest to largest and each element assigned a rank (ties elements are assigned average ranks). The sum of the ranks of sample elements from one population is calculated and the test statistic is a function of this rank sum. If one distribution has a smaller median, the statistic will tend to take on extreme values. Note, we apply this test to both continuous and discrete data. In the discrete case, there are many ties which necessitates a modification of the statistic.

The Kolmogorov-Smirnov test is designed to detect a general change in the underlying distributions. This test calculates empirical cumulative distribution functions based on the samples and detects differences in the distributions based on the deviations between these two functions. Define:

$\hat{F}(x) = (\#\{X_i \le x\})/n_1$,
$\hat{G}(y) = (\#\{Y_i \le y\})/n_2$. The K-S test uses a test statistic which is a function of $\max_{x \in \Re} \left| \hat{F}(x) - \hat{G}(x) \right|$. If the underlining true cumulative distribution functions are in fact different, this quantity will tend to take on relatively large values.

Utility of Wealth and Risk Attitudes

Consider the case where the distribution of wealth in the population can be used to derive utility:

$$U(x) = F(x) = \int_{x\min}^{x} f(x)dx$$

where $F(\cdot)$ is a cumulative density function of wealth levels in the population, $f(\cdot)$ is the corresponding probability density function, and $x\ \min$ is the smallest wealth holding in the population.

One implication of this framework is that the representative agent's attitude toward risk may be defined by his/her local position in the distribution of the population's wealth holdings. The standard local measure of risk attitude, i.e. absolute and relative risk attitudes from Arrow (1971) and Pratt (1964), are given respectively

$$\lambda(x) = -\frac{U''(x)}{U'(x)} = -\frac{f'(x)}{f(x)}$$

$$\rho(x) = -\frac{xU''(x)}{U'(x)} = -\frac{xf'(x)}{f(x)} = x\lambda(x)$$

When $\lambda(x)$ (and, for all positive $x, \rho(x)$) is, positive, negative, or equal to zero, then risk attitudes are referred

adjust each household to an estimate of its representation in the set of all U.S. households.

[2] See, Lehmann, E.L (1975) for details.

to as local risk aversion. risk loving, and risk neutral respectively. Changes in attitudes toward risk with respect to changes in wealth are given by:

$$\lambda'(x) = \left(\frac{f'(x)}{f(x)}\right)^2 - \frac{f''(x)}{f(x)}$$

$$\rho'(x) = x\left(\left(\frac{f'(x)}{f(x)}\right)^2 - \frac{f''(x)}{f(x)}\right) - \frac{f'(x)}{f(x)}$$

$$= x\lambda'(x) + \lambda(x)$$

Changes in absolute risk attitude are called increasing (IARA), decreasing (DARA), or constant (CARA), if $\lambda'(x)$ is respectively, positive, negative, or equal to zero. Also, changes in relative risk attitude are called increasing (IRRA), decreasing (DRRA), or constant (CRRA) if $\rho'(x)$ is respectively, positive, negative, or equal to zero. The Arrow-Pratt measure of risk aversion implies there is a relationship between the degree of concavity of the utility function and the degree of risk aversion (or a relationship between the degree of convexity of an indifference curve and the degree of risk aversion such that more risk averse agents have more convex indifference curves).

Arrow (1965) hypothesized that individuals would display decreasing absolute risk aversion (DARA) and increasing relative risk aversion (IRRA) with respect to wealth. Assuming that wealthy individuals are not more risk-averse than poorer ones with regard to the same risk, then if risky assets are "normal goods", a rise in wealth will lead to an increase in demand for them but if they are "inferior goods", then a rise in wealth will lead to a decrease in demand for them. In the case of IRRA as wealth increases and the size of risk increases, then the willingness to accept the risk should decline, in other words, IRRA implies that the wealth elasticity of demand for risky asset is less than one.

Empirical studies provide a range of estimates for the coefficient of risk aversion based on household behavior (Barsky, Juster, Kimball, and Shapiro 1997). Empirical estimates of ρ vary substantially, depending on the data, assumptions, and estimation methods. Some estimates using consumption data in the U.S. and in other developed countries have been between 0 and 1(and 15 (Hall 1988), but most estimates fall in the range of 1 to 6 (Skinner, 1985). Using equity premium data (i.e. the difference between the return on stocks and the return on risk-free assets such as Treasury bills), studies have found that a coefficient of relative risk aversion needs to be as high as 30 to 40 in order to explain the historical patterns of equity premium in the U.S. (Mehra and Prescott 1985) 1992b). These varied findings suggest that there are difficulties associated with making inferences about risk tolerance purely based on household behavior.

In the context of disparate estimates of household risk attitude this paper explores the consistency of households' responses about their willingness to take financial risks with the financial risk taking behavior of households. Specifically, this paper tests several hypotheses highlighted in recent analyses of the U.S. wealth distribution. In null hypothesis form these are:

(A) That there is no difference in the U.S. wealth distribution across the 1992, 1995, and 1998 survey years.
(B) There is no consistency between household attitudes toward financial risk and their financial risk taking behavior.
(C) That household wealth does not affect the distributions of household risk behavior and attitude to risk.
(D) That households' attitudes to taking financial risk do not influence the distribution of wealth.

EMPIRICAL RESULTS

Test statistics for the Mann-Whitney and Komolgorov-Smirnov tests are provided in Table 1. These results indicate that the null hypothesis of no change in the wealth distributions between 1995 and 1998 and between 1992 and 1998 is rejected at the five percent level of significance. However, there is a mixed message from the Mann-Whitney and Komolgorov tests for the 1992 and 1995 distributions comparisons. While the Mann-Whitney statistic does not reject the hypothesis of no change in U.S. wealth distributions between 1992 and 1995 at the five percent level of significance the Komolgorov-Smirnov test indicates a less conclusive result. Given the focal point of each test it appears that there was not a statistically significant shift in the central tendency between the 1992 and 1995 distributions but a borderline failure to reject (at the five percent level) the null hypothesis of no general change in the underlying distributions.

Consideration of the second hypothesis is based on households with networth over $10,000 in the 1992,

1995, and 1998. For each of these survey years the attitudes to risk and ratio of risky assets to total wealth are explored. The self-reported ordinal attitude to risk variable for each household, which ranges from 1 to 4, is rescaled to lie between zero and one. This linear transformation is ((5 -Coded Attitude to Risk)/4). This variable is interpreted as follows: the closer the rescaled value is to one the higher the risk-taking propensity of the household. The measure of actual risk taking behavior by each household is the ratio of risky assets to networth.

Segmenting households by quartiles based on their networth the mean values of the risk attitude and risk behavior variables were obtained for each quartile. Figures 1, 2, and 3 show that the means for both variables increase as networth increases, suggesting that on average households at the upper tail of the wealth distribution report a higher propensity to take financial risk and behave in a manner that is consistent with their stated preferences. The ordinal natural of the self-reported risk attitude does not lend itself to further quantification of the relationship between the self-reported and actual risk variables.

Figure 1: Mean Values for Risk Attitude and Risk Behavior: 1992

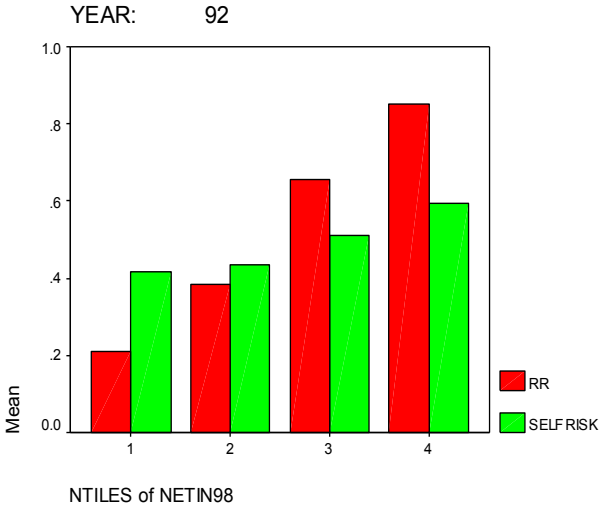


Figure 2: Mean Values for Risk Attitude and Risk Behavior: 1995

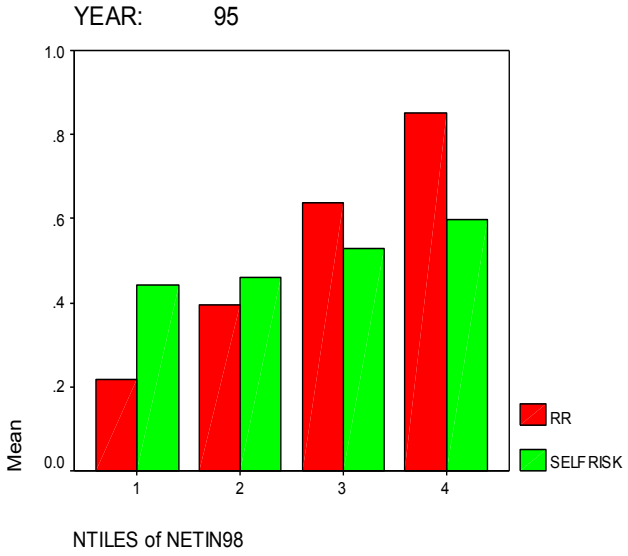
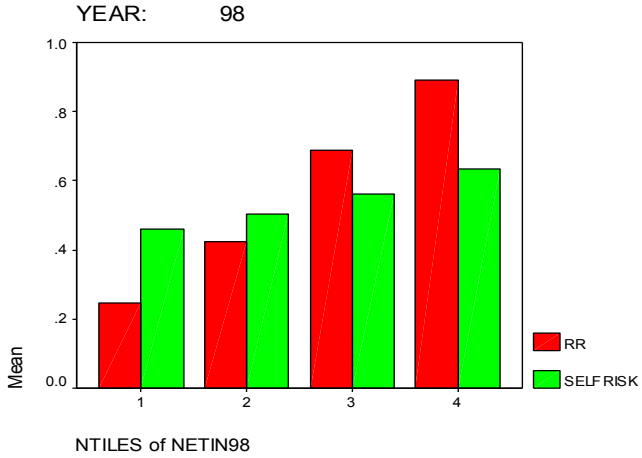


Figure 3: Mean Values for Risk Attitude and Risk Behavior: 1998



The third issue addressed is whether households' networth impact the distribution of their risk behavior and/or their self-reported attitude to risk. To test this, households were partitioned into two groups based on their networth. The grouping variable is called HALFNET. Nonparametric tests (Mann-Whitney and Komolgorov-Smirnov) were then conducted for each of the survey years to determine if the distributions of the risk behavior and risk attitude variables were affected. The results are reported in Table 1. In each survey year the nonparametric tests of the null hypotheses that networth does not affect the distributions of the risk behavior and risk attitude variables indicate that the null hypotheses are rejected.

The fourth issue addressed is whether attitudes to risk influence the distribution of networth. The corresponding null hypothesis is that attitudes to risk do not influence the distribution of networth. To test this hypothesis nonparametric tests were conducted on the data partitioned by attitudes to risk. The grouping variable is called HALFSELF and has a value of 1 if the rescaled attitude to risk variable is 0.25 or 0.5 (self-reported as risk adverse) and a value of 2 if is is 0.75 or 1.00 (self-reported as risk seeking). The results reported in Table 2 indicate that the null hypothesis is rejected for each of the survey years investigated.

CONCLUSION

The empirical findings of this paper show that there was no change in the distribution of household wealth across the 1992 and 1995 Surveys of Consumer Finances, but a statistically significant change between the 1995 and 1998 distributions as well as between the 1992 and 1998 wealth distributions. A second finding is that across the survey years there was a consistent pattern of increasing financial risk taking as well as self-reported willingness to take financial risks as wealth levels increased. Finally, statistical tests showed that households' attitudes to risk had a significant impact on the distribution of wealth.

The first finding is in sharp contrast to the theme of wealth polarization that can be found in much of the recent literature on household wealth distribution in the U.S. The third finding is consistent with the consensus view that decreasing absolute risk aversion characterizes the relationship between the level of wealth and the amount of wealth held in the form of risky assets. The fourth finding suggests that differences among households' financial risk taking behavior can help to explain the nature of the wealth distribution. An extension of this paper would be to consider the role of demographic and socio-economic variables in explaining the classification of households based on their self-reported attitudes to risk.

Table 1: Equality of Wealth Distribution Tests

	1992 vs 1995	1992 vs 1998	1995 vs 1998
Mann-Whitney U Test Statistic	8,356,178 Z=-0.092	8,313,142 Z=-2.083	9,022,930 Z=-2.331
Asymptotic Significance (2-tailed)	.927	0.037	0.020
Komolgorov-Smirnov Absolute Extreme Statistic	0.030 Z=1.355	0.040 Z=1.815	0.051 Z=2.352
Asymptotic Significance	0.051	0.03	0.00

Table 2: Nonparametric tests of the effect of Wealth on Risk Ratio and Risk Attitude

	1992	1995	1998
Risky Assets Ratio			
Mann-Whitney U Test Statistic	351,384 Z=-22.057	500,070 Z=-21.940	526,315 Z=-22.993
Asymptotic Significance (2-tailed)	0.000	0.000	0.000
Komolgorov-Smirnov Absolute Extreme Statistic	.446 Z=10.018	.420 Z=10.195	.410 Z=10.367
Asymptotic Significance	0.000	0.000	0.000
Self-Reported Risk Attitude			
Mann-Whitney Test Statistic	603,771 Z=-10.283	775,034 Z=-11.079	787,150 Z=-10.495
Asymptotic Significance (2-tailed)	0.000	0.000	0.000

Table 3: Nonparametric tests of the effect of Self-Reported Risk Attitudes on Wealth Distributions

	1992	1995	1998
Wealth/ Risk Attitude			
Mann-Whitney U Test Statistic	548,432 Z=-4.631	819,680 Z=-4.577	961197 Z=-6.346
Asymptotic Significance (2-tailed)	0.000	0.000	0.000
Komolgorov-Smirnov Absolute Extreme Statistic	.115 (ks) Z=2.321	.118 (ks) Z=2.478	.121 (ks) Z=3.093
Asymptotic Significance	0.000	0.000	0.000

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