Perspectives On Behavioral Finance: Does "Irrationality" Disappear With Wealth? Evidence From Expectations And Actions

Annette Vissing-Jorgensen
Kellogg School of Management, Northwestern University, NBER and CEPR

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Abstract

The paper discusses the current state of the behavioral finance literature. I argue that more direct evidence on investors' actions and expectations would make existing theories more convincing to outsiders and would help sort among behavioral theories for a given asset pricing phenomenon. Furthermore, evidence on the dependence of a given bias on investor wealth/sophistication would be useful for determining if the bias could be due to (fixed) information or transactions costs or is likely to require a behavioral explanation, and for determining which biases are likely to be most important for asset prices.

I analyze a novel data set on investor expectations and actions obtained from UBS PaineWebber/Gallup. The data suggest that, even for high wealth investors, expected returns were high at the peak of the market, many investors thought the market was overvalued but would not correct quickly, and investors' beliefs depend strongly on their own investment experience. I then review evidence on the dependence of a series of "irrational" investor behaviors on investor wealth and conclude that many such behaviors diminish substantially with wealth. As an example of the cost needed to explain a particular type of "irrational" behavior, I consider the cost needed to rationalize why many households do not invest in the stock market.

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1 Introduction

The contribution of behavioral finance is fourfold:

1. To document price patterns that seem inconsistent with traditional finance models of efficient markets and rational investors.

2. To document behaviors by investors that seem inconsistent with the advice of traditional finance theory.

3. To provide new theories for 1 and 2, often based on behaviors documented in the psychology literature or observed in experiments.

4. To argue that if prices deviate from fundamentals due to the behavior of irrational investors, arbitrage by rational investors may not be able to force prices back to fundamentals. This part of the behavioral finance literature is referred to as the 'limits to arbitrage' literature.

The most influential work on price patterns within the behavioral finance literature has concerned initial underreaction and (in some cases) subsequent overreaction of prices to new information. This work is described in Shleifer (2000) as well as in recent surveys of behavioral finance by (insiders) Barberis and Thaler (2002), Daniel, Hirshleifer and Teoh (2002) and Hirshleifer (2001).

Defenders of the standard rational expectations, efficient markets asset pricing approach have argued that the evidence on underreaction and overreaction is unconvincing since (a) there are as many cases of initial overreaction as initial underreaction, and the evidence is not that solid statistically, Fama (1998), and (b) if the documented price predictability was statistically solid and stable over time, mutual fund managers should be able to substantially outperform the market on average, but are not, Rubinstein (2001). On the modeling side, many have found references to the psychology literature or the experimental literature unconvincing. In some cases it seems that too much is possible in the sense that the literature provides evidence both in favor of a given behavioral bias as well as for the opposite bias. Furthermore, many have been skeptical of whether behavioral biases are present in real world cases where individuals have had time to learn (by themselves or from prior generations), and in particular whether the wealthiest investors with large amounts at stake exhibit behavioral biases. The behavioral side has defended itself by arguing that prices may be far from the predictions of standard models even if (risk-adjusted) profit opportunities are not present. This is the case since arbitrage is limited. First, the mispricing may get worse in the short run (noise trader risk). This is especially a problem when investment is delegated to portfolio managers with short investment

horizons (Shleifer and Vishny (1997)). Second, arbitrage is risky when it involves the whole stock market or when it involves individual stocks with no close substitutes. Third, arbitrage may involve substantial transactions costs or be hindered by costs of shorting stocks or restrictions on shorting stocks (e.g. by mutual funds). Barberis and Thaler (2002) provide a discussion of these limits to arbitrage. Abreu and Brunnermeier (2001, 2002) provide an additional argument for limited arbitrage. They show theoretically that it may be optimal for rational arbitrageurs to ride bubbles started by other investors.[1]

In this paper I argue that direct evidence on investor beliefs and actions is valuable for determining whether assumptions made in behavioral asset pricing models are valid, and thus for determining which (if any) of the models are convincing explanations of the facts they set out to explain. Furthermore, to understand the causes of non-standard beliefs/actions it is useful to distinguish between beliefs/actions that are present for wealthy investors and thus unlikely to be due to information or transactions costs, and beliefs/actions that predominantly are observed among less wealthy investors. This is also informative for determining whether a given bias is likely to have a substantial pricing impact. It is important to emphasize that biases affecting mostly low wealth investors are nonetheless also important, since these biases may have large effects on the utility of these investors.

I start in section 2 by discussing types of evidence about investors that would be valuable for understanding pricing anomalies and then in section 3 provide new evidence on investor beliefs based on a data set covering the period 1998-2002. Section 4 then turns to a set of investor behaviors that are inconsistent with the recommendations of standard finance theory and reviews evidence on whether these biases diminish substantially with investor wealth. Section 5 provides a rough calculation of how large information/transactions costs would be needed to explain one particular type of "irrational" investor behavior, limited participation in stock markets. Section 6 concludes.

2 The Value of Direct Evidence on Investor Beliefs and Actions

At the aggregate level, stock returns are predictable by the dividend-to-price ratio, the earnings-to-price ratio, the market-to-book ratio, the consumption-to-wealth ratio and a host of other aggregate variables, see Campbell (2000) for a list of references. The direction of predictability indicates that future stock returns tend to be lower when the stock price is high relative to dividends and earnings. Within a rational agent framework the interpretation of this is that

[1] In support of this theory, Brunnermeier and Nagel (2002) show that hedge fund portfolios were heavily tilted towards technology stocks during the stock market boom of the late 1990s and that hedge funds started to reduce their exposure in the quarter prior to the price peaks of individual technology stocks.

investors' expected (and required) returns are low at such times. The alternative theory proposed by behavioral finance is overreaction of stock prices to news at the level of the aggregate stock market. According to overreaction theories, the returns expected by market participants are not unusually low when price-to-dividend ratios are high.

The literature on the cross-section of stock returns has identified many return patterns not predicted by standard models. Examples of overreaction include: (a) the market-to-book effect (low market-to-book or low price-to-dividend stocks have historically outperformed high market-to-book stocks, Fama and French (1992) and earlier references cited therein), (b) the small firm effect (small stocks have outperformed large stocks, Banz (1981)), (c) long run reversal (past three or five year winners perform worse than past three or five year losers over the following three years, DeBondt and Thaler (1985)), and (d) the poor long run performance of the stock of firms issuing new stock, Loughran and Ritter (1995). Examples of underreaction include: (a) Momentum (past 3 to 12 month winners continue to outperform past 3 to 12 month losers during the following six months, Jegadeesh and Titman (1993)), and (b) the post-earnings announcement drift, Bernard and Thomas (1989).

Several risk-based models have been proposed for the cross-sectional return patterns. Berk, Green and Naik (1999) provide a rational model based on growth options and time varying risk which generates the market-to-book effect, the size effect, and the momentum effect. Gomes, Kogan, and Zhang (2003) provide a related investment based explanation of the market-to-book effect and the size effect.

The behavioral finance literature furthermore provides several possible explanations. In Barberis, Shleifer, and Vishny (1998) earnings are generated by a random walk process. However, investors think that shocks to earnings either are negatively correlated (regime 1) or positively correlated (regime 2). Investors update their beliefs based on observed earnings. Regime 1 is motivated by experimental evidence that people overweight their prior ("conservatism"), while regime 2 is based on experimental evidence that people believe in a "law of small numbers" in that they expect even short samples to reflect the population probabilities. The model generates momentum, long term reversal, and cross-sectional forecasting power for scaled price ratios (i.e. initial underreaction followed by subsequent overreaction). A related model based on the law of small numbers is given in Rabin (2002). Daniel, Hirshleifer, and Subrahmanyam (1998) provide an alternative model based on "overconfidence" in private signals plus "biased self-attribution". Overconfidence implies initial overreaction of prices to private information while biased self-attribution implies that new public information that supports the investor's private information is weighted more than contradictory news. This in turn on average leads to further overreaction. The model thus explains medium term momentum as well as long-run reversals. A third model is that of Hong and Stein (1999) in which two groups of agents interact to produce the same

facts. Private information diffuses slowly among "Newswatchers" who therefore generate initial underreaction. "Momentum traders" in turn generate overreaction.

The above behavioral models base their main assumptions on experimental evidence or simply assume certain trading strategies of investors. They all rely on expectational errors of investors. To provide evidence on whether the pricing anomalies reflect mispricing due to expectational errors, a few papers have studied whether a large part of the profits from value and momentum strategies occur at subsequent earnings announcement dates (the following references are from Daniel, Hirshleifer and Teoh (2002)). La Porta, Lakonishok, Shleifer and Vishny (1997) find that differences in postformation earnings announcements returns account for about a quarter of the value effect. Jegadeesh and Titman (1993) find that a similar fraction of the profits from their momentum strategies is due to expectational errors. Jegadeesh (2000) shows that firms that issue seasoned equity do especially poorly around subsequent earnings announcement dates.

While these findings are suggestive of some mispricing, they do not conclusively rule out the possibility that rational stories based on time varying expected returns could be most of the explanation. They also do not help sort among different behavioral explanations. Directly analyzing investor expectations would be valuable. Several papers analyze measures of expected returns of equity analysts, see Brav, Lehavy and Michaely (2002) and references to earlier work therein. Careful modeling of analyst incentives is needed to interpret such evidence since analyst forecasts and the forecasts of professional macroeconomic forecasters have been shown to depend on the incentives provided by existing payment schemes (Hong, Kubik and Solomon (2000) and Lamont (2002)). Consistent with this, Brav et al. (2002) find substantial differences between independent analysts and analysts with investment banking ties. Interestingly, for the independent analysts, they find that expected returns are higher for small stocks, consistent with the small firm effect being a rational phenomenon driven by risk, whereas book-to-market has little effect on expected returns and momentum affects expected returns with the opposite sign of what a risk based explanation of the momentum effect would suggest.

Evidence on the beliefs of investors gets around any incentive problems involved in interpreting analyst forecasts, and furthermore does not need to assume that investor beliefs are driven by/correlated with analyst forecasts. This turns out to be important since my evidence based on investor beliefs suggests that investors' expected returns were high during the last part of the stock market boom in the late 1990s which is the opposite of what Brav et al. (2002) find for the independent analysts. The data on investor beliefs also allows me to provide evidence regarding some of the behavioral stories put forward to explain momentum and reversals. Specifically I provide evidence in favor of a version of the law of small numbers (an ingredient in the model of Barberis, Shleifer, and Vishny (1998)) by analyzing the cross-section of investor beliefs. I

also find support for biased self-attribution (an ingredient in the model of Daniel, Hirshleifer and Subrahmanyam (1998). I show that these biases are present and fairly strong even for high wealth investors and thus that some pricing impact is likely.

As an alternative to evidence based on beliefs, analysis of investment patterns is informative for determining whether return puzzles are due to mispricing or to time varying risk and expected returns. Grinblatt and Keloharju (2000) confirm that the momentum effect is present in Finland and then analyze whether more sophisticated investors tend to be more momentum oriented/less contrarian in their trades. They find strong support for this, suggesting either that momentum represents mispricing and that this mispricing is better understood by more sophisticated investors, or that high momentum stocks are riskier in some yet to be identified way and that more sophisticated investors are better able to bear this risk. Cohen, Gompers and Vuolteenaho (2002) find that institutions buy shares from individuals in response to positive cash-flow news, and conversely for negative cash-flow news. Again, this has two possible interpretations. Either institutions attempt to exploit underreaction of prices to earnings announcements, the post-earnings announcement drift, or stocks with large positive (negative) earnings surprises are by some measure riskier (less risky) than stocks with small earnings surprises and those who invest through institutions are better able to bear high risk. In the context of both of these studies, the ideal evidence would be a combination of these facts on trades with evidence on whether or not the expected returns of institutions and households differed. If yes, that would provide further support for the mispricing interpretation.

Before turning to the evidence on investor beliefs it is important to emphasize that the data set I use covers only a short time period, 1998-2002, and mainly focuses on the aggregate stock market. While the large price movements makes this period particularly interesting, I view my results as simply suggestive. My evidence indicates that (1) expected returns were high at the peak of the market, (2) many investors thought the market was overvalued but would not correct quickly, (3) investors' beliefs depend on their own investment experience (a version of the law of small numbers), (4) the dependence of beliefs on own past portfolio performance is asymmetric consistent with theories of biased self-attribution, and (5) investor beliefs do affect their stocks holdings. Mainly, the purpose of providing this evidence is to illustrate the value that direct evidence on investor beliefs and actions can have in distinguishing rational theories of pricing anomalies from irrational ones, as well as for testing the assumptions of behavioral models using data for actual investors. While experimental evidence and references to the psychology literature are suggestive, such evidence certainly is more convincing if supplemented with facts about the beliefs and actions of investors.

3 Investor Beliefs from 1998 to 2002

3.1 Data

My study of investor beliefs is based on the data underlying the Index of Investor Optimism. Since 1996 UBS and Gallup have conducted monthly telephone surveys of U.S. individual investors (an international dimension was added starting in 2002). Until February 2003 the UBS/Gallup data were proprietary. The data can now be purchased via the Roper Center at the University of Connecticut. UBS granted me access to the data in late 2002 in order to undertake this study.

To be included in the survey investors must have at least $10,000 in household financial assets defined as "stocks, bonds, or mutual funds in an investment account, or in a self-directed IRA or 401(k) retirement account". In 1996, about one in three households qualified as potential participants in the survey based on this criteria, increasing to about 40 percent of households by the start of 2003. Using data from the 1998 Survey of Consumer Finances, households with $10,000 or more in financial assets, owned more than 99 percent of stocks owned directly or indirectly by U.S. households, more than 99 percent of household financial wealth, and about 95 percent of household net worth.

The UBS Index of Investor Optimism is based on qualitative responses to a series of questions about optimism/pessimism regarding the investor's own investment and income outlook as well as about the stock market and other macroeconomic variables. In this study I focus on the more quantitative questions also included in the survey.

Each month about 1,000 investors are interviewed. The survey is not a panel, but given the relatively large number of investors interviewed each month, cohort analysis is possible. Information is collected about a host of expectational and demographic variables. Four questions about returns are of particular interest:

One year own past return: "What was the overall percentage rate of return you got on your portfolio in the past twelve months?"

Expected one year own return: "What overall rate of return do you expect to get on your portfolio in the next twelve months?"

Expected one year market return: "Thinking about the stock market more generally, what overall rate of return do you think the stock market will provide investors during the coming twelve months?"

Expected ten year market return: "And, what annual rate of return do you think the stock market will provide investors over the next ten years?"

Information on these variables are available for June, September, and December 1998, and then monthly from February 1999 to December 2002, with the exception that the expected ten year

market return is not asked in June 98 and various months of 2002. For 1998 and 1999 responses of less than one percent (including negative responses) are coded as one category. I set these values to zero.[2] Furthermore, I drop observations of expected market or own portfolio returns and of own past portfolio returns that are below -95 percent or above 95 percent.[3] I supplement the answers to these questions with background information on age, years of investing experience ("How long have you been investing in the financial markets?"), financial wealth (categorical), and household income (categorical).

In order to determine if expectations affect investment decisions I consider special topical modules with information about portfolio shares (available for September 1998, February 2001, and May 2001), and about internet stock holdings and expectations (available for March, June, September 1999, and February, April, June, July 2000).

Finally, to analyze investors' perceptions about misvaluation of the stock market, and whether this is expected be corrected soon, I consider three additional questions:
Overvaluation perception: "Do you think the stock market is overvalued / valued about right / undervalued, or are you unsure?".[4]
Expected three month market change: "Over the next three months, do you think the stock market will go up, go down, or remain about the same?"
Expected one year market change: "A year from now, do you think the stock market will be higher than it is now, lower, or about the same?"
The overvaluation perception is available for most months of the survey since June 1998. The expected three month market change is available from December 1998 to August 2000, and the expected one year market change is available for September 1998 and from March 2000 onward.

3.2 Were Expected Returns High in the Late 1990s?

The UBS/Gallup data provide an opportunity to address several questions central to behavioral finance as well as to traditional finance theory.

I start by considering what the data from the recent stock market experience can teach us about the reasons for predictability of aggregate stock returns. If investors have rational expectations and understand the historical relation between price-dividend ratios and future

[2] In the 1998 and 1999 data fewer than 3 percent of responses for each of the four variables listed are in the less than one percent category suggesting that the lack of negative values for these years is not a substantial problem. To confirm this, I considered the data for January 2000, the first month where zero and negative values are available in non-categorical form. The average expected market return calculated by setting responses of less than one percent to zero differed by less than a quarter percentage point from the value using the actual responses.

[3] This approach was followed in some months in the data I received by Gallup. Furthermore, it is not clear how responses of 100 percent or above were coded before year 2000.

[4] This question is one of the few where respondents explicitly are allowed an "unsure" category.

stock returns, then their expected stock returns should be low during the last years of the market boom where both price-dividend and price-earnings ratios reached historical highs (and appropriate measures of risk should be low at that time). If on the contrary expected stock returns were high towards the end of the market boom, this would be lend support to behavioral stories of overreaction. Prior work on this issue includes Shiller, Kon-Ya, and Tsutsui (1996) who analyzed expectational data for institutional investors in Japan to analyze expectations at and after the peak of the Nikkei index. Their results are hard to interpret. Japanese institutional investors expected one year capital gains on the Nikkei index of about 10 percent at the peak of the market which seems neither unusually high or low, but expectations then increased to levels around 20 percent after the first year and a half of the Nikkei's decline.

Using the UBS/Gallup data Figure 1A shows average expected one year stock market returns from June 1998 to December 2002. The graph furthermore uses survey weights to make results representative of the population. For reference Figure 1B and 1C show the time series for the NASDAQ and NYSE market indices.

The average expected one year stock market return increased from an average of 11.8 percent in 1998 to 15.8 percent in January 2000, and then declined dramatically to around 6 percent at the end of 2002. Thus expected returns were high when the market was at its highest, counter to what the historical statistical relation would have predicted. The correlation at the monthly frequency between the average expected one year stock market return and the level of the NYSE is 64.6, and the corresponding correlation with the NASDAQ index is 78.0.[5] An OLS regression (not shown) of the average expected one year stock return on the NYSE index results in a coefficient of 0.035 with t-statistic of 5.9. Using the NASDAQ index, the regression coefficient is 0.0024 with a t-statistic of 8.6. Splitting the sample into investors with less than $100,000 in financial assets and investors with $100,000 or more (not shown), the average expected one year stock returns are about 1 percent lower throughout the period for those with $100,000 or more of in financial assets, but the time pattern is similar for the two groups.

This evidence suggests that, at least for this particular historical experience, prices and expected returns comove positively and thus that some amount of overreaction of prices may have been present. The average expected ten year stock market returns, also shown in Figure 1, are much more stable over time. Given the small number of ten year periods for which we have data, and the uncertainty return predictability at this frequency, stable beliefs at the ten year horizon seem rational.[6] Graham and Harvey (2001) study the stock market return expectations

[5] These correlations are calculated using the NYSE and NASDAQ indices at the start of the month. Survey interviews are conducted during the first two weeks of the month.

[6] The average expected ten year market returns are however surprisingly high relative to the average expected one year market returns. Median ten year return expectations also exceed median one year return expectations

of a smaller sample of CFOs for 6 quarters starting in the second quarter of 2000. They also find that one year return expectations are more stable than ten year return expectations and that one year return expectations comove positively with the realized market return.

3.3 Disagreement and Noise Trader Risk

Standard finance theory suggests that expected stock market returns should be very similar across investors. While some investors may have private information about the returns on individual stocks, private information about the return on the whole market is less likely. Furthermore, to the extent that trading by better informed investors lead prices to reflect their information, others are able to learn from this (Grossman and Stiglitz (1980)), reducing any belief heterogeneity further. In essence, since everyone by assumption believe in the same model of how expected stock returns are generated and are equally able to process information, any heterogeneity in beliefs requires both that some investors have private information about market returns and that noise traders or other impediments to learning prevent prices from revealing this information to all investors.

Behavioral finance theory on the other hand would suggest that differences in expected returns across investors are likely. There is no presumption that all investors use the same model to form expected stock market returns. Since Miller (1977) several models have considered the possible equilibrium effects of disagreement, emphasizing that in the presence of short-sales constraints, high disagreement leads to high prices and subsequent low returns. See Diether, Malloy and Scherbina (2002) for references to this literature and for empirical evidence in favor of this theory based on analysts' earnings forecasts and the cross-section of stock returns. Less is known about disagreement about aggregate stock market returns, and about how investor beliefs come to differ.

The time series of cross-sectional standard deviations are shown in Figure 2. In a cross-section of investors it is likely that some of the observed differences in responses for expected stock market returns simply reflect lack of knowledge about stock market returns, rather than firmly held beliefs on which the investor would place substantial trades. This is confirmed by the fact that the cross-sectional standard deviation of expected one year stock market returns is 11.3 percent for those with less than $100,000 in financial assets, compared to 9.2 percent for those with $100,000 or more in financial assets who have a greater incentive to be informed about returns. These numbers are averages over time of the monthly cross-sectional standard deviations. Figure 2 therefore shows both the disagreement across all investors, as well as the disagreement among those with $100,000 or more in financial assets. Consistent with the

although not quite as dramatically.

findings of Diether, Malloy and Scherbina (2002) for the cross-section of stocks, disagreement was highest just prior to the market decline. It is important to emphasize however, that finding a positive relation between disagreement and subsequent returns does not necessarily reflect the importance of short sales constraints. Did a significant number of investors in fact want to short the market in the late 1990s? De Long, Shleifer, Summers and Waldman (1990) and Shleifer and Vishny (1997) emphasize how noise trader risk can limit arbitrageurs willingness to take market stabilizing positions. The risk that misvaluation may worsen will lead rational arbitrageurs to bet less heavily against the mispricing, more so the shorter the horizon of the arbitrageur. The argument of Abreu and Brunnermeier (2002) that it may even be optimal for arbitrageurs to attempt to ride bubbles rather than bet against them only serves to limit arbitrage further.

Shiller has collected expectations data which provide useful information on this issue. His data cover U.S. institutional investors and U.S. individual investors with net worth generally $250,000 or more.[7] While between 50 and 70 percent thought that U.S. stock prices were overvalued in 1998 and 1999 (calculated excluding those with "Do not Know" responses), about 70 percent expected the Dow Jones Industrial index to increase over the next year.

Figure 3 provides related information for the UBS/Gallup data which covers a broader sample of individual investors and does not include institutions. As shown in Figure 3A, about 50 percent of investors thought the stock market was overvalued during the last two years of the boom, and typically less than 10 percent thought it was undervalued. However, Figure 3B shows that only about 20 percent thought that the market would decline over the next three months/one year (I use the three month horizon from December 1998 up to February 2000, and the one year horizon when it becomes available from March 2000 onward and for September 1998). Furthermore, as shown in Figure 3C, even among those thinking the market was overvalued in 1999-2000 only about 25 percent thought it would decline. A similar pattern obtains for investors investors with $100,000 or more in financial assets. Along with the evidence on hedge fund holdings from Brunnermeier and Nagel (2002) mentioned above, the expectations data support the idea that noise trader risk matters.

Of course, there is an identification problem here. Short sales constraints could be the reason that few thought the market would go down in the near future. Mankiw, Reis, and Wolfers (2003, this volume, Figure 4) provide a very interesting study of disagreement about inflation expectations based on data from the Survey of Consumer Attitudes and Behavior (CAB). They find the same positive relation between the level of inflation and disagreement about next year's inflation rate as was present for stock market returns. Since a high level of inflation is unrelated to short sales constraints for stocks it is possible that a positive relation between the level of a series and the disagreement about the series in the future is a more general feature of expectations

[7] Shiller's analysis is available at http://icf.som.yale.edu/confidence.index.

formation, for example because households have less history on which to base their expectations when the series is at an unusually high value.

3.4 The Dependence of Investor Beliefs on Own Investment Experience

A unique feature of the UBS/Gallup data is that it provides a host of information about each individual investor in terms of demographics and past portfolio performance. This allows further analysis of differences in beliefs. In this section I document that an investor's belief about future stock market returns depends on the investor's own experience measured by age, years of investment experience, and own past (self-reported) portfolio returns. A behavioral interpretation of these facts is that they provide support for the "law of small numbers" emphasized by Barberis, Shleifer and Vishny (1988) and Rabin (2002) (I discuss a possible rational story below). Investors subject to this bias will expect even short samples to reflect the properties of the parent population and will thus have high expected returns after a period of high realized returns. However, the dependence of expected returns on investor age and experience makes this bias more precise by pointing to what defines the beginning of the (more) relevant small sample - the date the investor started investing in the market. The data also allow a more detailed analysis of how investors' expected market return and expected own portfolio return depend on the past return on their own portfolio to determine whether investors exhibit biased self-attribution, a key ingredient in the model of momentum and reversal of Daniel, Hirshleifer and Subrahmanyam (1998).

Figure 4A plots the expected one year stock market returns of different investor age groups against time.[8] A strong relation between beliefs and age is apparent with young investors expecting substantially higher returns than middle aged investors, who in turn are more optimistic than old investors. At the peak of the market young investors, defined as those younger than 35 years, on average expected the market to do about 5 percentage points better over the next year than did old investors, those age 60 or older. The difference narrows as the market declines. One would expect such narrowing since new data points should be weighted more by young investors who effectively have a shorter data sample. How much the gap narrows during the market downturn depends on whether one uses sample weights or not. Figure 4A uses sample weights, Figure 4B does not. Differences between age groups narrow more consistently when the data are not weighted within age groups.[9] Analyzing medians rather than means lead to

[8] To have a reasonably large number of observations per age group per period, the figure shows quarterly average expectations rather than monthly average expectations.

[9] It is not clear whether weighting is preferred. For calculating overall average expectations for each time period weighting is appropriate. However, when considering the effect of a given investor characteristic on beliefs in a regression context we know that OLS is efficient (other problems aside), and weighting observations by sampling

similar patterns, although the difference in median expectations of young and old households at the peak of the market was around 2 percent compared to about 5 percent when focusing on means (except in the first quarter of 2000 where even the median difference increase to 5 percent). Figure 4C shows large age differences in ten year expected stock return as well. Table 1, regression 1, shows that the age effect is statistically significant at the 5 percent level in almost all quarters. Coefficients on age is allowed to vary over time (by year and quarter), and time dummies are included separately. The negative effect of age on the expected stock market return is strongest around the peak of the market. Table 1, regression 2, shows that the age effect is as strong for those with financial assets of $100,000 or more as for the full sample.

Further evidence regarding the effect on beliefs of the stock market returns observed by the investor him/herself can be gained by considering the effect of years of investment experience within age groups. If the dependence of beliefs on age in fact is due to investors weighting stock market returns they have observed more, then after a series of good stock returns expected returns should be higher for those with low investment experience for given age than for those with more years of experience. In Figure 5 households are split into those will less/more than median years of investment experience, within each age group. Over the time period covered by the UBS sample the less experienced investors expect about 1-2 percent higher market returns, with no clear time pattern in this difference.

A final approach to analyzing how experienced returns affect beliefs is to consider whether there is an effect of own past portfolio returns on expectations about the market return. This is strongly the case. I sort the respondents into four groups based on their reported own portfolio return over the past year. Figure 6 shows that compared to those with reported own past returns between 0 and 10 percent, those with own past returns between 10 and 20 percent expected the market return over the next year to be about 3-4 percentage point higher, with the difference increasing to about 10 percentage points for those with own past returns above 20 percent.[10] To determine whether age, years of investment experience and own past returns have independent effects on market expectations, Table 1, regression 3, provides regression results with all three variables included. Once experience and own past returns are included, the effect of age largely disappears. Thus the higher expected returns of young investors seems to be driven mainly by their, on average, shorter investment experience and the higher (actual or perceived) returns on their own portfolios during the stock market boom. This leads to two possible interpretations of the age effects on stock market return expectations. The first is that

probabilities leads to a less efficient estimator. Therefore, I do not use sample weights in the rest of the analysis.

[10] Some of this effect could be due to measurement error in reported own past portfolio returns, if those who exaggerate their past returns expect high market returns. The asymmetry of the effect of own past returns on expected market returns (and expected own returns) documented below is less subject to such problems.

investors are rational but information about past market returns is costly. Then investors may rationally form expectations about future market returns based on their own actual past returns or, if such information is also costly, own perceived past portfolio returns. Since the young report higher own past returns this would provide a rational explanation of the age effect. The second interpretation is that investors of different ages are equally informed about past market returns, but due to a behavioral bias nonetheless use their own portfolio returns in forming beliefs about future market returns. The fact that the age effect is equally strong for the wealthiest half of the sample suggests that information costs are unlikely to be driving it and thus that a behavioral story is needed.

The data on inflation expectations from the Survey of Consumer Attitudes and Behavior can be used to determine whether the age dependence of expectations about stock market returns generalizes to other aggregate variables.[11] The data furthermore has information about each respondent's perception of what inflation was for things he/she buys during the past year. This is useful for distinguishing the above two interpretations of the age dependence of stock market return expectations. If there is an age effect in inflation expectations but no differences in past perceived inflation (or the difference is the opposite of what is needed to explain the age effect in inflation expectations), that would be evidence against the rational costly information explanation of age effects in expectations about aggregate variables.

The CAB asks respondents whether they think prices will go up, down or stay the same over the next 12 months. From 1966-1979, respondents who expect price increases are asked for their expected inflation rate in percent. From 1980 onward all respondents are asked for their expected inflation rate. Before the third quarter of 1977 all or some of the percentage responses are categorical. To construct a comparable time series of expected inflation rates, I assume that inflation is normally distributed in the cross-section of respondents in each quarter/month (the survey is quarterly up to 1977 and monthly after that). I then estimate the cross-sectional mean and standard deviation based on the percentage of respondents who expect inflation to be below five percent, including those expecting no or negative inflation, and the percentage of respondents who expect inflation to be below ten percent.[12] Figure 7A shows the expected inflation rate for the next 12 months, by age of respondent, for the period 1966-2001. The expectation plotted for a given year and age group is the cross-sectional average based on responses from all months of that year. Figure 7B shows similar series for 1975-2001 based on expected (annual) inflation

[11] See Souleles (2001) and Mankiw, Reis, and Wolfers (2003) for further description of the data and analysis of heterogeneity in inflation expectations.

[12] In principle it would be more efficient to use all the inflation categories provided, rather than only two pieces of information. In practice, a lot of the responses are at inflation rates of zero, three, five, ten percent etc. A more sophisticated statistical approach would therefore need to either use a different distribution than the normal distribution or model the "rounding" of the responses to popular values.

over the next five to ten years. The actual inflation rate plotted in Figure 7C. Since survey interviews are spread out over the year, the actual inflation rate plotted is the annual inflation rate from July of the current year to July of the following year.

Inflation expectations for the coming year peak in 1979 after a period of high actual inflation rates. In that year the average expected inflation rate for the next 12 months of those under age 35 exceeded that of those age 60 or older by 2.5 percentage points. The difference widens to 4.9 percentage points in 1981, due to a more dramatic drop in expected inflation for older respondents in 1980 and 1981, and then gradually diminishes during the 1980s. For the years starting with 1980 where the expected inflation rates are available for all households, a simple approach to test whether the age differences are significant is to run a pooled OLS regression of expected inflation rates on year dummies and on age interacted with year dummies, thus allowing the coefficient on age to differ by year (this approach is similar to that used for stock returns in Table 1). The regression, not included in a table for brevity, shows that age is significant at the five percent level in all years from 1980 to 1987. Overall, the age differences in expectations around the period of high inflation are quite similar to the evidence for stock market return expectations. Figure 7B shows that a strong age pattern is also present in expectations about the level of inflation over the next 5 to 10 years.

In some periods of the survey, households are asked for the inflation rate (for things they buy) over the past 12 months. Quantitative data, consistently defined across years, are available for 1975-1985. Time series for average perceived inflation rates are constructed using the same method as was used for the two forward looking variables, and are illustrated in Figure 7D. Notably, the youngest group generally have the *lowest* perceived inflation, while the ordering of the other three age groups depends on the year in question. A regression (not included in a table) of perceived inflation over the past 12 months on year dummies and on age interacted with year dummies can be run for 1980-1985 (again, percentage responses are only available in a non-categorical form for all respondents from 1980 on). Perceived inflation is significantly *positively* related to age in each of these six years. Consistent with this, the negative effect of age on expected 12 month inflation is a bit stronger when controlling for perceived past inflation which itself has a strong positive effect on expected inflation. Thus, the finding that the old expected much lower inflation than the young around 1980 is not driven by different perceptions about inflation over the past year. This again suggests that costs of acquiring information about the inflation level is not likely to explain the age difference in beliefs, consistent with the finding for stock return expectations that the age effect was equally strong for wealthier investors.

Further study of whether the young or the old have more accurate inflation and/or stock market expectations would be interesting. Whether weighting recent data more is advantageous depends on the persistence of the series being predicted and thus could be expected to lead to

improved accuracy for inflation but possibly decreased accuracy for stock returns. Given the quite short series of expectations on stock returns available in the UBS/Gallup data, I do not pursue the issue of forecast accuracy further.

3.5 Biased Self-Attribution

Figure 8 illustrates that the dependence of expected one year stock market returns on the investor's own past portfolio return is asymmetric. Figure 8A is based on a regression (not included a table) of market return expectations on age, experience, own past portfolio return, and time dummies.[13] The age and experience effects are allowed to vary by year and quarter as in Table 1. The effect of own past portfolio return is now allowed to differ depending on whether the return was positive or negative and is allowed to vary by amount of financial wealth. The regression is estimated using data only from 2000-2002 where responses (for market and own return expectations and for own past porfolio returns) of less than one percent are not combined into one category. Figure 8A plots the predicted effect of own past portfolio return on expected one year market return. For those with financial wealth less than $100,000, an own past portfolio return of 25 percent increases the expected market return by 10.4 percent while an own past portfolio return of -25 percent leads to an increase of 1.6 percent.[14] Thus while positive own past portfolio returns leads to higher expected market returns, negative own past portfolio returns have a quite small and positive effect on expected market returns. The effect of positive own past returns is weaker for wealthier investors but a 25 percent own past portfolio return still leads to an increase in the expected market return of as much as 6.7 percent even for those with financial wealth of $500,000 or more. The difference to the lowest wealth group is significant at the one percent level. A diminished effect of positive own past returns was also found for higher income or higher education groups.

Several robustness checks are needed to determine if these findings reflect biased self-attribution. If so then the asymmetry results should be stronger for expected own portfolio returns than for expected market returns since the investor presumably is more likely to think that good own past portfolio returns are indicative of good future returns on his or her own portfolio than on the stock market as a whole. Figure 8B shows that this is indeed the case. The effect of positive own past returns on expected own portfolio return over the next year is about 50 percent larger than the effect on the expected one year market return. When focusing on the expected own portfolio return, a potentially important concern is whether the positive slope in the region of

[13] Note that by including time dummies, the effect of own past return on expected market returns is identified based on cross-sectional differences in own past returns, not based on time variation in own past returns.

[14] Both these effects are significant at the one percent level. About 24 percent of own past portfolio returns for 2000-2003 are negative.

negative past own returns could be due to lack of controls for portfolio choice. The question in the survey refers to the investor's entire portfolio of financial assets, not just the return on stock holdings. To get a substantial negative return an investor likely had invested a lot in stocks which are likely to have a higher expected return than other assets. Investors' portfolio shares for each of the categories "stocks, stock mutual funds", "bonds, bond mutual funds", "cash, CDs, money market funds" and "real estate investments" are available for September 1998, and February and May, 2001. Using data for these three months, controlling for portfolio shares has only a negligible impact on the effect of own past portfolio returns on expected own portfolio returns (or expected market returns). Another concern may be that an own past return of zero may not be the most reasonable comparison point against which to evaluate whether own past portfolio performance is good or bad. Allowing for a kink at an own past portfolio return of 10 percent lead to strong positive effects to the right of this and a flat relation left of this, again suggestive of biased self-attribution.

Overall the results support the assumption of biased self-attribution made by Daniel, Hirshleifer and Subrahmanyam (1998). The finding that the effect diminishes in investor wealth or other measures of investor sophistication does however suggest that more work is needed to understand why some investor are more subject to this bias than others.

3.6 Do Beliefs Affect Actions?

The above results regarding investor beliefs would be of little interest if expectations reported to the survey are not correlated with investor choices. For the three months for which portfolio shares for broad investment categories are available it is possible to determine whether investors with higher expected stock returns did in fact have higher equity portfolio shares.[15] Table 2 shows that this is strongly the case in the region of expected market returns up to 20 percent. This range covers over 95 percent of the investors used in the regression. As another piece of information about the link between expectations and portfolio holdings, Table 3 turns to the relation between internet stockholdings and expectations about internet stock returns. Information about internet stockholdings are included in six months of the survey spread out over 1999 and 2000. Investors who expected internet stocks to have much higher returns than the stock market on average held as much as 25 percent more of their portfolio in internet stocks than those expecting internet stock returns to be somewhat lower or much lower than the return on

[15] Since the observed equity portfolio shares are in the range from zero to 100 percent I estimate the relation using a two-sided Tobit model. The estimation furthermore controls for age, investment experience, financial assets, education, and income since these factors may affect portfolio choice directly and as discussed earlier are correlated with expectations.

other stocks.[16] Lower perceived risk of internet stocks relative to the risk of the market similarly has the expected positive effect on internet stockholdings. Overall the portfolio data thus show that investor actions are linked to their beliefs.

4 The Value of Correlating "Irrational" Actions With Wealth

In this section I turn to the other main strand of the behavioral finance literature which has focused on types of investor behavior that are inconsistent with the recommendations of standard finance models. Part of this literature is separate from the literature on pricing anomalies, while the pricing impact of other of these behaviors has been studied and linked to the pricing puzzles. Of course, even those of the below listed behaviors which may not have significant pricing impact are still important since such behaviors could have large effects on the utility of investors who act in supposedly irrational ways.

Investor behaviors that contradict the predictions of traditional finance models have been surveyed elsewhere (among others, see Barberis and Thaler (2002) and Daniel, Hirshleifer and Teoh (2002)). What I would like to focus on here is whether a given type of "irrational" behavior diminishes with investor wealth or with other measures of investor sophistication.

If the frequency or intensity of such behaviors diminish substantially with wealth/sophistication then two possibilities arise. The first possibility is that these behaviors are driven by information costs which likely have a large fixed component (once you understand diversification you can costlessly apply your insights to a larger portfolio). If so, then investors may be acting rationally given the costs they face. For this to be the case we would need to (a) establish that the required information costs are not implausible, and (b) argue that the behavior exhibited is a reasonable response to lack of information. (b) is more likely to be satisfied in cases where the behavior involves "too little" or "too simple" action (e.g. lack of investment in some securities, lack of reallocation) than in cases where the behavior involves "too much" action (excessive trading). If information costs are to blame for seemingly irrational investor behavior, the policy recommendation would be increased investor education, especially for low wealth/low sophistication investors who may not choose to become informed at their own cost. Of course, from an efficiency perspective, this would only be the policy recommendation if such education has positive externalities (i.e. that one educated investor can help another improve his or her choices) or can be provided cheaper than the cost at which investors could have acquired the information on their own.

If "irrational" behaviors diminish with wealth, a second interpretation is that psychological

[16] It is not clear from the question asked whether the internet portfolio share is the share of internet stocks in the investors equity portfolio or in his total financial asset portfolio.

biases differ across individuals. Further analysis of such cases would improve our understanding of the more fundamental determinants of the biases in beliefs and behavior and such correlations would need to be accounted for in models/calibrations of the likely pricing impact of such biases. To draw a parallel to the traditional finance literature, absolute risk aversion is typically thought and estimated to be decreasing in wealth. This does not mean that risk aversion is not a fundamental element of preferences or that risk averse behavior is due to information costs, but it does mean that it is crucial for modeling and calibration whether or not this wealth dependency is accounted for. Correlating investor choices with other investor characteristics would also be helpful in this context.

Conversely, if a given "irrational" action remains equally frequent for high wealth investors then it is unlikely to be driven by information costs. Furthermore, such investor biases are likely to have the largest impact on equilibrium prices. The behavioral finance literature is still not at the point where calibration of theoretical general equilibrium asset pricing models is done to determine the magnitude of the effects of nonstandard types of behavior on asset prices. Hopefully work will progress to this stage as more information about investor expectations and actions becomes available and we get increasingly accurate estimates of the strength of the various biases.

Of course, it is important when considering the relation between biases and wealth to determine whether reverse causality could be driving the results. Some of the biases listed below are known to generate poor returns and thus low wealth. This means that one has to consider investors with vastly different wealth for comparisons to be robust to endogeneity, or look at more exogenous measures of investor wealth and sophistication such as labor income or education, or compare the behavior of different investor types as in the earlier mentioned studies of trading behavior of households versus institutions, households versus foreign investors, and households versus hedge funds. An even better approach would be to consider the effects of exogenously provided information on investor behavior (examples of such studies are given in the next section).

A partial list of investor behavior not in accordance with standard finance theory includes the following. Some of these facts were documented by researchers in the rational camp. I include them to provide a more complete picture.

The disposition effect: This refers to a tendency of investors to delay selling investments on which they have incurred losses in the hope that they will recover their losses. This has been documented in the stock trades of individuals trading through discount brokers in the U.S. (Odean (1998)), in the stock trades of Israeli individuals (Shapira and Venezia (2001)), in the stock trades of Finnish individuals and institutions (Grinblatt and Keloharju (2001)), in the

option exercise patterns of employees in the U.S. (Heath, Huddart, and Lang (1999)), and in sales patterns for homes (Genesove and Mayer (2001)).

The leading argument against the disposition effect being a rational phenomenon is that winners sold by individual investors subsequently outperform losers not sold (Odean (1998)). Behavioral researchers typically attribute the disposition effect to prospect theory (Kahneman and Tversky (1979)) with a reference price equal to the investor's purchase price. Kahneman and Tversky argued based on experimental evidence that utility should be defined not over wealth or consumption but over gains and losses, and that people are risk averse in the region of gains, but risk loving in the region of losses. Such preferences can induce the disposition effect since investors become risk loving in a security's payoff after a loss but not after a gain. An alternative behavioral story is a mistaken belief in mean-reversion. Odean (1999) argues against this by showing that the stocks purchased by individuals tend to be past winners. Grinblatt and Han (2002) consider the general equilibrium implications of the disposition effect. They construct a model where the momentum effect is driven by some investors exhibiting the disposition effect in their trading behavior. Goetzmann and Massa (2003) provides evidence that a "disposition effect factor" is priced in the cross-section of daily stock returns.

Dhar and Zhu (2002) provide evidence on how the strength of the disposition effect depends on investor sophistication. Using U.S. data from a discount brokerage firm they find that the disposition effect is only about half as strong for high income, retired investors as for low income investors working in non-professional jobs. Controlling for income and occupation they furthermore find a significant weakening of the disposition effect in investor age, and in investor trading experience. 20 percent of investors in their sample exhibit no disposition effect or exhibit a reverse disposition effect. Brown, Chapel, Rosa, and Walter (2002) analyze the disposition effect using Australian data and find that the effect is weaker but still significant for investors taking large positions compared to others. Shapira and Venezia (2002) compare the disposition effect for accounts of independent investors and accounts of investors who have delegated portfolio management to a professional portfolio manager. The trades decided upon by the investment professionals exhibit a weaker, but still substantial, disposition effect. In their study of the disposition effect in real estate transactions, Genesove and Mayer (2001) find that the disposition effect is twice as strong for owner-occupants as for (likely wealthier/more sophisticated) real estate investors. The evidence overall suggests that the disposition effect weakens substantially with investor wealth.

Limited diversification of stock portfolios: French and Poterba (1991) emphasize that investors on average concentrate the vast majority of their equity portfolios in domestic stocks (the home bias puzzle). Coval and Moskowitz (1999) document a local equity preference in

domestic portfolios of U.S. investment managers ("home bias as home"). Huberman (2001) reports a similar local stock preference showing that the amount invested in local regional bell phone companies far exceeds the amount invested in out-of-state regional bell phone companies in most states. Grinblatt and Keloharju (2001) report that home bias at home is also present among Finnish stockholders while Massa and Simonov (2003) document it for Swedish investors. Benartzi (2001) analyzes stockholdings in employer stock and show that employees invest 23 percent of their discretionary retirement plan contributions in company stock. Furthermore, Blume, Crockett and Friend (1974) and many subsequent papers have emphasized the low number of stocks held by many investors.

Coval and Moskowitz (2001) argue that informational advantages may motivate local holdings in their sample since fund managers earn an extra 2.67 percent per year from their local investments relative to their non-local investments. Benartzi (2001) shows that this is not the case for own company stockholdings. While employees tend to allocate more to company stock in firms that have done well in the past, these companies do not outperform other firms going forward. Furthermore, Benartzi provides survey evidence that employees on average think good past returns will continue in the future and that only 16.4 percent of the respondents believe company stock is riskier than the overall stock market, measured by the likelihood of losing half its value over the next five years.

The UBS/Gallup data provide a new opportunity to analyze the relation between "familiarity", expectations, and investments. For three months in 1999 the survey contains information about both internet stock holdings, internet stock return expectations and internet use. Table 4 shows that of those reporting to use the internet and have purchased something online, about 69 percent expected higher returns on internet stocks than on other stocks, compared to 40 percent for those who did not use the internet. Internet users also perceived internet stocks to be riskier. This could be consistent with an information story where internet use leads to cheaper/free information about internet stocks, since internet stocks probably were riskier and therefore may have had higher expected returns than other stocks in 1999. Interestingly, the second regression in Table 3 shows that even controlling for expected returns and risk (and a host of other variables), internet use has a strong effect on internet stockholdings, with those getting on the internet and having purchased something online investing about 20 percent more in internet stocks than those who do not use the internet. This may be suggestive of an "attention effect" where investors simply do not know about all stocks and invest in those stocks they – partly by accident – become aware of. Barber and Odean (2002) and Frieder and Subrahmanyam (2002) find evidence of an attention effect in the stock purchases of individual investors. If information is costly, the attention effect could be rational although one could argue that any deviations of an investors equity portfolio from the market portfolio is irrational.

Turning to the relation between diversification and wealth/sophistication, Table 5 documents a relation between home bias and investor income. The numbers are from NYSE (2000), and are based on a survey of 4842 investors in early 1999 (see Investment Company of America and the Securities Industry Association (1999)). The home bias is seen to diminish quite strongly with investor income, especially when it comes to directly-held non-U.S. stock or holdings of foreign stock through equity mutual funds inside a retirement accounts. Addressing home bias as home, Grinblatt and Keloharju (2001) show that the preference of Finnish investors for local stocks or for stocks with a CEO of their own cultural origin diminishes in investor sophistication as measured by number of stocks held by the investors. Massa and Simonov (2003) find that the local stock preference of Swedish investors is driven purely by low wealth investors.

Furthermore, Table 6 uses data from the 1998 Survey of Consumer Finances to document that the number of stocks held in directly held equity portfolios in strongly increasing in the wealth of the household. While households with net worth below $100,000 on average hold just a couple of stocks in directly held stock portfolios (conditional on having any directly held stock), the average number of stocks increase to about 14 for households with a net worth of a million dollars or more. Vissing-Jorgensen (1999) argue that the percentage of equity owned by very poorly diversified investors in terms of number of stocks is quite small. Goetzmann and Kumar (2001) analyze equity portfolio diversification using investor accounts at a particular brokerage firm and conclude that the majority of such investors are very poorly diversified. While analysis of brokerage accounts can be useful e.g. for analyzing the disposition effect, it is less compelling for analyzing diversification. Investors may use multiple brokers or hold most of their equity portfolios in mutual funds.

Overall investors with larger amounts of wealth or income and thus greater incentives to become informed hold better diversified portfolios than others.

Limited asset market participation. A more extreme example of poor diversification is limited asset market participation. Many households have zero holdings of certain asset classes. The most well known is limited participation in stock markets. Other examples include holding no bonds, or no investment real estate. The papers in the volume edited by Guiso, Haliassos, and Jappelli (2002) provide evidence that limited participation in markets for risky assets is prevalent in many countries. In Vissing-Jorgensen (2002) (and section 5 below) I consider the role costs of stock market participation may play in providing a rational explanation for this. Heaton and Lucas (1999), Polkovnichenko (2001), Vissing-Jorgensen (1998) and others have considered the equilibrium impact of limited participation on the equity premium. The consensus is that in standard models where the equity premium is small with full participation, limited participation on its own will have some but not a dramatic effect on the equilibrium equity premium.

Table 6 illustrates that stock market participation is strongly increasing in investor wealth and income. I return to this in section 5.

Naive diversification of retirement account contributions. Benartzi and Thaler (2001) document that the relative number of equity-type investment options offered in 401(k) plans affects the mean allocation to equities of plan participants. Investors in plans that are in the highest third in terms of percentage of equity-type investment options on average invest 64 percent in stocks, compared to 49 percent for investors in plans in the bottom third in terms of equity-type options. Experimental evidence roughly confirms these magnitudes and also suggests that this is driven by some investors choosing portfolio shares of 1/n for each plan option. A 1/n rule seems like a reasonable response to diversifying for an investor who understands the basic idea of diversification but not the exact differences between asset classes. Correlating this type of behavior with income or wealth would be informative for determine if a simple information explanation is likely.

Status quo bias in retirement account allocations. Ameriks and Zeldes (2001) analyze a ten-year panel of TIAA-CREF participants. Consistent with earlier findings of Samuelson and Zeckhauser (1988) they find that both changes in flow allocations and reallocation of accumulated assets are rare. 47 percent of individuals made no changes in flow allocations over a ten year period, 73 percent made no changes in the allocation of accumulated assets. Ameriks and Zeldes suggest a rational explanation, namely that individuals may face a non-monetary fixed cost per transaction. If so we would expect the status quo bias to diminish with the dollar amount invested, and thus with employee salary. The bias would also be expected to diminish with age or years of employment since a certain amount of free information about the value of reallocating arrives over time from interaction with colleagues and friends. Table 7 shows that these predictions are borne out in the data. The table is from on Agnew, Balduzzi and Sunden (2003) who analyze data from a large 401(k) plan. They find that employees with higher income and older employees place substantially more trades (changes in portfolio allocation) and have a higher retirement asset turnover than employees with lower income and younger employees.

Excessive trading. In sharp contrast to the trading behavior in retirement plans, some investors trading though brokers or online trade very frequently, and on average lose money on this as a result of the transactions costs involved. Odean (1999) find an average monthly turnover rate of 6.5 percent in a sample of discount brokerage customers. He argues that trading by these investors is excessive since the stocks purchased on average perform worse than the stocks sold, implying that the trades are disadvantageous even before payment of commissions. Also using a sample of accounts at a discount brokerage firm, Barber and Odean (2000) find that the

average investor in their sample performs about the same as the S&P500 index before costs but underperforms the index by 1.5 percent per year after costs. Within the sample those in the top quintile in terms of turnover underperform the index by 6.5 percent after costs. The authors argue that overconfidence motivates frequent trading.

Table 8 provides evidence on the dependence of trading in directly held stocks on wealth and income. Interestingly, wealthier households trade much more than less wealthy households, with about a quarter of the wealthiest group (those with a million or more in net worth) trading more than 10 times per year. This could be interpreted as evidence that wealthier investors are more overconfident than others. This interpretation would be consistent with the earlier evidence provided on biased self-attribution. Alternatively, high wealth investors were seen to hold more shares on average and that could be driving the results. It would be interesting to correlate the dependence of underperformance due to frequent trading in Odean and Barber's study with wealth (or better, labor income or education) to determine whether the wealthy in fact are trading more excessively than others with direct stockholdings or whether their frequent trading is rational. Coval, Hirshleifer and Shumway (2002) document significant persistence in the performance of invididual investors buying and selling directly held stocks through a particular brokerage firm, suggesting that some do seem to have investment skill.

In sum, there is evidence that most of the "irrational" investor behaviors are weaker for investors with higher wealth or income (frequent trading of directly held stocks being the main exception). This points to information or transactions costs as a potentially important contributing factor for these behaviors. I now turn to a simple calculation of the costs needed to explain one of such behavior, namely limited stock market participation.

5 Costs of Stock Market Participation

Information and/or transactions costs are a possible explanation for investor behavior which consists of inaction/too infrequent action/too simple action relative to the predictions of traditional finance theory. However, for each such behavior it must be shown that the necessary costs are not implausibly large. In this section I give an example of how one might approach a such calculation in the case of stock market participation. I start by considering which types of costs may be involved and then turn to an estimation of how large a per period cost of stock market participation would be needed to explain the choices of a substantial fraction of those who do not participate in the stock market.

5.1 Costs Faced by Stock Market Investors

Consider the optimization problem of a household that maximizes expected lifetime utility given an exogenous stream of nonfinancial income and faced with the opportunity to invest in two assets, a risky asset and a riskless asset. The risky asset represents the stock market. The riskless asset is a catchall for less risky financial assets such as bonds, T-bills, bank accounts etc. I assume it is costless to invest in the riskless asset whereas investing in stocks may involve several types of costs. First time buyers likely incur an initial cost F^I representing the time/money spent understanding basic investment principles as well as acquiring enough information about risks and returns to determine the household's optimal mix between stocks and riskless assets. Add to that the cost of time spent setting up accounts. Subsequently, a per period stock market participation cost F^P may be incurred. This cost would include the value of time spent throughout the year determining if trading is optimal. With time varying conditional asset return distributions, theory suggests that households should actively follow the stock market in order to form more precise expectations of future returns and change their portfolios accordingly. Furthermore, for households who attempt to gather information to benefit from buying individual stocks or subcomponents of the stock market index, the cost of this would be included in F^P. A more subtle part of F^P is that it complicates tax returns. According to IRS numbers for 2002, households who have to fill out schedule D and D1 (the schedules for capital gains and losses) on average spend 8 hours and 34 minutes on this. In addition to F^I and F^P, stock market investors face a fixed cost of trading stocks, including the fixed part of brokerage commissions as well as the value of time spent implementing the trade. Investors also face variable (proportional) costs of trading stocks. For directly held stocks, this cost represents the bid-ask spread and the variable part of brokerage commissions.[17] Indirect holding of stocks also involve transactions costs. For load mutual funds the front load paid upon entry into the fund would enter the proportional trading costs. In addition to this, or as an alternative, some funds have contingent deferred sales loads requiring investors to pay a certain percentage of their initial investment if they sell their mutual fund shares before a given number of years. These again work as a variable cost. Annual expenses on mutual funds furthermore reduce investor returns.[18]

[17] Jones (2001) documents a quite strong decline in NYSE average one-way transactions costs (commissions plus half of the bid-ask spread) since the mid 1970s, from around 1.10 percentage point in 1970 to around 0.20 percentage in the late 1990s. Consistent with the importance of trading costs, turnover has increased dramatically over the same period (of course, reverse causality cannot be ruled out based on these aggregate data).

[18] Investment Company Institute (2002) estimate average annual total shareholder costs (operating expenses plus distribution costs) for equity mutual funds of 2.26 percent in 1980, gradually declining to 1.28 percent in 2001.

The above emphasizes costs of acquiring and processing information as an important element of F^I and F^P. Several recent papers find evidence that households who report to be better informed about financial issues make portfolio decisions more in line with theoretical predictions by having a higher probability of owning risky financial assets and holding a larger number of financial asset classes (see Guiso and Jappelli (2002) for evidence based on Italian data, Alessie, Hochguertel and van Soest (2002) for results based on Dutch data, and Eymann and Borsch-Supan (2002) for findings from German data). While these relations may not be causal, other papers suggest a causal effect of information on savings and portfolio choice. Chiteji and Stafford (2000) find that parental stockholding has a strong effect on the probability that children become stockholders, controlling for economic and demographic characteristic of the children as well as for bequests. This suggests an effect of education about financial matters on stock market participation. Duflo and Saez (2000) study retirement plan choices among the employees in various departments of a particular university. They find that the decision to enroll in a tax deferred account plan (and the choice of mutual fund vendor for people who enroll) are affected by the decisions of other employees in the same department. Information flow from colleagues is a plausible explanation for such effects. Hong, Kubik, and Stein (2003) provide related evidence of peer effects. Bernheim, Garrett and Maki (2001) find that the savings rate of households who grew up in a state with a high school financial curriculum mandate was about 1.5 percentage points higher than for others, controlling for income and demographics. Bernheim and Garrett(2002) find similar effects of employer-based retirement education plans.

5.2 How Large Costs are Needed to Explain Non-Participation?

I now turn to a simple estimation of how large costs are needed to explain non-participation in the stock market by many households. I focus on the case with a fixed per period participation cost F^P only but discuss how an entry cost or transactions costs may affect the results. I first estimate how large a value of F^P is needed for participation costs to explain the majority of nonparticipants' choices not to participate in the stock market. This assumes that all nonparticipating households face the same value of F^P. I then allow F^P to differ across households and estimate its cross-sectional distribution. The advantage of allowing heterogeneity in F^P is that this enables the framework to explain different participation choices of households with similar wealth and other observable characteristics.

Both estimations are based on estimating the benefits of stock market participation for each household, taking as given its current level of financial wealth. The advantage of this simple approach over a more structural one is that it allows me to use the actual distribution of financial wealth in the data without providing a detailed model able to generate the observed distribution.

In terms of related work, the most closely related paper on costs of stock market participation is Mulligan and Sala-i-Martin (2000). They focus on all interest bearing assets and the per period cost of investing in such assets. At an interest rate of 5 percent, they estimate the median cost of holding interest bearing assets to be 111 dollars per year. I focus on stockholdings only and present a theoretical argument to clarify the assumptions needed for the analysis of per period participation costs. In addition, I consider a case where the cost is restricted to be the same for all nonparticipants in order to be able to say what the smallest cost needed to explain the choice of a given percentage of nonparticipants is. Other related papers on investment costs and asset pricing are Luttmer (1999), and Paiella (1999), who focus on the costs needed to prevent households from adjusting their consumption from its current value (as opposed to reallocating existing financial wealth as emphasized here).

5.2.1 Theoretical Framework

My approach to estimating the benefits of stock market participation relies on the definition of the certainty equivalent return to a portfolio. Start by considering a one period setting with utility defined over end of period wealth and with no nonfinancial income. Consider a portfolio with stochastic net return r. If household i invests an amount W_i in the portfolio at the beginning of the period, end of period wealth is $W_i(1+r)$. The certainty equivalent end of period wealth W_i^{ce} is given by[19]

$$EU\left(W_i\left(1+r\right)\right) = U\left(W_i^{ce}\right). \tag{1}$$

Correspondingly, the certainty equivalent return to the portfolio r_i^{ce} can be defined as

$$EU\left(W_i\left(1+r\right)\right) = U\left(W_i\left(1+r_i^{ce}\right)\right) \tag{2}$$

with the interpretation that the investor is indifferent between investing W_i in the risky portfolio with stochastic return r and investing it in a riskless portfolio with return r_i^{ce}. In a setting with participation costs of investing in the risky portfolio, replace initial wealth by $W_i^{\text{Post}} = W_i - F^P$. This wealth level then enters on the right hand side of the equation as well:

$$EU\left(W_i^{\text{Post}}\left(1+r\right)\right) = U\left(W_i^{\text{Post}}\left(1+r_i^{ce}\right)\right). \tag{3}$$

If the risky portfolio consists of stocks and riskless assets in the fractions α_i and $1-\alpha_i$, the above equation says that

$$EU\left(W_i^{\text{Post}}\left(1+r_f+\alpha_i\left(r_s-r_f\right)\right)\right) = U\left(W_i^{\text{Post}}\left(1+r_i^{ce}\right)\right) \tag{4}$$

[19] In the terminology of Pratt (1964), W_i^{ce} is given by $E\left(W_i\left(1+r\right)\right) - \pi_i$, where π_i is the risk premium that makes the investor indifferent between receiving the stochastic amount $W_i\left(1+r\right)$ and the certain amount $E\left(W_i\left(1+r\right)\right) - \pi_i$.

where r_s is the stock return and r_f the riskless rate. Since the only risk in the portfolio of stocks and riskless assets stems from stocks, the certainty equivalent return to stocks $r_{s,i}^{ce}$ can be defined by the equation

$$EU\left(W_i^{\text{Post}}\left(1+r_f+\alpha_i\left(r_s-r_f\right)\right)\right)=U\left(W_i^{\text{Post}}\left(1+r_f+\alpha_i\left(r_{s,i}^{ce}-r_f\right)\right)\right). \tag{5}$$

This states that the investor is indifferent between investing fractions α_i and $1-\alpha_i$ in a portfolio of stocks and riskless bonds and investing all of W_i^{Post} in a riskless asset with return $r_f+\alpha_i\left(r_{s,i}^{ce}-r_f\right)$. Thus $r_{s,i}^{ce}$ depends on α_i. For those households who participate in the stock market, their choice of α_i will provide information about $r_{s,i}^{ce}$. In particular, if the household is risk averse then r_i^{ce} is a number smaller than the expected net return on the risky portfolio $E\left(r_f+\alpha_i\left(r_s-r_f\right)\right)$. Therefore, if $\alpha_i\leq 1$, $r_{s,i}^{ce}<E\left(r_s\right)$.[20] A household choosing $\alpha_i>0$ furthermore reveals that $r_{s,i}^{ce}>r_f$.

Consider now the more realistic case where households live for multiple periods and have nonfinancial income. In that case, we can define the certainty equivalent stock return $r_{s,i,t+1}^{ce}$ by the equation

$$\begin{aligned}&\max_{C_{it}}\left\{U\left(C_{it}\right)+\beta EV_t\left(\left(W_{it}^{\text{Post}}-C_{it}\right)\left(1+r_{f,t+1}+\alpha_{it}\left(r_{s,t+1}-r_{f,t+1}\right)\right)+Y_{i,t+1}\right)\right\}\\ =\;&\max_{C_{it}}\left\{U\left(C_{it}\right)+\beta EV_t\left(\left(W_{it}^{\text{Post}}-C_{it}\right)\left(1+r_{f,t+1}+\alpha_{it}\left(r_{s,i,t+1}^{ce}-r_{f,t+1}\right)\right)+Y_{i,t+1}\right)\right\}\end{aligned} \tag{6}$$

where $V_t\left(W_{i,t+1}\right)$ denotes the value function defined over date $t+1$ wealth and β is the discount factor. On the left side of this equation, the expectation is taken over $r_{s,t+1}$ and $Y_{i,t+1}$. On the right side it is taken over $Y_{i,t+1}$ only since $r_{s,i,t+1}^{ce}$ is nonstochastic. In the above definition, consumption in period t is allowed to differ depending on whether the risky portfolio or the riskless portfolio is held. However, below I will need to assume that the chosen consumption for period t (but not for future periods) is approximately unaffected by the portfolio choice.

The certainty equivalent stock return can now be used to determine the value of participating in the stock market. Given the definition of $r_{s,i,t+1}^{ce}$, the household will choose to participate in the stock market in the current period iff

$$\begin{aligned}&\max_{C_{it}}\left\{U\left(C_{it}\right)+\beta EV_t\left(\left(W_{it}^{\text{Post}}-C_{it}\right)\left(1+r_{f,t+1}+\alpha_{it}\left(r_{s,i,t+1}^{ce}-r_{f,t+1}\right)\right)+Y_{i,t+1}\right)\right\}\\ >\;&\max_{C_{it}}\left\{U\left(C_{it}\right)+\beta EV_t\left(\left(W_{it}-C_{it}\right)\left(1+r_{f,t+1}\right)+Y_{i,t+1}\right)\right\}\end{aligned} \tag{7}$$

[20] If households can borrow to invest in stocks at a rate lower than $E\left(r_s\right)$, it is is possible for r_s^{ce} to exceed $E\left(r_s\right)$. Judging from the borrowing rates reported by Davis and Willen (2002) borrowing rates on personal loans likely exceed $E\left(r_s\right)$. Data on margin investing also suggest that few borrow to invest in equity. Less than one percent of households had margin loans at a brokerage house in the 1998 Survey of Consumer Finances, and the loans totalled less than one percent of the value of the stock market. The magnitude of borrowing for investment through other channels (e.g. by taking out a second home mortgage) is difficult to estimate.

where as earlier $W_{it}^{\text{Post}} = W_{it} - F^P$.

Below I consider two estimations. The first, estimation A, estimates the per period cost sufficient to explain the choices of a given percentage of nonparticipants. The second more ambitious part, estimation B, estimates the distribution of participation costs in the population.

5.2.2 Estimation A: Homogeneous F^P

From (7) above it follows that the gross benefit, as of time $t+1$, of participating in the stock market in period t is

$$\text{Benefit}_{it} = \left(W_{it}^{\text{Post}} - C_{it}\right) \alpha_{it} \left(r_{s,i,t+1}^{ce} - r_{f,t+1}\right) \tag{8}$$

under the simplifying assumption that period t consumption (but not future consumption) is unaffected by whether the household decides to enter the stock market or not.

On the cost side, the per period cost of stock market participation that could be avoided in period t by not entering, or entering in a subsequent period, reduces $W_{i,t+1}$ by

$$\text{Avoidable cost}_{it} = F^P \left(1 + r_{f,t+1}\right). \tag{9}$$

A value of $F^P \left(1 + r_{f,t+1}\right)$ greater or equal to Benefit_{it} is sufficient to deter the household from participating in this period.[21] A lower value will also be sufficient if there are transactions costs (this is the case since the household would need to be able to recover these additional costs either in this period or in future periods of stock market participation). In other words, if x percent of nonparticipants have benefits less than y dollars in period t, then it is conservative to say that a per period cost of $F^P = y$ is sufficient to explain the nonparticipation of x percent of nonparticipants.

Under an additional assumption one can be more precise.

Assumption A: The per period benefits of stock market participation for observed nonparticipants are approximately the same across time periods for a given household i.

Most importantly, this assumes approximately constant holdings of financial wealth across periods for this group.[22] Then the entry condition states that the household should participate iff

$$\begin{aligned} \text{Benefit}_{it} \quad > \quad & F^P \\ & + \text{Annuity value of all stock market transactions costs for household } i. \end{aligned} \tag{10}$$

[21] Since $1 + r_{f,t+1}$ is close to 1, I for simplicity replace $F^P \left(1 + r_{f,t+1}\right)$ by F^P in what follows.

[22] This assumption clearly would make less sense for participants since the fact that they decided to enter the stock market at some point suggests that their financial wealth likely increased to make this optimal.

I will refer to the right hand side as the 'total participation cost', F_i^{Total}. The advantage of this is that it no longer ignores the potential importance of any initial entry cost F^I or transactions costs (but at the cost of the extra assumption needed). The annuity value is calculated over years of stock market participation.[23] Under Assumption A one can then estimate which annualized value of total stock market participation costs of y dollars is sufficient to explain the nonparticipation of x percent of nonparticipants. One problem with assumption A is that there may be a life cycle component to financial wealth even for relatively low wealth households. One could consider repeating the estimations below with middle aged households to provide a more conservative estimate of the costs needed to explain non-participation.

The data for the estimation come from the Panel Study of Income Dynamics. I use the Survey Research Center sample of the PSID which was representative of the civilian noninstitutional population of the US when the study was started in 1968. The PSID tracks all original family units and their adult offspring over time, so with low attrition rates the sample remains representative as long as offsprings are included. To keep the sample representative, I excluded the poverty sample and the Latino sample. Wealth information from the 1984, 1989 and 1994 supplements is used to calculate financial wealth, defined as the sum of cash (checking or savings accounts, money market bonds, or Treasury bills, including such assets held in IRAs), bonds (bond funds, cash value in life insurance policies, valuable collections, rights in trusts or estates), and stocks (shares of stock in publicly held corporations, mutual funds, or investment trusts, including stocks in IRAs). To identify entries for which imputations were used, I use the wealth information as given in the family files instead of the wealth supplement files. Imputed values for cash, bonds or stocks can then be coded as missing. Topcoding of wealth or income variables is very rare in the PSID and topcoded variables were left at their topcodes. Although households in reality can have a portfolio share for a given asset above one, the PSID wealth data does not allow one to observe this due to the way the wealth questions are formulated. For example, the questions asked concerning stockholdings are "Do you (or anyone in your family living there) have any shares of stock in publicly held corporations, mutual funds, or investment trusts, including stocks in IRAs?" and "If you sold all that and paid off anything you owed on it, how much would you have?". Thus, a household who had borrowed to invest more than its total financial wealth in stocks would be recorded as having a portfolio share for stocks of one. Similarly, it is not possible to identify short sales from these questions. To allow comparison of amounts for different years, wealth variables are deflated by the consumer price index for all urban consumers, with 1982-84 as basis year. Vissing-Jorgensen (2002) contains summary

[23] Note that unlike F^I, F^P and the transactions costs, which are exogenous parameters in the household's problem, the total participation cost has an endogenous element since the number of periods of stock market participation is chosen by the household.

statistics for the sample.

To implement estimation A I make three additional assumptions. First, I calculate the benefit of stock market participation as $W_{it}\alpha_t\left(r^{ce}_{s,i,t+1} - r_{f,t+1}\right)$ rather than $\left(W^{\text{Post}}_{it} - C_{it}\right)\alpha_t\left(r^{ce}_{s,i,t+1} - r_{f,t+1}\right)$. This overstates the benefits both by assuming that no wealth must be set aside for current period consumption and by replacing W^{Post}_{it} (financial wealth after entry and participation costs) by observed financial wealth. Second, I assume a value of $r^{ce}_{s,i,t+1} - r_{f,t+1}$ of 0.04. With a historical equity premium around 7 percent and a tax rate of e.g. 20 percentage points, the after tax equity return will be 5.6 percent.[24] Since the certainty equivalent excess return on stocks is risk adjusted, 4 percent seems, if anything, to be a high value. Thus both these assumptions are conservative in that they most likely overstate the benefits of stock market participation and thus the costs needed to explain nonparticipation. Third, for the values of α_{it} I assume that each nonparticipant would have had a value of α_{it} equal to the average value for participants in the PSID in that year (43.6 for 1989, 55.2 for 1994). Having calculated the period t benefit of stock market participation for each of the nonparticipants as $W_{it}\alpha_t 0.04$, I calculate the percentiles of the cross-sectional distribution of this benefit in the set of nonparticipants. Figure 9 illustrates these percentiles and thus gives the minimum dollar amount necessary to explain the choices of various percentages of nonparticipants.

The curve labeled '1989' shows the percentiles of the benefit distribution for those who were nonstockholders in 1989 (and in 1984 to be reasonably confident that the household did not participate in earlier periods). The benefits are calculated based on the households' 1989 financial wealth. Similarly the curve labeled '1994' is based on those who were nonparticipants in 1994 and 1989. For readability the figure leaves out percentiles above the 95th percentile.

In both 1989 and 1994 half of nonparticipants had estimated real annual stock market participation benefits of less than 30 dollars. The price index used to calculate the real values has basis value one on average over the years 1982-84. Multiply dollar values in the figure by 1.817 to get them in January 2003 dollars. Thus a per period stock market participation cost (or a total participation cost under assumption A) of around 55 dollars in year 2003 prices is enough to explain the nonparticipation of half the nonparticipants. This reflects the fact that these households had little or no financial wealth to invest. Of the nonparticipants in 1989 (and 1984) around 21 percent had no financial wealth. Of the nonparticipants in 1994 (and 1989) about 29 percent had no financial wealth.

Interpreting the per period participation cost as the cost of additional time spent following the market and doing more complicated taxes, a cost of 55 dollars translates into only 5.5 hours at an hourly wage of 10 dollars per hour. For both 1989 and 1994 a cost of 150 dollars

[24] The exact tax rate is difficult to calculate since some stockholdings are in pensions plans in which returns accumulate tax-free and are only taxed upon withdrawal.

per year (about 275 dollars in 2003 prices) is enough to explain the choices of 75 percent of nonparticipants.

5.2.3 Estimation B: Heterogeneous F^P

Suppose now that F^P is allowed to differ across households and time. This improves the models' ability to explain different choices by households with similar observable characteristics. For now, assume again that F^I and transactions costs are zero. I return to the possible effects of these costs on this estimation below.

Given the definition of the benefit of stock market participation in (8) above, a simple approach to estimating the cross-sectional distribution of F^P at date t is as follows. Suppose that $\alpha_{it} = \alpha_t$ for all i, that $r^{ce}_{s,i,t+1} - r_{f,t+1} = 0.04 \ \forall i$, and that F^P_{it} is uncorrelated with financial wealth in the cross-section of households. Given these assumptions, the stock market participation condition states that household i should participate in period t iff

$$\left(W^{\text{Post}}_{it} - C_{it}\right) \alpha_t 0.04 > F^P_{it} \left(1 + r_{f,t+1}\right). \tag{11}$$

This condition is similar to the condition used by Mulligan and Sala-i-Martin (2000) in the context of the demand for interest bearing assets more generally.

Since the incentive to participate is linear in financial wealth, one can estimate the cross sectional distribution of F^P_{it} directly from the wealth distribution at date t. A simple non-parametric approach consists of calculating the percentage of households in different financial wealth groups who participate in the stock market. For example, if 27 percent of households with financial wealth of \$10000 participate, then 27 percent of these households must have participation cost below $\$10000\alpha_t 0.04 = \$400\alpha_t$ (as in estimation A in replace $\left(W^{\text{Post}}_{it} - C_{it}\right)$ by W_{it} and $F^P_{it}\left(1 + r_{f,t+1}\right)$ by F^P_{it}). Given the assumption that F^P_{it} is cross-sectionally uncorrelated with W_{it}, this implies that 27 percent of all households must have had participation costs below $\$400\alpha_t$. By splitting the sample into 10 wealth deciles and using this approach for each decile, one obtains 10 estimates of points on the cumulative distribution function for the cross sectional distribution of F^P_{it}.

How will the presence of an initial entry cost F^I or of transactions costs affect this estimation? Transactions costs imply that stock market participation status becomes a state variable in the household's value function. This is the case since participating today affects the choices available tomorrow given the entry or transactions costs. In the example above where 27 percent of those with approximately \$10,000 in financial wealth were stock market participants, one can no longer be sure that this implies that 27 percent of the draws of F^P_{it} are below $\$400\alpha_t$. Let S_{it} be an indicator variable for whether household i participates in the stock market in period t. At date t households can be split into four groups according to their participation choices at $t-1$ and

t : ($S_{i,t-1} = 0$, $S_{it} = 0$), ($S_{i,t-1} = 0$, $S_{it} = 1$), ($S_{i,t-1} = 1$, $S_{it} = 0$), ($S_{i,t-1} = 1$, $S_{it} = 1$). We would like to determine how many percent of the draws of F_{it}^P are less than $\$400\alpha_t$. The group ($S_{i,t-1} = 0$, $S_{it} = 1$) poses no difficulties. We can be sure that their F_{it}^P draw is less than $\$400\alpha_t$ (since their choice reveals that the period t benefit exceeds F^P plus any part of entry or transactions costs that must be covered by the period t benefits for entry to have been worthwhile). Similarly with the group ($S_{i,t-1} = 1$, $S_{it} = 0$). We can be sure that their F_{it}^P draw is above $\$400\alpha_t$ since they have revealed that F_{it}^P exceeds their current period benefit of $\$400\alpha_t$ plus any future transactions cost they may save by staying in the market during this period.[25] The possible misclassifications arise for the groups choosing ($S_{i,t-1} = 0$, $S_{it} = 0$) or ($S_{i,t-1} = 1$, $S_{it} = 1$). Those choosing ($S_{i,t-1} = 0$, $S_{it} = 0$) only reveal that $\$400\alpha_t$ is not sufficient to cover F_{it}^P plus any part of the entry and transactions costs that must be covered by a period t gain in order for entry to have been optimal. Thus they reveal $F_{it}^P \geq \$400\alpha_t - z_{it}^{00}$ for some positive value z_{it}^{00}. Using the approach outlined above and classifying them all as having $F_{it}^P \geq \$400\alpha_t$ leads one to overestimate the deciles of the cost distribution. However, those choosing ($S_{i,t-1} = 1$, $S_{it} = 1$) lead to a counterbalancing bias: They only reveal that $\$400\alpha_t$ plus any future transactions cost they save by staying in the market during this period exceeds F_{it}^P, i.e. that $F_{it}^P \leq \$400\alpha_t + z_{it}^{11}$ for some positive value z_{it}^{11}. Thus classifying them all as having $F_{it}^P \leq \$400\alpha_t$ leads one to underestimate the deciles of the cost distribution. Overall, if equally many of the ($S_{i,t-1} = 0$, $S_{it} = 0$) households and the ($S_{i,t-1} = 1$, $S_{it} = 1$) households are misclassified, then the approach outlined assuming the absence of transactions costs will lead to an unbiased estimate of the cross-sectional distribution of F_{it}^P. Since it is difficult to evaluate whether the two biases are likely to cancel out, the cost distributions estimated below should be interpreted with some caution.

In both estimation A and B one can allow for heterogeneity in α_{it} across households (rather than only across time). Nonparticipants may have chosen to stay out of the market due to a low optimal stock share conditional on participation. However, accounting for heterogeneity based on a sample selection model has only small effects on the results and for simplicity is therefore omitted in the results shown. Essentially, this is due to the fact that while the fit in models of the stock market participation decision is quite high, models of the share invested in stocks conditional on participation typically has low explanatory power (possibly due to transactions costs of portfolio adjustment leading to substantial differences between optimal and observed portfolio shares for equity).

The results of estimation B are shown in Figure 10 for the sample of all households with positive financial wealth and again assuming that α_{it} (the actual or potential share of financial

[25] For example, a household with a temporary increase in consumption needs may decide to run down only non-stock wealth in this period in order save the transactions costs involved in trading stocks.

wealth invested in stocks) for each household equals the average value for participants in the PSID in that year (43.4 for 1984, 43.6 for 1989, and 55.2 for 1994). Households with no financial wealth provide no information about the participation cost in this approach since their benefit of stock market entry is zero assuming they cannot borrow or change their current consumption to invest in the stock market. The median per period participation cost is around $350 (real 1982-84 dollars) for 1994, around $500 for 1989, and around $800 for 1984. Since even among very rich households not all hold stocks, the estimated CDF does not reach one at any wealth level (the point corresponding to the last wealth decile is not included in the graph but is also far below one). This emphasizes the advantage of using a nonparametric approach, since a parametric approach would impose the requirement that the CDF reaches one. The economic implication is that participation costs are unlikely to be the explanation for nonparticipation among high wealth households. More generally, if at each wealth level some of the nonparticipants have chosen not to hold stocks for reasons other than participation costs, my estimated CDF of the cost distribution will be shifted down compared to the true CDF.

Overall the results of the estimations of stock market participation costs show that while it is not reasonable to claim that participation costs can reconcile the choices of all nonparticipants, modest costs are sufficient to understand the choices of a large part of these households due to their fairly low amounts of financial wealth.

6 Conclusion

Behavioral finance, and behavioral economics more generally, is a very active area of research. The state of the literature is still one of exploration with little agreement among researchers on what the most important investor biases are from an asset pricing perspective.

In this paper I have argued that more direct evidence on the beliefs and actions of investors would make behavioral theories more convincing to outsiders, many of whom remain unconvinced that any of the multitude of biases documented in the psychology literature and the experimental literature have much impact on asset prices (see Hirshleifer (2001) for a thorough discussion of the evidence from psychology and experiments). To exemplify the potential value of such direct evidence I have analyze new data from UBS/Gallup on investor expectations and stock holdings for 1998-2002. The evidence suggests that, even for wealthy investors, (1) expected returns were high at the peak of the market, (2) many investors thought the market was overvalued but would not correct quickly, (3) investors' beliefs depend on their own investment experience (a version of the law of small numbers), (4) the dependence of beliefs on own past portfolio performance is asymmetric consistent with theories of biased self-attribution, and (5) investor beliefs do affect their stocks holdings suggesting that understanding beliefs is in fact useful for understanding

prices.

I then turned to existing evidence on investor behaviors that are inconsistent with traditional finance theory recommendations. Information and/or transactions costs represent a possible rational explanation of behaviors which involve too little or too simple actions relative to the theoretical benchmark. I argued that many such behaviors tend to diminish with investor wealth/sophistication and thus that information/transactions costs should be seriously considered as an explanation. As an example, a simple calculation showed that given the observed distribution of financial wealth, an annual cost of about 55 dollars is enough to explain the choices of half of those who do not invest in the stock market.

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Figure 1: Average Expected One Year And Ten Year Stock Market Returns, UBS/Gallup Data, And The Level Of The NYSE And NASDAQ Indices 1998-2002

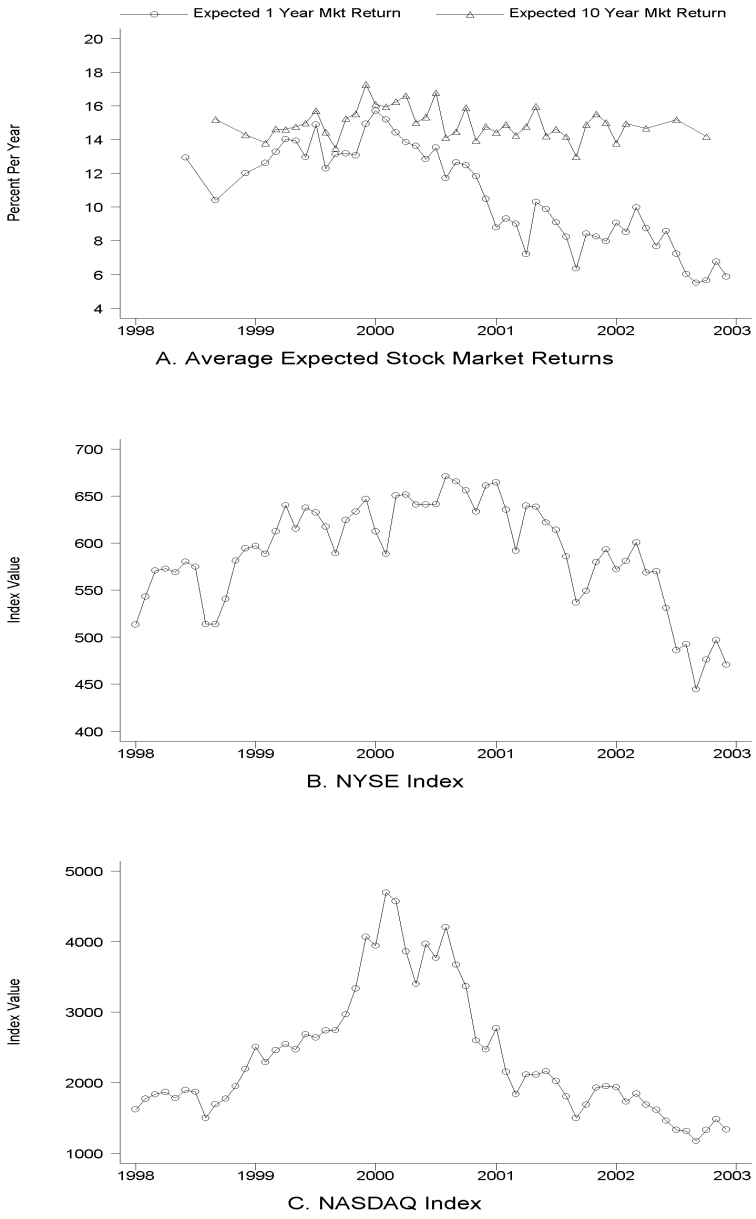


Figure 2: Cross-Sectional Standard Deviation Of Next Year's Expected Stock Return (Disagreement), UBS/Gallup Data

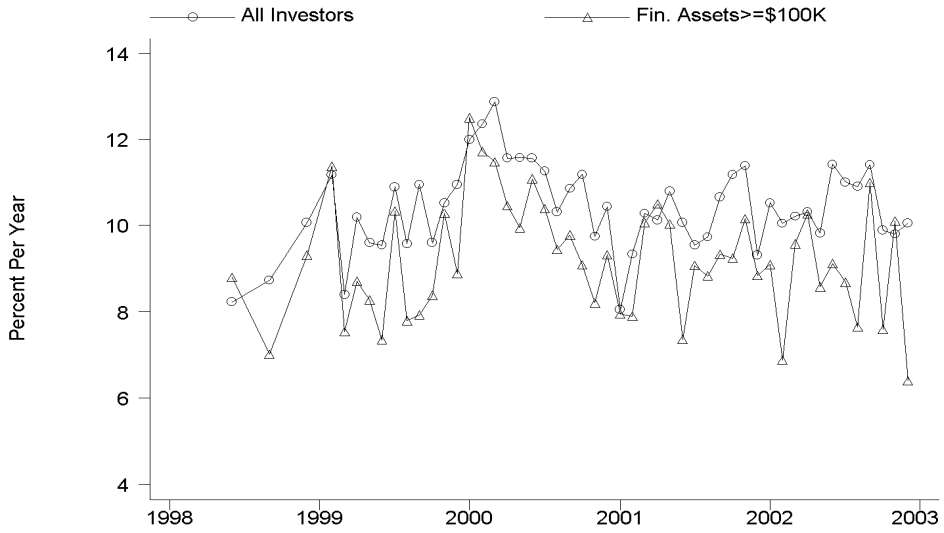
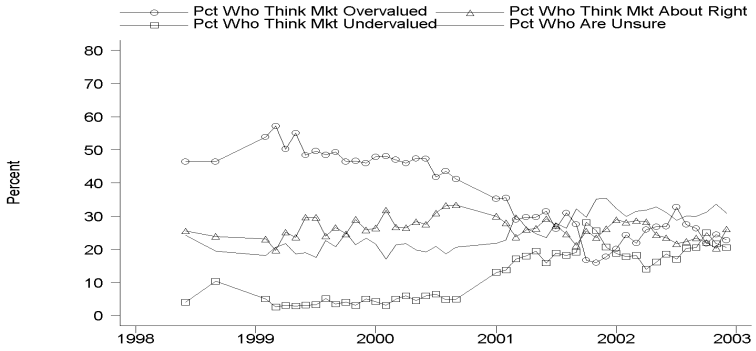
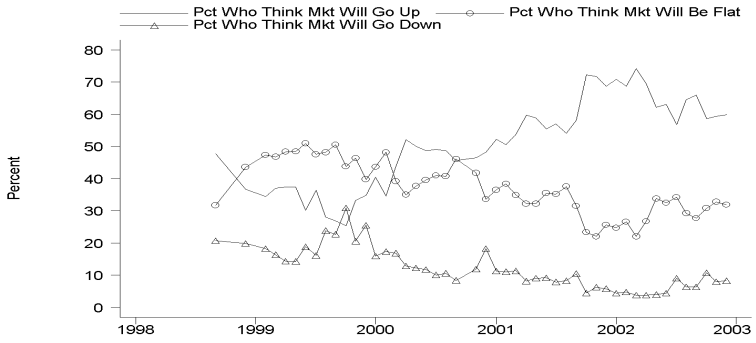


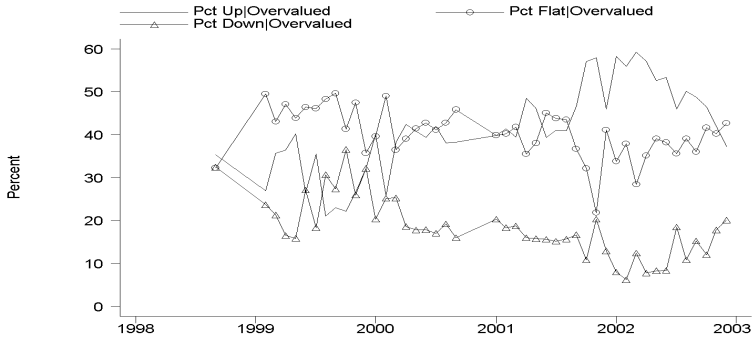
Figure 3: Perception Of Market Valuation And Expected Direction, UBS/Gallup Data



A. Perception of Market Valuation

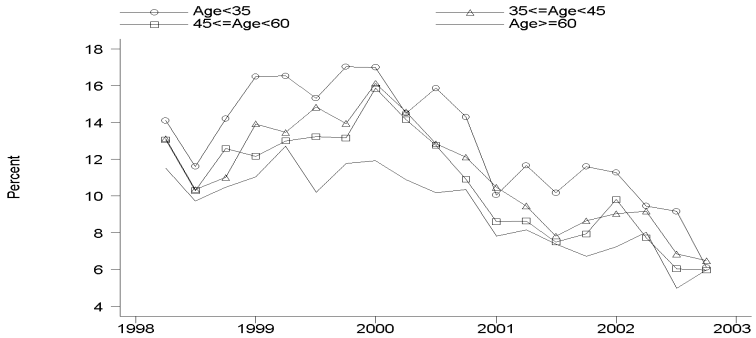


B. Expected Direction, All Investors

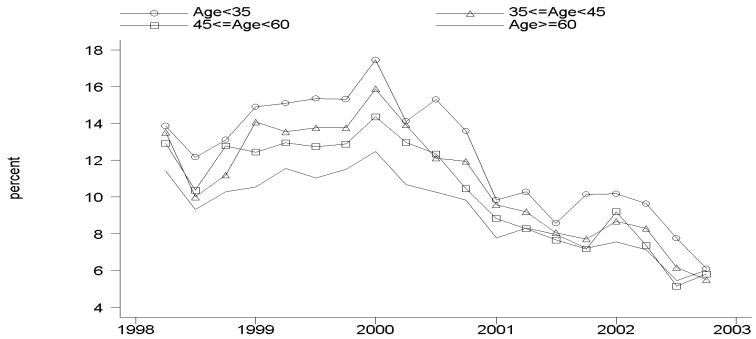


C. Expected Direction, Investors Who Think Market Is Overvalued

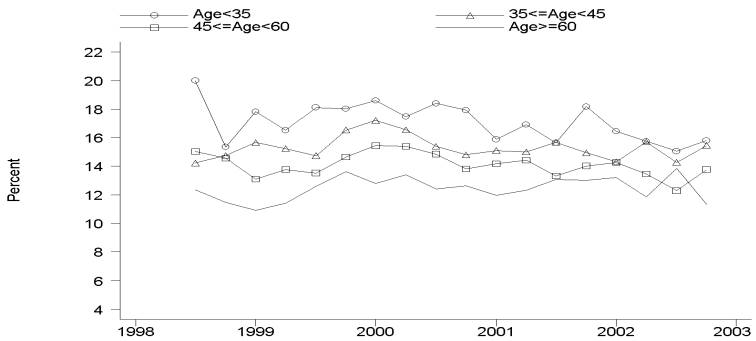
Figure 4: Average Expected One And Ten Year Stock Market Returns By Investor Age, UBS/Gallup Data



A. Expected One Year Stock Market Returns, Survey Weights Used



B. Expected One Year Stock Market Returns, Survey Weights Not Used



C. Expected Ten Year Stock Market Returns, Survey Weights Not Used

Figure 5: Average Expected One Year Stock Market Returns By Investment Experience Within Age Groups, UBS/Gallup Data

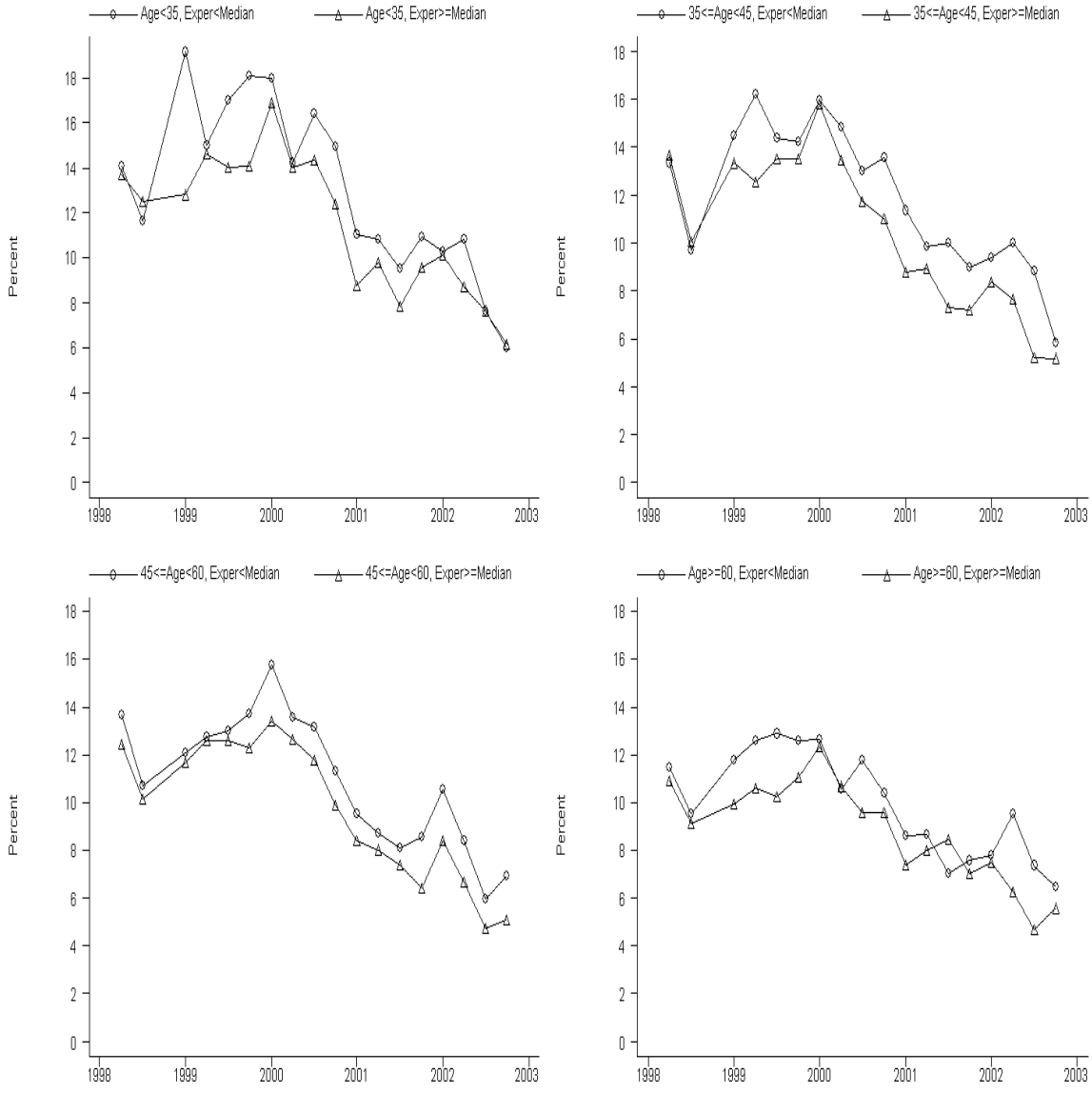


Figure 6: Average Expected One Year Stock Market Returns By Investor Own Past Portfolio Return, UBS/Gallup Data

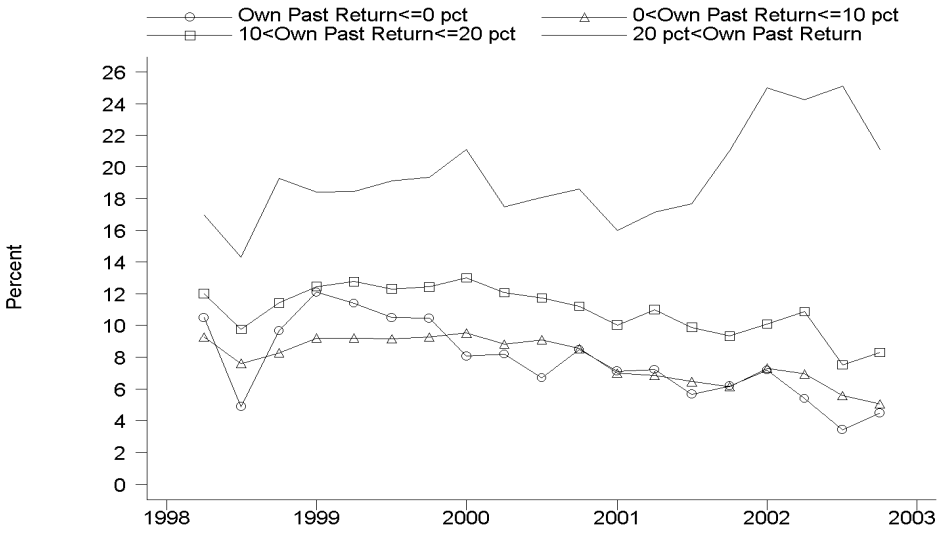


Figure 7: Average Expected One Year And Five To Ten Year Inflation Rates By Investor Age, Survey of Consumer Attitudes and Behavior, And The Actual Inflation Rate For The Year, 1966-2001

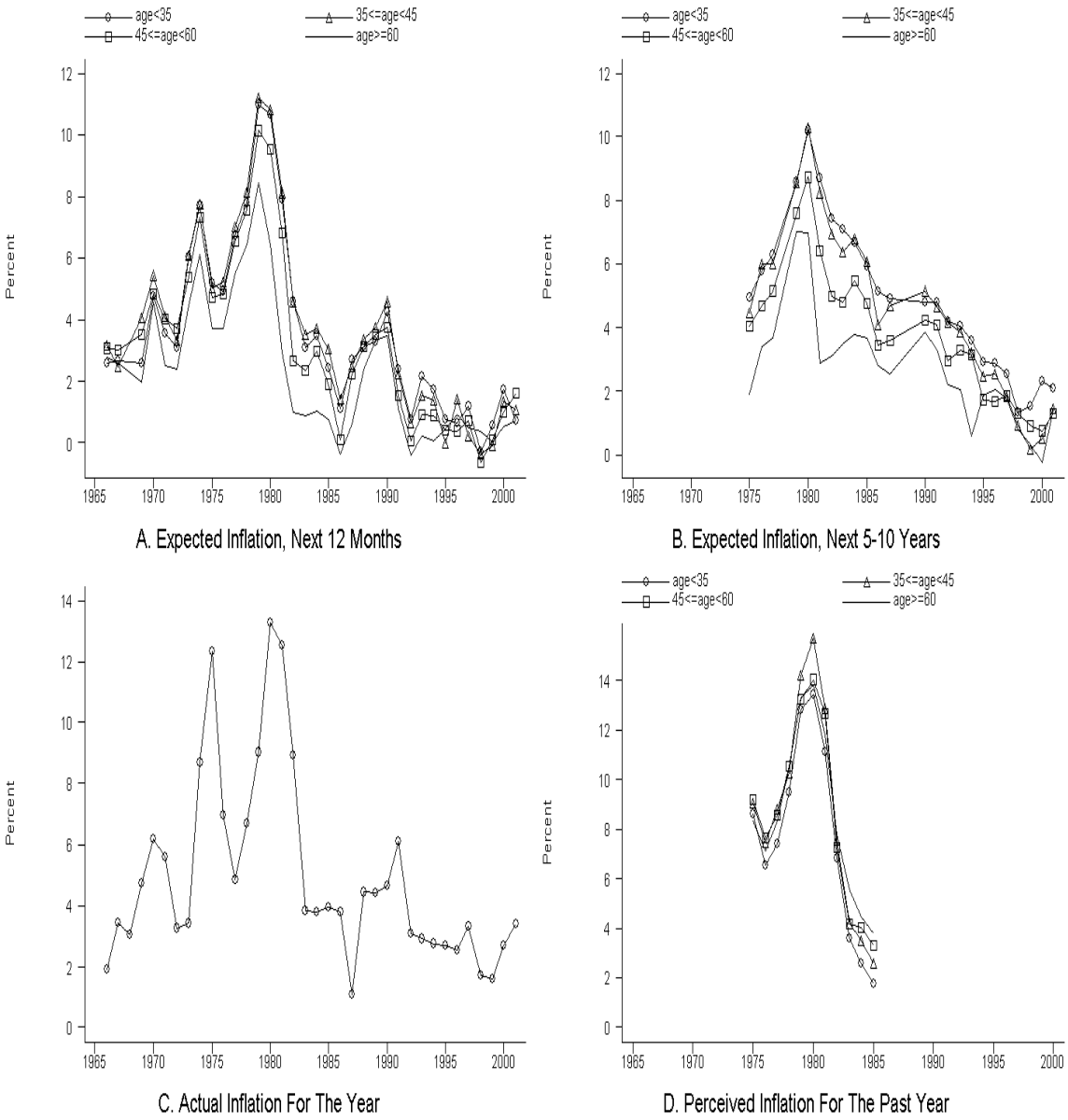
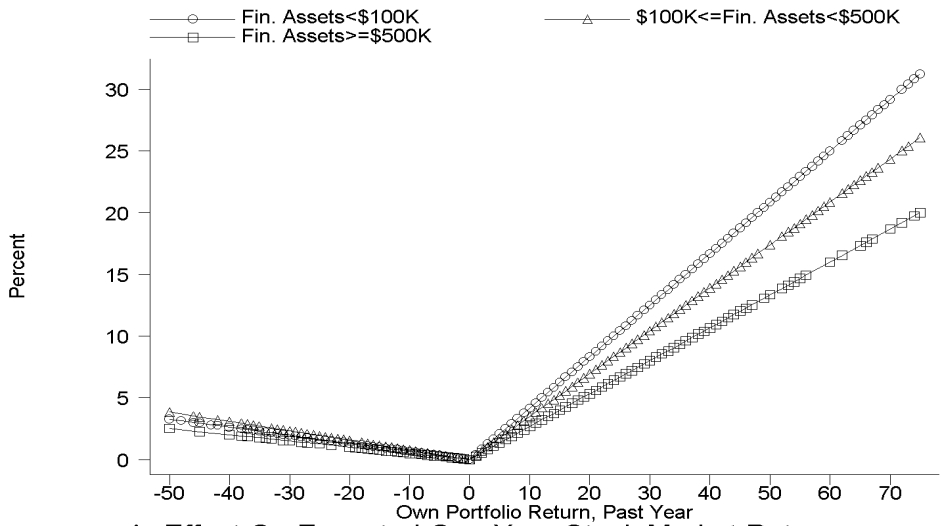
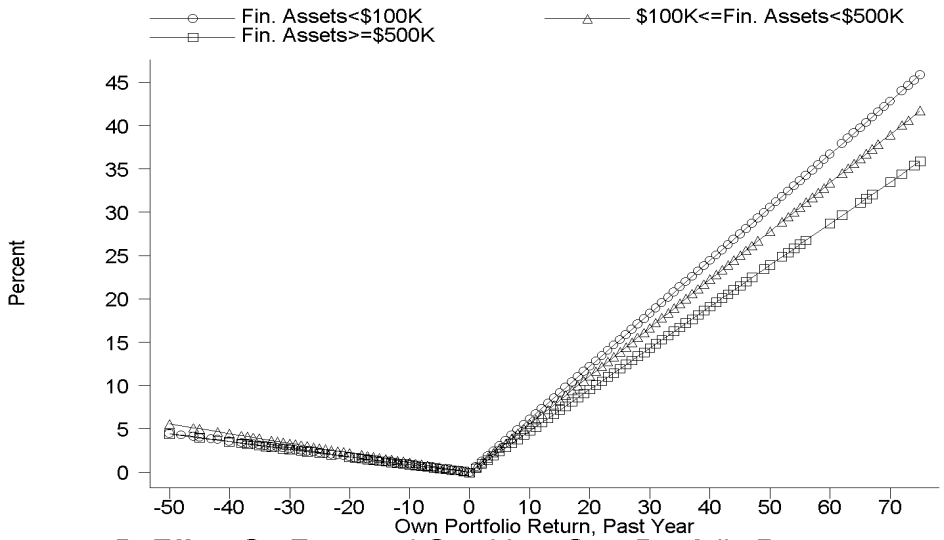


Figure 8: Estimated Effect Of Own Past Portfolio Return On Expected One Year Stock Market Return And Expected One Year Own Portfolio Return, UBS/Gallup Data



A. Effect On Expected One Year Stock Market Return



B. Effect On Expected One Year Own Portfolio Return

Figure 9: Stock Market Participation Benefits For Nonparticipants, Panel Study Of Income Dynamics

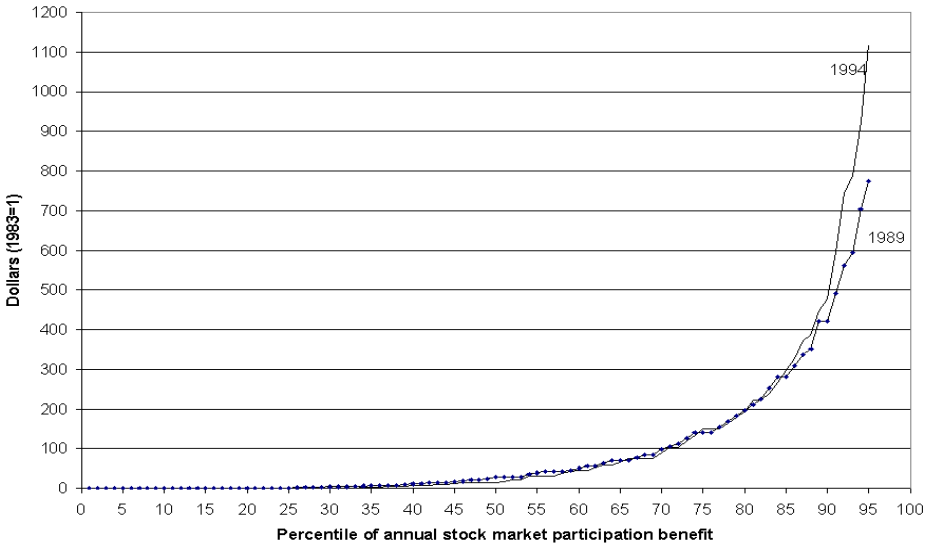


Figure 10: Estimated CDF Of Per Period Stock Market Participation Cost, Panel Study Of Income Dynamics

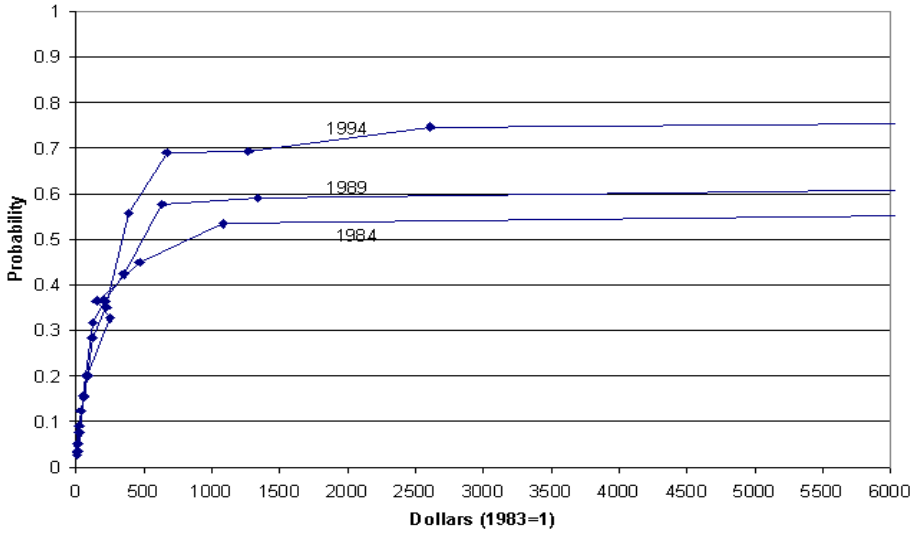


Table 1: Determinants Of One Year Stock Market Return Expectations, UBS/Gallup Data, OLS Regressions

Dependent Variable: One Year Expected Stock Market Return						
	Regression 1		Regression 2		Regression 3	
Regressor	β	t-stat	β	t-stat	β	t-stat
Age*d983	-0.057	-2.03	-0.049	-1.25	-0.012	-0.40
Age*d984	-0.069	-2.27	-0.096	-2.24		
Age*d991	-0.115	-5.79	-0.158	-5.55	-0.020	-0.66
Age*d992	-0.082	-5.06	-0.088	-3.74	0.029	1.22
Age*d993	-0.104	-6.30	-0.098	-4.11	-0.037	-1.91
Age*d994	-0.088	-5.35	-0.084	-3.63	0.024	1.24
Age*d001	-0.125	-7.60	-0.113	-4.74	0.011	0.54
Age*d002	-0.091	-5.73	-0.081	-3.60	-0.001	-0.07
Age*d003	-0.102	-6.03	-0.114	-4.77	-0.006	-0.31
Age*d004	-0.100	-6.00	-0.055	-2.32	-0.029	-1.48
Age*d011	-0.055	-3.40	-0.056	-2.40	0.004	0.21
Age*d012	-0.053	-3.21	-0.053	-2.18	-0.031	-1.62
Age*d013	-0.026	-1.61	-0.020	-0.87	-0.034	-1.85
Age*d014	-0.061	-3.82	-0.066	-2.84	-0.019	-1.03
Age*d021	-0.049	-3.01	0.004	0.19	0.007	0.38
Age*d022	-0.056	-3.43	-0.050	-2.14	-0.033	-1.72
Age*d023	-0.052	-3.22	-0.019	-0.79	-0.038	-2.05
Age*d024	-0.001	-0.09	0.028	1.16	0.018	0.93
Experience*d983					-0.042	-1.06
Experience*d984						
Experience*d991					-0.072	-1.80
Experience*d992					-0.122	-4.05
Experience*d993					-0.042	-1.63
Experience*d994					-0.116	-4.52
Experience*d001					-0.114	-4.63
Experience*d002					-0.089	-3.84
Experience*d003					-0.093	-3.79
Experience*d004					-0.088	-3.57
Experience*d011					-0.103	-4.09
Experience*d012					-0.027	-1.13
Experience*d013					-0.019	-0.78
Experience*d014					-0.064	-2.62
Experience*d021					-0.060	-2.40
Experience*d022					-0.056	-2.32
Experience*d023					-0.016	-0.64
Experience*d024					-0.012	-0.49

Table I, Continued

Own Past*d983					0.278	8.97
Own Past*d984						
Own Past*d991					0.301	10.86
Own Past*d992					0.335	15.30
Own Past*d993					0.374	22.42
Own Past*d994					0.419	24.82
Own Past*d001					0.369	28.77
Own Past*d002					0.267	20.37
Own Past*d003					0.311	20.16
Own Past*d004					0.264	17.03
Own Past*d011					0.117	9.74
Own Past*d012					0.110	10.27
Own Past*d013					0.114	9.75
Own Past*d014					0.101	9.62
Own Past*d021					0.173	14.92
Own Past*d022					0.179	14.27
Own Past*d023					0.167	15.73
Own Past*d024					0.106	9.81
d983	13.038	9.42	12.367	5.95	6.618	4.55
d984	15.138	10.29	16.202	7.19		
d991	18.404	18.81	20.762	13.82	9.392	6.45
d992	17.118	21.20	16.834	13.34	7.609	7.15
d993	18.099	22.33	17.509	13.89	8.819	10.29
d994	17.461	21.42	17.213	14.05	6.457	7.42
d001	20.916	25.50	20.533	16.27	8.377	9.63
d002	17.311	21.83	16.398	13.75	9.106	11.05
d003	17.203	20.32	17.321	13.56	8.703	9.96
d004	16.052	19.31	13.357	10.58	10.392	12.42
d011	11.631	14.20	11.160	8.80	9.197	11.65
d012	11.404	13.64	11.081	8.60	10.200	12.61
d013	9.210	11.33	8.689	6.95	9.116	11.84
d014	10.745	13.08	10.601	8.38	9.388	12.10
d021	11.278	13.54	7.901	6.09	9.084	11.38
d022	10.605	12.87	9.496	7.48	9.875	12.17
d023	8.403	10.10	5.639	4.25	8.157	10.23
d024	5.890	7.00	3.764	2.89	5.379	6.53
	N=39391		N=17138		N=31106	
	Adj. R2=0.503		Adj. R2=0.527		Adj. R2=0.590	

Note: "Experience" refers to years of investment experience, "Own Past" refers to the self-reported return on the investor's portfolio over the Past year, 'dYYQ' is a dummy equal to 1 for year YY, quarter Q. Regression 1 and regression 3 is based on all investors while regression 2 is for those with $100,000 or more in financial assets.

Table 2: Effect Of Expectations On Stock Holdings, 1998 (September), 2001 (February, May), UBS/Gallup Data, Tobit Regressions

Dependent variable: Percent Of Portfolio Held In Stocks		
Regressor	β	t-stat
Expected Market Return Dummies (Omitted=d($E(r_M) \leq 0$))		
d($0 < E(r_M) \leq 5$)	2.729	0.84
d($5 < E(r_M) \leq 10$)	4.648	1.51
d($10 < E(r_M) \leq 15$)	10.164	2.88
d($15 < E(r_M) \leq 20$)	10.191	2.30
d($E(r_M) \geq 20$)	5.016	1.14
Time Dummies (Omitted=d9809)		
d0102	5.699	2.93
d0105	-7.883	-4.20
Age Dummies (Omitted=d(Age<30))		
d(30≤Age<40)	0.517	0.15
d(40≤Age<50)	-6.009	-1.68
d(50≤Age<60)	-7.411	-1.98
d(60≤Age<70)	-14.847	-3.48
d(Age≥70)	-22.754	-4.82
Experience Dummies (Omitted=d(Exper≤5 Years))		
d(5<Exper≤10)	-2.195	-0.91
d(10<Exper≤15)	1.354	0.49
d(15<Exper≤25)	-5.686	-2.03
d(Exper>25)	-0.374	-0.11
Financial Asset Dummy (Omitted=d(Fin. Assets<100K)		
d(Fin. Assets≥100K)	3.793	2.06
Education Dummies (Omitted=d(≤High School Graduate))		
d(Some Coll/Tech. Coll)	4.444	1.63
d(College Graduate)	10.931	4.05
d(>College Graduate)	10.146	3.64
Income Dummies (Omitted=d(Income<40K))		
d(40K≤Income<50K)	-1.627	-0.45
d(50K≤Income<60K)	2.839	0.83
d(60K≤Income<75K)	-3.057	-0.94
d(75K≤Income<100K)	1.171	0.38
d(Income≥100K)	-0.875	-0.28
Constant	51.601	9.64
N	2026	
N censored at 0	123	
N censored at 100	221	

Table 3: Internet Stock Holdings: Tobit Regression Of Percentage Of Portfolio Held In Internet Stocks, 1999 (March, June, September) And 2000 (February, April, July), UBS/Gallup Data

Dependent Variable: Percent Of Portfolio Held In Internet Stocks				
Regressor	β	t-stat	β	t-stat
Expected Internet Stock Return Dummies (Omitted=d(Much Higher))				
d(Somewhat Higher)	-7.787	-4.65	-8.049	-3.39
d(About Same)	-18.039	-8.40	-18.462	-6.14
d(Somewhat/Much Lower)	-25.151	-8.81	-22.560	-5.49
Perceived Internet Stock Risk Dummies (Omitted=d(Much More Risky))				
d(Somewhat More Risky)	4.674	2.89	4.290	1.83
d(About Same Risk)	4.955	2.31	4.723	1.58
d(Somewhat Less/Much Less Risky)	7.276	2.27	9.325	2.19
Expected One Year Stock Market Return (Omitted=d($0 \leq E(r_M) < 5$))				
d($0 < E(r_M) \leq 5$)	-3.751	-0.80	4.961	0.69
d($5 < E(r_M) \leq 10$)	-0.209	-0.05	5.135	0.79
d($10 < E(r_M) \leq 15$)	3.835	0.91	8.672	1.32
d($15 < E(r_M) \leq 20$)	7.147	1.60	11.896	1.71
d($E(r_M) \geq 20$)	8.337	1.84	12.427	1.73
Age Dummies (Omitted=d(Age<30))				
d(30≤Age<40)	-8.730	-3.23	-9.565	-2.51
d(40≤Age<50)	-17.359	-6.17	-15.247	-3.85
d(50≤Age<60)	-15.801	-5.21	-9.877	-2.30
d(60≤Age<70)	-21.640	-5.85	-17.218	-3.18
d(Age≥70)	-23.780	-5.33	-13.569	-2.10
Experience Dummies (Omitted=d(Exper≤5 Years))				
d(5<Exper≤10)	-6.816	-3.31	-7.961	-2.61
d(10<Exper≤15)	-4.259	-1.80	-1.684	-0.49
d(15<Exper≤25)	-2.669	-1.09	-2.770	-0.77
d(Exper>25)	-0.824	-0.27	3.995	0.91
Education Dummies (Omitted=d(≤High School Graduate))				
d(Some College/Tech. College)	5.051	1.79	9.146	2.18
d(College Graduate)	10.743	4.04	10.532	2.61
d(>College Graduate)	11.755	4.33	8.810	2.13
Financial Wealth Dummy (Omitted=d(Fin. Wealth<100K)				
d(Fin. Wealth≥100K)	9.617	5.94	6.039	2.61
Income Dummies (Omitted=d(Income<40K))				
d(40K≤Income<50K)	6.829	1.83	5.155	0.93
d(50K≤Income<60K)	6.296	1.78	1.381	0.26
d(60K≤Income<75K)	10.491	3.14	6.825	1.35
d(75K≤Income<100K)	9.429	2.85	4.905	0.97
d(Income≥100K)	19.768	6.08	13.134	2.63
Internet Use Dummies (Omitted=d(Never Gets On Internet))				
d(Gets On Internet, Never Purchased Online)			8.209	2.57
d(Gets On Internet, Purchased Online)			20.500	6.40
Constant	-32.806	-5.40	-44.982	-4.85
N/N cens. at 0/N cens. at 100	4164/1076/9		2084/445/2	

Note: Regressions include time dummies. The table omits these for brevity.

Table 4: Perceptions About Risk And Return Of Internet Stocks, By Internet Use, 1999 (March, June, September), UBS/Gallup Data

Overall, compared to investing in other common stocks, do you think that investing in selected Internet companies is ...						
	Much more risky	Somewhat more risky	About the same risk	Somwhat/much less risky	Do not know	N obs.
Never gets on internet	21.22	37.08	24.65	9.65	7.40	933
Gets on internet, never purchased online	26.52	37.55	25.81	8.10	2.02	988
Gets on internet, purchased online	36.37	38.45	19.04	5.32	0.81	1108
Overall	28.49	37.74	22.98	7.56	3.24	3029
Again, compared to the return one can get from investing in other common stocks, do you think that the percentage return from investing in selected Internet companies is ...						
	Much higher	Somewhat higher	About the same	Somwhat/much lower	Do not know	N obs.
Never gets on internet	12.33	28.08	33.90	11.58	15.11	933
Gets on internet, never purchased online	17.61	36.34	29.05	10.73	6.28	988
Gets on internet, purchased online	28.79	39.80	19.22	8.66	3.52	1108
Overall	20.07	35.06	26.64	10.23	7.99	3029

Table 5: Effect Of Household Income On Home Bias

Income	$< \$15K$	$\$15-25K$	$\$25-50K$	$\$50-75K$	$\$75-100K$	$\$100-250K$	$> \$250K$
Percentage of shareowners who have directly-held non-U.S. stock or an equity mutual fund holding non-U.S. stock inside a retirement account	11.9	11.5	27.7	35.9	38.1	42.3	38.5
Percentage of shareowners who have equity mutual funds holding non-U.S. equities, outside retirement accounts	26.2	23.3	21.8	29.3	30.0	34.8	39.2

Source: NYSE (2000), based on Investment Company of America and the Securities Industry Association (1999).

Table 6: Effect Of Household Net Worth On Stock Market Participation And Diversification Of Directly Held Equity

Net Worth	$< \$10K$	$\$10-50K$	$\$50-100K$	$\$100-250K$	$\$250-1M$	$> \$1M$	All
Percent Who Hold Stocks							
1998	16.2	42.3	46.9	59.7	81.0	91.9	48.9
2001	18.0	38.8	48.4	62.0	79.3	92.9	51.9
Mean (Median) Number Of Directly Held Stock Cond. On Owning Stock Directly							
1998	1.5 (1)	2.4 (1)	2.5 (2)	3.1 (2)	5.3 (3)	14.9 (8)	5.7 (2)
2001	1.7 (1)	1.9 (1)	2.6 (1)	3.0 (2)	6.0 (0)	13.3 (8)	6.3 (3)
Mean Percent Of Stocks Held Directly							
1998	12.9	12.1	15.9	20.3	25.7	35.9	20.6
2001	20.3	14.6	12.5	15.7	21.8	33.1	19.7

Source: Calculated using data from the 1998 and 2001 Survey of Consumer Finances (using survey weights).

Table 7: Effect Of Household Salary And Age On Status Quo Bias In Retirement Plans

Salary	Annual Number Of Trades	Annual Turnover, Percent	Age	Annual Number of Trades	Annual Turnover, Percent
$< \$25K$	0.11	7.78	<35	0.17	10.40
\$25-50K	0.16	10.80	35-44	0.27	17.14
\$50K-75K	0.22	14.18	45-54	0.36	22.28
\$75K-100K	0.39	23.11	55-64	0.60	36.93
$\geq \$100K$	0.66	39.43	65+	0.03	2.78

Source: Agnew, Balduzzi, and Sunden (2003), Table 4 and 5.

Table 8: Effect Of Household Net Worth On Trading Frequency For Directly Held Stocks

Net Worth	$< \$10K$	$\$10-50K$	$\$50-100K$	$\$100-250K$	$\$250-1M$	$> \$1M$	All
Percent Who Hold Stocks Directly							
1998	3.2	8.3	13.8	21.5	43.1	68.6	19.2
2001	4.8	8.2	11.2	21.0	41.3	67.4	21.3
Percent Who Bought Or Sold Stocks In The Last Year, Cond. On Owning Stock Directly							
1998	6.4	17.8	12.9	16.7	35.7	61.3	22.8
2001	2.2	17.1	11.2	15.4	33.4	64.1	24.9
Percent Who Traded 1-2 Times							
1998	4.2	8.9	8.7	7.7	14.6	11.1	9.1
2001	0.7	7.5	4.7	9.2	11.6	12.7	8.5
Percent Who Traded 3-10 Times							
1998	0.9	5.7	3.6	6.3	12.1	22.6	7.8
2001	0.6	5.7	3.8	4.0	13.7	26.9	9.7
Percent Who Traded >10 Times							
1998	1.2	3.1	0.6	2.7	9.0	27.6	5.9
2001	0.9	3.8	2.6	2.2	7.8	24.5	6.7

Source: Calculated using data from the 1998 and 2001 Survey of Consumer Finances (using survey weights).