

Cost of Time and Household Choice
between Direct and Delegated Investment

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Abstract

This study investigates decisions made by households between direct equity investment and indirect investment through equity mutual funds. We present evidence that the tendency to invest through delegated portfolio management (i.e. mutual funds) versus direct investing depends heavily on cost of time. Households with greater professional engagement, personal responsibilities, and less leisure time -- proxies for higher cost of time-- invest more in mutual funds relative to direct investment. The results are robust when controlling for risk-aversion, investment abilities, and other household characteristics. The findings underscore how search costs (Sirri and Tufano 1996) influence household financial decision-making and offer explanations for the growth of the mutual fund industry.

The past two decades witnessed the rapid growth of the mutual fund industry (Gruber 1996, Investment Company Institute 2002). In contrast to the large body of work devoted to understanding individuals' choices among different mutual funds (Jain and Wu 2000, Sirri and Tufano 1998)², it is striking that an equally important question, how individuals choose between direct equity investment and indirect investment through mutual funds, remains largely unanswered. If one were to assume that individuals make hierarchical decisions about their investments, individuals would first have to decide how much they want to invest in mutual funds, as compared to through direct investment, before they can decide which funds they want to invest in. Therefore, it is important to examine how individuals choose between direct investment and investment through mutual funds.

This is the objective of the current study. This paper focuses on an important element that influences the choice between direct and indirect investment: the cost of time. Picking stocks is not a full-time job for most households. Direct investment not only requires individuals to have financial analysis skills, but also demands them to spend time researching the universe of stocks for promising investments. Should individuals possess the required skills, the sheer amount of time required to research the stock market could be so high that individuals may choose to invest through delegated portfolio management, such as mutual funds. That is, households may choose to --instead of having to-- invest through mutual funds, if they feel they can save the time of investment research for some more valuable activities. If we assume that all households would spend the same amount of time doing research for direct investment and achieve the same returns,³ we expect investment research to incur greater search costs for households with

² Jain and Wu (2000), Sirri and Tufano (1998) investigate how advertising and marketing influence individuals' choices. Hendricks et al. (1993) and Carhart (1997) and Chevalier and Ellison (1999) study whether mutual fund managers possess skills. Zheng (1999), Lynch and Musto (2003) examine whether fund flows influence individual returns; Barber et al. (2004) investigates how individuals respond to different types of fund expenses and fees. Malloy and Zhu (2004) find that the tendency to invest in mutual funds with loads depend on the neighborhood that investors live in.

³ It is possible that some individuals, for example individuals with more training in economics and investments, require less time to process the same amount of information on the financial decisions. However, the more sophisticated investors may choose to do more research than other investors due to their training in investment-related fields. Hence, it is unclear whether the more sophisticated investors spend less time on doing research for direct investment.

higher per unit cost of time. Consequently, such households with higher cost of time should have greater incentives to save time, by investing through delegated portfolio management (i.e. mutual funds) instead of direct investing.

We perform the empirical tests by using data on self-reported household investment choices from the Survey of Consumer Finance (SCF) between 1992 and 2001 and a separate data on individual investor trading and portfolio position record from a large national discount brokerage firm between 1991 and 1996. We are able to calculate the fraction of households' equity portfolios that are invested through indirect investment vehicles, namely the mutual funds that invest in stocks. Relating the fraction to various proxies for cost of time reveals that households with higher cost of time prefer mutual funds more to self-investment, and invest a much higher proportion in mutual funds, than those with lower cost of time.

The empirical results are easy to summarize. Using the SCF data, households with greater professional engagement invest a higher fraction of their portfolios in mutual funds. *Ceteris Paribus*, a household with \$10,000 higher annual income or a household head working in a professional occupation, invests 7 and 9 percentage more in mutual funds. Because such investors have greater professional responsibilities and busier schedule, the findings support our conjecture about the cost of time.

Households with more family responsibilities also favor mutual funds. Households in which household heads are married or live with a spouse/partner or that own their primary residences, invest 6 and 15 percentage more in mutual funds, among all equity investments.⁴ Such households are busier with domestic activities and hence have less time for direct investment, lending support to the hypothesis that investors with higher cost of time are more likely to invest through mutual funds.

Finally, we find households that have more/less leisure time tend to invest less/more in mutual funds. Households in which household heads are retired invest 19

⁴ All marginal effects are calculated when holding other variables constant.

percentage less while households in which both adults are full-time employed invest 12 percentage more in mutual funds, providing further evidence that the cost of time influences household choice between direct and indirect investment in equities. The results remain virtually the same under various robustness checks.

The analyses using data from the large discount brokerage firm generate similar results. In addition, the large discount brokerage data reveal that the relationship between the cost of time and mutual fund choice remains strong when controlling portfolio risk and portfolio performance, proxies for household risk aversion and investment skills.

This paper provides additional evidence on how search costs influence individual decision-making in the financial markets. Stigler (1961)'s seminal work on search costs has been successfully applied to explain economic behavior such as advertising, brand loyalty and education (Stigler 1961, Parsons 1974, Urbany 1986). Recent financial studies investigate how cost of time influences financial decision-making. Sirri and Tufano (1998) and Jain and Wu (2000) show that individuals respond significantly to outstanding fund performance but not much to lagging performance. Both studies attribute the phenomena to search costs: among the universe of mutual funds, individuals may choose those that can be accessed with lower search costs, instead of the ones that generate higher future returns. Our current findings show that search costs not only influences an individual's choice among funds, but also the choice between investing directly in stocks and indirectly through equity mutual funds.

Two possible outcomes may emerge if search is too costly. First, individuals may use heuristics and only process the more salient and available information. Barber and Odean (2004), Barber, Odean, and Zhu (2004), and Barber, Odean, and Zheng (2005) find that individuals respond to salient information in selecting stocks and mutual funds. Hirshleifer et al. (2004, 2005) find that companies with bloated balance sheets are valued higher because investors with limited attention respond more to salient information.

Alternatively, individuals may decide to give up the search process and turn to alternatives (Kiesler 1966). Experimental studies indicate that individuals feel less motivated and give up the search process when given too many alternative choices (Iyengar and Lepper, 2000). We believe this is the situation that individuals face between direct and delegated investment. Picking stocks can be challenging and time-consuming even for professional traders. It is understandable that individuals have to spend costly time going through process of picking stocks and potentially dealing with disappointing investment outcomes. Alternatively, households may opt to delegate at least part of their portfolios to professional money managers to save time from the above activities. Because some households have higher cost of time than others, the alternative of investing through mutual funds should be more appealing to households with higher cost of time.

Our study also contributes to a better understanding of individual investor behavior. Previous studies (Barber and Odean 2000, Barber, Odean, and Zhu 2004) show that individuals could be better off by investing through mutual funds, especially from a return-to-risk ratio perspective. Our current findings indicate that some households benefit more from delegated portfolio management due to time constraint. Even if individuals can out-perform the market in their direct investments, our results emphasize that the cost of time may be high enough for individuals to direct at least part of their assets to professional managers. Given the evidence that individuals on average cannot beat the market (Barber and Odean 2000), our findings provide additional incentives for individuals to invest through mutual funds.

Finally, the findings have implications on the development of the mutual fund industry. Our results provide one reason for the industry's fast development in the past decades (Gruber 1996). Households gain increasing control over their retirement accounts that they have to manage during the past decade. Meanwhile, the number of stocks doubled and makes picking stocks more challenging and time-consuming. The cost of time for self-investing has become so high that individuals choose to give it up and look for alternatives, even if their direct investment may outperform the market. The

mutual fund industry developed quickly during the same period in response to such an increasing demand. Our findings stress the importance of marketing efforts to mutual funds. If the need to save time attracts some investors to mutual funds, mutual fund industry as a whole have to advertise more and make itself more available to investors.

The rest of the paper proceeds as follows: Section 2 discusses how cost of time influences the choice between direct and indirect investment and proposes three types of proxies for cost of time; Section 3 describes the data and research methodology; Section 4 presents empirical results and robustness checks, and Section 5 concludes.

2. The Impact of Cost of Time on Choice between Self-Investing and Mutual Funds

Mutual funds should be an appealing alternative to direct investment to individual investors given recent evidence that individuals are susceptible to behavioral biases and make various mistakes in direct equity investments (Barber and Odean 2000, Dhar and Zhu 2005, Odean 1998, 2000)⁵. In particular, individuals hold severely under-diversified portfolios and undertake high idiosyncratic risk in their direct equity investment (Goetzmann and Kumar 2004, Zhu 2004) and can improve their investment's return-to-risk ratio (the Sharpe ratio) by diversifying through mutual funds.

On the other hand, all investors are not equally attracted to mutual funds. Previous studies find that individual investors value mutual fund total performance without fully understanding that the return difference may come from risk loading or pure chance and may not be repeated (Sirri and Tufano 1996, Jain and Wu 2000). If individuals only value raw portfolio performance, they may prefer self-investing to investing in mutual funds because it is unclear that actively managed mutual funds can out-perform the market index after management fees⁶. Recent evidence that some individual investors can indeed

⁵ Barber, Odean, and Zheng (2005) report that individuals also make sub-optimal decisions in their mutual fund decisions. The economic cost of such decisions are, however, unclear.

⁶ Jensen (1969) and Carhart (1992, 1997) question whether fund managers possess abilities to outperform the market while Brown and Goetzmann (1995), Hendricks et al. (1993), Grinblatt and Titman (1988,1992) find evidence of persistence in mutual fund performance for different groups of funds during separate periods.

outperform the market (Coval et al. 2004, Nicolosi et al. 2004) implies that individuals may choose to invest on their own if they possess the ‘hot hands’ ability, or believe that they do.

Alternatively, individuals may prefer professional investment services (i.e. mutual funds) because they do not have the time to invest on their own, *ceteris paribus*. Just as people no longer sew their own clothes or make their own furniture, households may no longer desire to spend time doing their own investment research, especially after the stock market has grown and there are too many stocks to follow. Should that be the case, we expect households with a higher level of cost of time to be more enthusiastic about mutual funds.

We implement several proxies for cost of time that fall in the following three broad categories: professional engagement, personal responsibilities, and leisure time, and discuss how they influence a household’s tendency to invest in mutual funds.

Professional engagement

Some occupations call for longer working hours and more personal interactions, which call for closer attention and greater responsibilities. Therefore, it is natural to assume that investors with greater professional involvement are more likely to be busy with their career. We expect such people to have less time for investment decisions and hence invest more heavily in mutual funds.

Hypothesis 1: Individuals with greater professional engagement and higher cost of time in career tend to invest more in mutual funds.

For cost of time in career, we use two proxies: income and work status of the household head. Labor economics argues that salary should reflect the tradeoff between employment and leisure and hence the shadow price of time. Consequently, we contend that households with higher salary tend to have higher cost of time. For example,

Goldhaber (2002) shows that a particular type of employee, teachers, exhibit a higher quality at work and devote more time to teaching, after receiving salary increases. This confirms the common notion that occupations with higher pay require more time and devotion. We therefore expect individuals with higher income to have less time for making direct investment research and decisions.

Because household income may not come entirely from salary, income can only serve as a noisy measure of a household's cost of time in professional engagement. We therefore include another proxy, the household head's occupation. Labor economists show that professional occupations such as managerial and technical positions require more working hours than other positions (Lazear 1976). As a result, such jobs limit the time that a household has outside a career, including the time that may otherwise be spent on doing research for stock investments. In addition, income and professional occupation are positively correlated (the correlation between logarithm of income and professional occupation dummy is 0.37 for the SCF data and 0.31 for the large discount broker data, both significant at 1 percent), suggesting some occupations have higher income and providing additional confirmation that occupation is a proxy for cost of time.

Personal responsibilities

Previous literature develops the theory and provides evidence that household activities take time and effort, similar to professional engagement. A series of work by Becker (1964, 1985) finds that household activities production, which is more effort intensive than leisure time, has considerable impact on a household's decisions on marriage, childbirth, and labor market participation (Blank 1988). If we consider household production as a weak form of substitute for job market production, it is clear that the households that have greater familial responsibilities, similar to those with greater professional engagement, tend to have less disposable time and hence are more likely to invest through delegated portfolio management.

Hypothesis 2: Individuals with greater personal responsibilities and higher cost of time should invest more in mutual funds.

We use marriage status, child status, and homeownership status as proxies for different levels of household production activities. Marriage can be time-consuming because both parties have to accommodate each other's demand, which can call for great efforts in coordination and negotiation (Lommerud, 1989, Manser and Brown 1980). Therefore, we expect married people to have higher cost of time and invest more in mutual funds.

Childcare and offspring education can take significant amount of time from adults. According to an article published in the USA Today (magazine) August 2000⁷, the average American child spends more than 5 hours with parents on workdays and more than 10 hours on weekends. Such findings depict a clear picture that households with children have less time for other activities, including investment research.

The American Housing Survey (1999) reveals that more than 50 percent of all American house owners made alterations, additions, and repairs to their houses during 1999. Such jobs not only include tasks completed by contractors but also those accomplished by homeowners themselves. As a matter of fact, maintenance costs and efforts, including the costs of a homeowner's own time, are frequently cited as a major negative factor against owning as opposed to renting (Orman 2000). Therefore, homeowners probably have to spend more time maintaining their residences and have less time for picking stocks.

Leisure time

The use of leisure time as a proxy for cost of time can be easily justified by labor economics literature that labor supply is basically a trade-off between work and leisure time. The more leisure time a household has, the lower the marginal cost of time it

⁷ 'How much Time do Kids Spend With Dad?' (Brief Article) USA Today Magazine, August 2000

commands (Owen 1971). Following the same spirit, we argue that households with less leisure time, hence higher cost of time, should invest relatively more in mutual funds.

Hypothesis 3: Individuals with more/less leisure time invest less/more in mutual funds.

We adopt two variables as proxies for leisure time, the retirement status and the dual employment status. It is not surprising that people have more time to themselves after retirement. Although not all retired people spend their time picking stocks, it is reasonable to assume that retired people have more time to spend on researching stock markets if they choose to.

If both the household head and the spouse/partner are engaged in full-time employment, they tend to have less time to attend to their children and residence, let alone investment decisions. Dual employment has been shown to be an important factor in other household decisions related to retirement, childcare, and mortgages. (Gustman and Steinmeier 2000, Ogawa and Ermisch 1996, Fortin 1995). Despite some theories arguing that the production of household goods and market goods should be comparable in value, households in which both adults work would face greater coordination and scheduling problems than those with only one adult working for full-time. Therefore, we believe that households with dual-employment status should invest more in mutual funds.

At first glance, some of the proxies for cost of time may resemble those for investor sophistication. Although investors with higher income, professional occupation, and larger portfolio may possess better investment skills and less susceptible to behavioral biases (Dhar and Zhu 2005, Zhu 2003), proxies for personal responsibilities and leisure distinguish the cost of time hypothesis from investor sophistication hypothesis. In addition, more sophisticated investors may opt to invest more in individual stocks because they feel they can outrun the market. This should lead to less investment in mutual funds, opposite to what cost of time would predict. We perform further analyses in section 5.1 and confirm that the selected proxies also influence other investment decisions sensitive to time constraint.

Another issue that merits further discussion is that choosing among mutual funds takes time too, especially as the number of mutual fund increased rapidly during the past decade⁸. We argue that the number of stock mutual funds still seems small compared to the number of publicly traded companies, which makes picking mutual fund relatively time-saving.⁹ Further, mutual funds disclose their investment objectives and risk levels, which further narrow the search process if households have a clear investment objective. Finally, Mutual funds are more diversified and hence less risky. Finally, returns are more homogeneous among mutual funds than among individual stocks, making easier to chose among funds because households are unlikely to lose value sharply, as many stocks do¹⁰. Therefore, we believe that individuals may find choosing mutual funds a less demanding and time-consuming task than picking stocks.

3. Data and Methodology

We use data from two primary sources in this study. The first data come from the Survey of Consumer Finance in 1992, 1995, 1998 and 2001.¹¹ The second data are investor trading, position and demographic information from a large discount brokerage firm between 1991 and 1996¹². One advantage for using SCF data from the selected years is that the data are temporally comparable between the two sources.

The Survey of Consumer Finances (SCF) is a triennial survey of detailed information on the balance sheet, pension, income, and other demographic characteristics of U.S. families. The survey also gathers information on the use of financial institutions. The study is sponsored by the Federal Reserve Board in cooperation with the Department of the Treasury. Since 1992, data have been collected by the National Organization for

⁸ The number of stock funds increase from 1,346 in December, 1992 to 4,601 in December, 2004 (Trends in Mutual Fund Investing 2004, ICI, http://www.ici.org/stats/mf/arctrends/trends_12_04.html#TopOfPage)

⁹ 4,601 stock funds in December, 2004 (ICI), as compared to about 15,000 publicly traded companies within U.S. (Wall Street Journal Online <http://www.wall-street.com/annualreports/index.html>)

¹⁰ An ideal way to address this issue to calculate what fraction of household portfolio is invested in equity index funds, the most time-saving way to invest in equity market. Unfortunately, neither data source identifies index mutual funds from other types of mutual funds.

¹¹ The sampling method for the 1983 and the 1989 survey is different from the one used in the sample years. See <http://www.federalreserve.gov/pubs/oss/oss2/89/scf89home.html> for greater details.

¹² Please see Odean (2000) and Barber and Odean (2000) for greater details about the brokerage data.

Research at the University of Chicago (NORC). Respondents are randomly selected to ensure the representativeness of the study. A strong attempt is made to select families from all economic strata (for more details, see Kennickell, 2002, 1999). Data from the SCF are widely used, from analysis at the Federal Reserve and other branches of government to scholarly work (for example, Blume and Friend 1975, Bommerber, 1993, and Gale and Scholz 1994, among others).

(Insert Table 1 about here)

Participation in the study is strictly voluntary. However, because only about 4,500 families are interviewed in the main study, every family selected is very important to the results. To retain the scientific validity of the study, interviewers are not allowed to substitute respondents for families that do not participate. Thus, if a family declines to participate, it means that families like theirs may not be represented clearly in national discussion.^{13 14}

The variables of interest include an individual's investment in different classes of securities. In particular, we use self-reported total dollar value invested in financial assets, equity, and equity mutual funds (the survey uses dollar value in respective years when the survey was conducted). The total financial assets are the sum of all household investments in liquid assets, certificate of deposits (CDs), non-money-market mutual funds, common stocks, bonds, retirement portfolios, cash value of whole life insurance, saving bonds, other mutual funds, and other financial assets. Following the Survey definition, total investment in equities is calculated as the total value of investment in common stocks and stock mutual funds and part of the value of investment in combination mutual funds, IRA and Keogh accounts invested in stocks, investment in other managed assets with equity interest (such as annuities and trusts), and thrift-type

¹³ The confidentiality of the information provided in the study is of the highest importance to NORC and the Federal Reserve. Strenuous efforts are made to protect the privacy of participants, and in the history of the survey, there has never been a leak. The names of the participants in the survey are known only to NORC, which has more than 50 years of successful experience in collecting confidential information.

¹⁴ Kennickell 1999, 2002 report that survey of consumer finance over-sample wealthy households. We will perform robustness test on this in Section 5.

retirement accounts invested in stocks.¹⁵ We calculate the fraction of indirect equity investment among all equity investment as:

$$\text{Percent (Indirect Equity Investment)} = \frac{(\text{Equity} - \text{Stocks})}{\text{Equity}} \quad (1)$$

Where *Equity* is the dollar value of a household's total equity investment and *Stocks* is the dollar value of the household's total direct equity investment.^{16 17}

Household income variable is household income in the previous calendar year (Survey variable X5729). Professional dummy equals to 1 if the official title of the household head's job falls into 'Managerial/Professional/Specialty Occupation' categories, and 0 otherwise (Survey variable X7401).

The marriage dummy equals to 1 if the respondent reports to be 'married or living with partner', and 0 otherwise (Survey variable X8023). The child dummy takes the value of 1 if there are least one child under the age of 18, and 0 otherwise (Survey variable X108, X114, X120, X126, X202, X208, X214, X220, X226).¹⁸ Homeownership dummy variable equals to 1 if the household owns its primary residence, and 0 otherwise (Survey variable X604, X614, X623, and X716). The retirement dummy takes the value of 1 if household head is older than 65 and not employed, and 0 otherwise (Survey

¹⁵ The Survey of Consumer Finance defines total equity investment as the sum of: 1. directly-held stock; 2. stock mutual funds: full value if described as a stock mutual fund, 1/2 value of combination mutual funds; 3. IRAs/Keoghs invested in stock: full value if mostly invested in stock, 1/2 value if split between stocks/bonds or stocks/money market, 1/3 value if split between stocks/bonds/money market; 4. other managed assets with equity interest (annuities, trusts, MIAs): full value if mostly invested in stock, 1/2 value if split between stocks/mutual funds & bonds/CDs, or "mixed/diversified," 1/3 value if "other"; 5. thrift-type retirement accounts invested in stock: full value if mostly invested in stock, 1/2 value if split between stocks and interest earning assets;

¹⁶ We exclude investments in the retirement accounts from the study. We also use an alternative definition that includes investment in retirement accounts and the results are very similar.

¹⁷ The median portfolio size \$41,475 for SCF and \$35,200 for the large discount broker data, representing about 80 percent and 50 percent of household income respectively. Hence, we believe it is unlikely that households treat such investments as entertainment.

¹⁸ We also use an alternative definition of the kid dummy for younger children and the results are similar.

variable X112 and X7401). The dual career dummy equals to 1 if the current status for both the household head and the spouse/partner is ‘worker’, and 0 otherwise (Survey variable X4100 and X4700).¹⁹

We also include several control variables. The age of the household head is reported in Survey variable X122. Race dummy takes the value of 1 if the household head reports ‘non-white or Hispanic’ and 0 if the household reports ‘white non-Hispanic’ (Survey variable 6809).

The data from the large national discount brokerage firm complement the SCF data in two important senses. First, the large discount brokerage data are the complete record of household investment decisions with the firm during a 6-year period. Data of such nature can depict investors’ real-life decision making (compared to the self-reported survey in the SCF) over a longer time horizon (compared to the snapshot in the SCF). Second, we are able to control for household differences in risk tolerance and investment capabilities, factors that can potentially influence the choice between direct investment and mutual funds, yet not included in the SCF data. From the household end-of-month portfolio holdings, we can calculate the monthly portfolio returns. Based on the return time series, we calculate the volatility of the portfolio returns and the raw and risk-adjusted portfolio performance for each household. If ex-post portfolio return and volatility can proxy for household ex-ante investment ability and risk tolerance, such information enables us to examine how investment ability and risk aversion influence the choice between direct and delegated equity investments and ensure the our findings are not driven by such household differences.

We calculate the fraction invested in mutual funds for each household as the monthly average of equity mutual fund investment divided by the sum of the monthly

¹⁹ To verify the above variables represent cost of time, we perform unreported analyses that regress the number of stocks/mutual funds that household invest in. Because households with higher cost of time have less time for making investment decisions, we expect such households to invest in a smaller number of

average of stocks and equity mutual fund investment, using the end-of-month portfolio position holdings. Similar to the SCF data, we include the income²⁰ and occupation to proxy for household professional engagement. The household characteristics were separately collected by InfoBase and available only on a subset of the households. We also create dummy variables for marriage, child, homeownership, retirement and dual employment when possible. We acknowledge that the household characteristics are not as reliable as those from the SCF because the demographic information is available only for a sub-sample of households, which only report some of their demographic characteristics. Unlike the SCF data, we do not have information on household investments in other financial assets or equity investment with other brokerage firms. Neither do we have information on the race for the household head in the data from the large discount brokerage firm. Due to data limitation, we expect noisier results for the large discount brokerage data than for the SCF data.

4. Empirical Results

1. Summary Statistics

We first summarize the household characteristics for households that invest and those that do not invest in mutual funds as a preliminary way of testing the hypotheses. Following the hypotheses, we expect investors who invest in mutual funds to have higher cost of time, represented by greater professional engagement, personal responsibilities, and less leisure time.

(Insert Figure 1 about here)

stocks and mutual funds to save time. We indeed find households with higher cost of time invest in a smaller number of securities, which provides additional support for the proxies for cost of time.

²⁰ Household income is a continuous variable backed out from original categorical data in Infobase. Household income is reported in nine categories (0-15, 15-20, 20-30, 30-40, 40-50, 50-75, 75-100, 100-125, and 125+ thousands of dollars. We assume that household income levels for households in the first eight categories was the midpoint of the income range and \$250,000 for the last category according to the 1992 Survey of Consumer Finance.

Among the 16,980 households in the Survey, 8,311 households invest and 8,669 households do not invest in equity mutual funds.²¹ We plot the characteristics for households that invest and do not invest in mutual funds in Figure 1. Households that invest in mutual funds tend to have higher incomes and more household heads working as professionals, our proxies for cost of time. The mean household income for mutual fund households (\$629,925) is almost four times as high as that for non-mutual-fund households (\$161,330).²² The fraction of mutual fund investors working in professional occupations (59.76%) is more than 50 percent higher than that for non-mutual-fund investors (37.94%).

(Insert Table 2 about here)

Households that invest in mutual funds tend to have more familial responsibilities. For mutual fund investors, 78.05% of the household heads are married or live with spouse/partner, 45.12% have kids, and 85.43% own their primary residences. All three fractions are higher than households that do not invest in mutual funds (54.86%, 41.67%, and 57.85%, respectively) at 1 percent significant level, strongly supporting that households with greater personal responsibilities are more likely to invest in mutual funds.

Households that invest in mutual funds also tend to have less leisure time. A higher fraction of mutual fund investors witness both adults employed for full-time jobs (34.26% compared with 22.12% for non-mutual fund investors) and a lower fraction of household heads at mutual fund investors households are retired (17.64% compared with 25.59% for non-mutual fund investors). Both differences are statistically significant at the 1-percent level.

Comparisons on other control variables reveal that mutual fund investors tend to be white and non-Hispanic in ethnicity and invest considerably more in all types of assets and stocks, both directly and indirectly. There is little difference in household head age.

²¹ There is an increasing trend in the fraction invested in mutual funds in the sample period.

²² The median income for households investing and those not investing equity mutual funds is \$86,169.67 and \$25,697.77, significantly different at 1 percent.

The summary results from the large discount brokerage firm is qualitatively similar to those from the SCF data in that mutual fund investors have higher costs of time than those who do not. The differences in investor characteristics are highly statistically significant but smaller in economic sense, compared to the SCF results. We believe this can be attributed to the data limitation outlined in Section 3.

In sum, the profiles for households that invest and do not invest in equity mutual funds are consistent with the proposed hypotheses that households with higher cost of time are more likely to use intermediaries such as mutual funds for equity investment.

2. Regression results

We perform Probit regression to estimate how cost of time influences households' propensity to invest in mutual funds. The dependent variable is a binary variable that equals to 1 if a household invests in mutual funds and 0 if it does not. The independent variables include our proxies for professional engagement (household income and household head occupation), personal responsibilities (marriage status, child status, home ownership), and leisure time (retirement status and dual-career status). In addition, we also control for household head age, race, and total equity investment (and portfolio performance and risk for the large discount broker data).

The results in Table 3 indicate that, consistent with the above profile comparison, investors with higher cost of time are more likely to invest in mutual funds. For the SCF data, an increase of \$10,000 in income can increase the probability of investing in mutual funds by about 40 percent. This is consistent with the idea that households with higher income tend to have higher cost of time and are therefore more likely to invest through mutual funds. The coefficient for professional occupation is 0.15 and significant at 1 percent, when controlling for all other variables. The variable that a household head working in a professional occupation alone can increase the households' tendency to mutual fund investment by 15 percent, completely consistent with Hypothesis 1, too. As to proxies for personal responsibilities, being married and owning a primary residence

can each increase a household's probability of investing in mutual funds by about 8%, both significant at 1 percent, *ceteris paribus*, also supporting Hypothesis 2.

(Insert Table 3 about here)

Finally, we show that households where the household heads are retired have 38% less probability of investing in mutual funds, while the probability of investing in mutual funds is 12 percent higher if both the household head and the spouse/partner are full-time employed. This provides additional evidence that households with more/less leisure time are less/more likely to use delegated portfolio management.

For all specifications, we include age and race as control variables. We find that older investors are less likely to invest in mutual funds: a 10-year difference in age leads to 8 percent difference in mutual fund investment likelihood. Non-white or Hispanic investors are about 28 percent less likely to invest in mutual funds. All current results suggest that, consistent with the hypotheses, households with higher cost of time are more likely to invest in mutual funds.²³

We next perform Tobit regression to estimate how cost of time influences the fraction that each household chooses to invest in mutual funds. The dependent variable, the fraction of equity investment invested through mutual funds (indirect delegated portfolio management), is bounded by 0 and 1 and therefore OLS is not appropriate due to the discussion in Heckman (1979) and Greene (1997). Instead, the Tobit regression performs a two-stage regression in which the first-stage estimates for each household's likelihood to invest in mutual funds and the second-stage estimates the impact of cost of time on the fraction invested in mutual funds when controlling mutual fund investment tendency. The same independent variables are included as in the Probit regression.

(Insert Table 4 about here)

²³ In an alternative specification, we also include the gender of household head. Households with female household head invest a insignificantly higher fraction in mutual funds.

When controlling for households' choices to invest in mutual funds, we find in specification (4) of Table 4 that investors with higher income tend to invest more in mutual funds. An increase of \$10,000 in household income leads to a 7 percentage increase in the fraction invested in mutual funds²⁴. The coefficient on professional occupation also remains strong and highly significant. Working in a professional occupation can increase the household's fraction invested in mutual funds by 9 percentage, controlling for other variables.

The fraction invested in mutual funds is 6 and 15 percentage higher for households in which the household head is married or living with a spouse/partner and households that own their primary residence, *ceteris paribus*. Both results are highly significant at 1 percent level. Somewhat surprisingly, having kid reduces the fraction invested in mutual funds by about 2 percentage. One possible explanation is that kid dummy highly interacts with the retirement variable. When running the same regression for a sub-sample of households where the household head is not retired, the impact of having kid becomes positive and weakly significant. The mutual fund investment fraction is 19 percentage lower for households where the household head is retired and 11 percentage higher for households where both household adults are full-time employed.

The coefficient of age is negative and an increase of 10 years in age reduces the fraction of mutual fund investment by about 5 percentage. The results remain that the non-white or Hispanic households invest about 16 percentage less in mutual funds than white and non-Hispanic households. The portfolio size has non-negligible impact. A household with \$1 million more invested in equities will invest almost 50 percentage more in mutual funds than another otherwise identical household with less equity investment. This is consistent with the notion that delegated portfolio management is more common for large portfolios.

²⁴ All marginal effects (Dfraction/DX) are calculated based on coefficient estimation of the second stage regression while controlling for the truncated observation. See stata (1997) for greater details.

So far, the evidence is completely consistent with our conjecture that households with higher cost of time and greater search costs are more likely to use and invest more through delegated portfolio management in their equity investments. Our results provide micro-level evidence that search costs can greatly influence an investor's decision between direct and indirect investment. The findings complement previous studies (Sirri and Tufano 1996, Jain and Wu 2000) that emphasize how search costs influence individual choices among various mutual funds and underscore the importance of information dissemination and search costs in influencing investment decisions.

3. Influence from Retirement Accounts

One source that may lead a household to mutual fund investments is a retirement account. Even though we already exclude retirement investment in the above analyses (footnote 10), it is possible that a household's decision in retirement accounts would influence other investment decisions.²⁵ Because retirement investment decisions depend considerably on the plan design and available choices (Benartzi and Thaler 2001), some of our results (i.e. professionals and dual-career households are more likely to invest in mutual funds) may be explained by that some households are more likely to be influenced by their retirement account choices than others do. Because equity mutual funds are offered in almost all retirement plans, individuals with retirement plans may be more likely to invest through mutual funds in the rest of their portfolios.

To isolate the potential impact from retirement accounts, we replicate the tobit regression for a subset of 5,079 households that report to be self-employed (the response to Survey variable X4701 is "2", "self-employed/partnership"). We believe our results are not driven by retirement accounts if the same pattern prevails for the self-employed

²⁵ Availability heuristics predict that investors are more likely to invest in securities than they are aware of. Now that they have become aware of their investments in the retirement accounts, they may choose to invest in the same stocks and mutual funds outside the retirement accounts. Support of availability heuristics in investment decisions can be found in Cohen (2005), Huberman (2001), and Zhu (2003)

households, who are least likely to be under the influence of the retirement accounts²⁶. This is exactly what we found. The results in Specification (5) of Table 4 are very similar to what we obtain before and even stronger for income, marriage status, and home ownership. This indicates that mutual funds in retirement accounts are not driving our findings.²⁷

4. Controls for Portfolio Risk and Investor Ability

We understand that two important aspects may influence a household's choice between direct and delegated equity investment but cannot be addressed using the SCF data. Because mutual funds are more diversified--hence less risky--portfolios, some individuals may invest more in mutual funds because of higher level of risk aversion. However, the SCF results are opposite to what risk aversion would predict. Constant Relative Risk Aversion (CRRA) utility function would predict that households with lower income and less investment should be more risk-averse and invest a higher fraction in mutual funds, which are more diversified and less volatile. However, our results actually show the opposite: households with higher income and more investment invest a higher fraction in mutual funds. In contrast, households with lower income, who are assumed to be more risk-averse, opt to the riskier alternative of self-investing.

Second, households may have different abilities. Although Barber and Odean (2000) show that average individual investors from a large discount brokerage firm cannot outperform the market benchmark, Coval et al. (2004) find that a sub-sample of these individual investors can persistently beat the market. In addition, Dhar and Zhu (2005) and Nicolosi et al. (2005) find that trading experience can help alleviate behavioral biases and improve investment performance. Hence, it is possible that the cross-sectional difference in the fraction invested in mutual funds may reflect differences

²⁶ It is possible that such households may have rolling-over from previous employers' retirement accounts. Nevertheless, we do not expect investment decisions made in the past to have considerable impact on a household's current investment choices.

²⁷ It would be instrumental to compare mutual fund investments for households that invest in mutual funds in the retirement accounts versus those that do not. Unfortunately, Survey of Consumer Finance does not distinguish between stocks and mutual funds in retirement accounts.

in household investment abilities: households with good investment abilities choose to invest more directly in stocks and those with poor abilities rely more on mutual funds.

However, this is again inconsistent with our findings that the more sophisticated investors, investors with higher income and working in professional occupations, are more likely to invest in mutual funds. Previous studies (Dhar and Zhu 2005, Goetzmann and Kumar 2004, and Zhu 2003) find that more sophisticated investors are less likely to exhibit behavioral biases and hence perform relatively better than less sophisticated investors. Therefore, it is unlikely that the more sophisticated investors choose to invest in mutual funds because they lack the skills to invest on their own.

We next use the data from the large discount brokerage firm to directly test whether the above factors drive our results. We first calculate the gross value-weighted monthly return on the household stock portfolio (R_{ht}) as:

$$R_{ht} = \frac{\sum_{i=1}^{S_{ht}} v_{it} R_{it}}{\sum_{i=1}^{S_{ht}} v_{i,t}}$$

where v_{it} is the beginning-of-month market value for the holding of stock i by household i in month t , R_{it} is the gross monthly return for stock i and S_{ht} is the number of stocks held by household h in month t . Portfolio risk is calculated as the standard deviation of the time series of the gross monthly return of individual stock holdings.

The risk-adjusted return for each household is obtained by estimating the intercept (three-factor alpha) from the Fama-French three-factor model for the time series of the gross monthly return for each household.²⁸ We only calculate the alpha if a household has at least 24 months of return series. We believe risk-adjusted return is more appropriate than raw returns in reflecting investors' abilities. The portfolio risk and performance can be considered as ex-post measures of household risk aversion and investment skills,

assuming various households have similar understanding about their investment skills and portfolio risks.²⁹

(Insert Table 4 about here)

We report the Probit and Tobit results for the large discount brokerage data in Table 3 and 4, respectively. Results in Table 3 reveal that large discount broker investors with higher cost of time are more likely to invest in mutual funds. The coefficients for cost of time proxies are all in the same direction but smaller in magnitude, partly due to the measurement errors. We next perform Tobit regression of the fraction invested in mutual funds on household equity portfolio return and risk, along with other independent variables as in the SCF regression. In Table 4, the coefficient is positive and highly significant for portfolio risk, indicating that households holding investing in mutual funds hold riskier stock portfolios. This is consistent with Shefrin and Statman (2000) that individuals may treat mutual funds as ‘safety net’ and invest in more risky stocks in the direct investment. The economic significance of risk aversion is, however, muted: one standard deviation change in portfolio risk leads to less than 1 percentage change in the mutual fund fraction. If one were to assume that households have similar abilities in forecasting portfolio risk ex-ante, the current findings suggest that risk aversion cannot explain the cross-sectional difference in mutual fund investments.

The coefficient of common stock portfolio return is positive but insignificant. This provides little support for the conjecture that some households choose to invest more in mutual funds because they obtain inferior returns in direct investment and consequently avoid direct investment. In contrast, the results hint that households that have higher returns in direct stock investment are indeed more likely to invest in stock

²⁸ We also calculate the risk adjusted returns by using the Cahart four-factor model and the results remain very similar. This should not be surprising because individuals tend to be contrarian investors on the monthly basis (Barber, Odean, and Zhu 2005)

²⁹ Alternatively, we use the raw portfolio returns. The coefficient for raw portfolio return is also insignificant and the regression results are very similar to the base regression.

mutual funds.³⁰ This provides additional evidence that the difference in investment ability is not driving our results. Consistent with the SCF data, the coefficient for portfolio size is positive and significant at 1 percent. An increase of \$1 million in equity investment can lead to almost a 30 percentage increase in the fraction of mutual fund investment.

We next replicate the same analyses in Section 4.2 using data from the large discount brokerage firm and control for portfolio performance and risk. The results are completely consistent with the SCF results. Households with \$10,000 higher income or a household head working in a professional occupation each invest about 4 percentages more in mutual funds. Married households, households that own their primary residences, and households in which both the household head and the spouse/partner work full-time, each invest about 2 to 3 percentages more in mutual funds. Older investors invest a smaller fraction in equity mutual funds and retired households invest 5 percentages less in equity mutual funds, *ceteris paribus*.

It is worth mentioning that the economic and statistical significance of cost of time proxies are both smaller for the large discount brokerage than for the SCF data. We believe this can largely be attributed to two reasons. First, whereas the Survey collects information on each household's complete assets and investments, we only observe a household's portfolio with the large discount broker. Therefore, the measure of indirect investment proportion is noisier for the discount broker data than the survey data (i.e. the "error-in-variable" problem). Secondly, household characteristics are missing for many sample households with the large discount broker data. Information for variables such as home ownership and number of children is missing for about one half of the sample households. To preserve as many observations as possible, we only delete a household from the regression if all household characteristics are missing. For the remaining sample, some household characteristics may be missing and we treat the missing observations as taking the value of 0 for the dummy variable. This procedure introduces additional noises,

³⁰ The economic significance of investment ability and risk aversion are both modest, compared to proxies for cost of time.

confounds the true impact of the proxies for cost of time, and is responsible for the reduced significance.

Summarizing the results from SCF and the large discount brokerage firm, we find strong support for our conjecture that households with higher cost of time invest more through delegated portfolio management. Competing hypotheses such as investor sophistication, ability, and risk aversion, are not as convincing.

5. *Robustness Check*

1. Cost of Time and Other Investment Decisions

One natural way to verify the validity of the cost of time proxies is to examine whether households with higher cost of time also take less active role in other investment decisions. In particular, households with time constraint are expected to invest in a smaller number of stocks and turn over their portfolio less frequently, because they do not have much time to research a large pool of stocks or follow the stock market very closely.³¹

(Insert Table 5 about here)

There is support for our conjecture in both data sources. For the SCF data, we perform ordered logit regression for trade frequency (specification 1 in Table 5). Survey respondents report their trade frequency in one of the following six categories (Day, Week, Bi-weekly, Month, Quarter, and Year). We construct dependent variable equal to 1 through 6, corresponding to the six categories (1 corresponds to trade daily and 6 corresponds to trade annually) and include the same independent variables as in Table 4. It is evident that households with married adults, kids, both adults working, and owning

³¹ We also regress the number of asset classes (stocks, bonds, option, foreign currencies) that each household holds over the same set of independent variables as in Section 5.2. As there are some indications that households with higher cost of time hold smaller number of asset classes, the results are statistically insignificant possibly due to the coarse definition of asset classes from SCF.

their houses trade less frequently. In contrast, retired people trade insignificantly more frequently. As expected, larger portfolios result in higher trading frequency.

In addition, we also run linear regression of the unique number of stocks and mutual funds that each household invests in on the same independent variables (specification 2 and 3 in Table 5). Similar to the trading frequency results, households with married adults, kids, both adults working full-time, and owning their houses invest in a smaller number of unique stocks and mutual funds. Both pieces of evidence confirm that the proxies for households' cost of time indeed relate to households' overall involvement with investments.

For the large discount broker data, we first run regressions with dependent variables as stock and mutual fund turnover (specification (4) and (5) in Table 5), respectively. Monthly stock turnover is defined as the average of the buy and sell turnover, calculated as the dollar value of purchasing/selling trades on stocks divided by the dollar value of the end-of-month/start-of-month value of portfolio holdings. Monthly mutual fund turnover is similarly calculated. The stock and mutual fund turnover for each household is the average of the monthly time series of turnover for the household.

The regression results indicate that households with higher income, child, both household adults being full-time employed, and owning their primary residence, turn over their equity portfolio less frequently. These variables are all proxies for higher cost of time. The results also indicate that retired people tend to trade more frequently (statistically insignificant), which is also consistent the time constraint hypothesis.

We finally use the number of unique stocks and funds that each household invests in as the dependent variables in OLS regressions (specification (6) and (7) in Table 5). Consistent with the expectation, households with married adults, both adults working full-time, and owning their primary residence, invest in a significantly smaller number of unique stocks. Meanwhile, households with higher income, household head working in professional occupation, and married adults invest in a significantly larger number of

unique mutual funds. This should not be surprising because such households invest relatively more in mutual funds (both relative to stocks and in absolute dollar value), resulting in a larger number of unique mutual funds. Finally, households with both adults working or owning their house invest in a smaller number of mutual funds, lending additional support that the proxies relate closely to household time constraint and time spent on investments.

2. Sub-sample of each year

To test the robustness of the results, we divide the survey of consumer finance data into separate years when the survey was conducted, and repeat the above analyses. All major findings remain the same within each year, providing supporting evidence for our conclusions.

(Insert Table 6 about here)

3. High Net Worth Households

Survey of Consumer Finance over sample wealthier households and may influence statistical inferences (Kennickell 1999, 2002) and our results may also be susceptible. We believe this should bias us against finding the results because households with high net worth usually have professionals manage their assets, so cost of time may not be as an important factor as for other households.

We perform an additional test by excluding 2,236 households (13.19% of all sample households) whose total assets are greater than \$5 million³² from all years of SCF survey. The results remain similar and indeed turn stronger for most proxies.³³

³² We also use different cutoff points such as \$1 million and \$10 million and the results remain the same.

³³ Only 8 investors with the large discount brokerage firm invest more than \$5 million in stocks and mutual funds. Hence, we believe they have little impact on our results and additional regressions (not reported) confirm our belief.

4. Conclusions

We present evidence that cost of time plays an important role in a household's decision between direct and delegated equity portfolio management. Households with greater professional engagement, family responsibilities and less leisure time, proxies for higher cost of time, invest a higher fraction of their equity investment through delegated portfolio management, such as mutual funds.

Our results emphasize that search cost can influence an investor's decision between direct investment in equities and delegated portfolio management through mutual funds. The findings also offer explanation to the cross-sectional difference in adoption of mutual fund investment, and also shed light on the fast development of the mutual fund industry during the past two decades.

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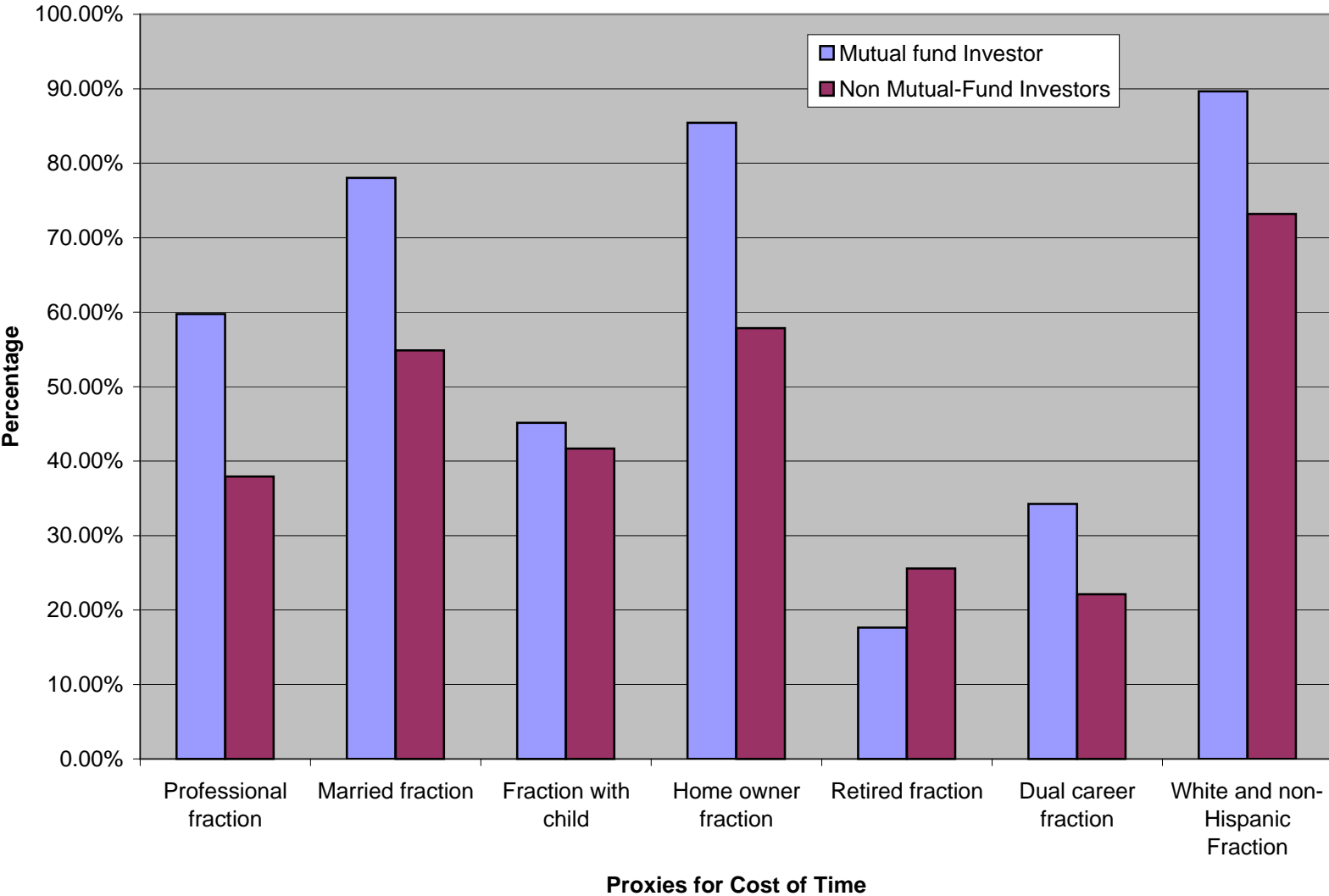
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Figure 1. Household Characteristics for Mutual Fund and Non-Mutual-Fund Investors
Survey of Consumer Finance (1992-2001)



	Panel A: Survey of Consumer Finance (1992-2001)					Panel B: Large Discount Brokerage Firm (1991-1996)					
	mean	median	min	max	std dev	mean	median	min	max	std dev	N
Age	50	48	17	95	17	50	48	17	94	13	44,761
Income	391,067	48,179	0	179,000,000	2,728,331	76,749	62,500	7,500	150,000	38,500	48,168
Kids	0.84	0.00	0.00	9.00	1.17	0.80	0.00	0.00	8.00	1.24	77,666
Total Assets	5,529,086	204,535	-14,400,000	179,000,000	5,529,086						
Total Financial Assets	2,016,133	41,475	0	79,200,000	1,317,000	1,681,018	35,200	0	792,000,000	15,000,000	77,666
Total Equity Investment	1,186,013	3,000	0	408,000,000	9,566,991	52,706	17,998	0	38,000,000	207,708	77,666
Total Equity Mutual Fund Investment	198,350	0	0	87,500,000	4,865,937	13,783	0	0	6,928,042	61,953	77,666
Fraction of Indirect investment in All Equity Investment	0.38	0.00	0.00	1.00	0.45	0.23	0.00	0.00	1.00	0.36	77,666

Table 1. Summary Statistics

In Panel A, there are 16,980 households surveyed in the 1992,1995, 1998, and 2001 Survey of Consumer Finance. Age is the reported age in the year of the survey. Income is the income in the year prior to the survey, in the dollar of the survey year. Kids is the number of children living with the household. The total financial assets are the sum of all household investments in liquid assets, certificate of deposits (CDs), non-money-market mutual funds, common stocks, bonds, retirement portfolios, cash value of whole life insurance, saving bonds, other mutual funds, and other financial assets. Total equity investment is calculated as the total value of investment in common stocks and stock mutual funds and part of the value of investment in combination mutual funds, IRA and Keogh accounts invested in stocks, investment in other managed assets with equity interest (such as annuities and trusts), and thrift-type retirement accounts invested in stocks. Total Equity Mutual Fund Investment is the sum of the total value of stock mutual fund and one half of the combination mutual fund investments. Fraction of indirect investment in all equity investment is calculated as equity investment through indirect investment intermediaries (i.e. mutual funds) divided by the total equity investment. In Panel B, there are 77,666 households from the large discount brokerage firm between 1991 and 1996. Age and child are obtained from the accompanying demographic file. Income is backed out from self-reported income categories. Total equity investment and total equity mutual fund investment are the monthly average of household position invested in stocks and equity mutual funds. The fraction of mutual fund in all equity investment is calculated as the average monthly position in equity mutual funds divided by the average monthly position in stocks and equity mutual funds.

	Panel A: Survey of Consumer Finance				Panel B: Large Discount Brokerage			
	MF	W/O MF	Difference	T-stat	MF	W/O MF	Difference	T-stat
Observation	8,311	8,669			35,294	45,072		
Income	629,925	161,330	468,595	11.22***	77,790	76,055	1,735	4.86***
Professional fraction	59.76%	37.94%	21.82%	29.14***	30.45%	26.71%	3.74%	8.64***
Married fraction	78.05%	54.86%	23.19%	32.94***	56.56%	53.78%	2.78%	6.04***
Fraction with child	45.12%	41.67%	3.45%	4.54***	19.06%	17.38%	1.68%	5.94***
Home owner fraction	85.43%	57.85%	27.58%	41.72***	52.72%	49.54%	3.18%	8.80***
Retired fraction	17.64%	25.59%	-7.95%	12.62***	8.33%	8.63%	-0.30%	1.43
Dual career fraction	34.26%	22.12%	12.14%	17.75***	7.19%	6.74%	0.45%	2.03**
White and non-Hispanic Fraction	89.64%	73.18%	16.46%	28.23***				
Age	50.41	49.54	0.87	3.46***	50.84	50.13	0.71	5.82***
Total Assets	8,385,850	2,781,422	5,604,428	12.32***				
Total Equity Investment	2,085,766	320,621	1,765,145	12.06***	76,624	35,410	41,214	27.82***

Table 2. Characteristics for Households with and without Mutual Fund Investment

In Panel A, There are 16,980 households surveyed in the 1992,1995, 1998, and 2001 Survey of Consumer Finance. 8,311 invest in mutual funds and 8,669 do not invest in mutual funds. Income is the income in the year prior to the survey, in the dollar of the survey year. Professional is a dummy variable that equals to 1 if household head engages in "professional" occupation and 0 otherwise. Married is a dummy variable that equals to 1 if household head is married or live with partner and 0 otherwise. Child is a dummy variable that equals to 1 if there is child under the age of 18 living with the household, and 0 otherwise. Homeowner is a dummy variable that equals to 1 if the household owns its primary residence and 0 otherwise. Retired is a dummy variable if the household head is over the age of 65 and not employed and 0 otherwise. Dual career is a dummy variable that equals to 1 if both adults in the household are full-time employed and 0 otherwise. White and Non-Hispanic is a dummy variable equal to 1 if the household report its ethnicity to be white and non-hispanic and 0 otherwise. Age is the reported age in the year of the survey. Total asset is the sum of all household assets. Total equity investment is calculated as the total value of investment in common stocks and stock mutual funds and part of the value of investment in combination mutual funds, IRA and Keogh accounts invested in stocks, investment in other managed assets with equity interest (such as annuities and trusts), and thrift-type retirement accounts invested in stocks. In Panel B, there are 80,366 households from the large discount broker data. 35,294 households invest in mutual funds and 45,072 households do not invest in mutual funds. Income is backed out from income category from the Infobase data. Total equity investment is the monthly average of household position in common stocks and equity funds. Other household characteristics are similarly defined as for the SCF data and collected from Infobase. *** denotes statistical significance at the 1-percent level.

	Survey of Consumer Finance 1992-2001			Large Discount Brokerage Firm (1991-1996)			
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	-3.779*** (0.000)	-3.498*** (0.000)	-3.283*** (0.000)	-0.312*** (0.000)	-0.320 (0.000)	-2.680*** (0.000)	-3.141*** (0.000)
Log(income)	0.329*** (0.000)	0.259*** (0.000)	0.096*** (0.000)	0.019** (0.013)	0.066*** (0.005)	0.024** (0.013)	0.040*** (0.006)
Occupation	0.308*** (0.000)	0.324*** (0.000)	0.149*** (0.000)	0.076*** (0.000)	0.077*** (0.000)	0.085*** (0.000)	0.075*** (0.000)
Married		0.208*** (0.000)	0.084*** (0.002)		0.291** (0.021)	0.209** (0.015)	0.108** (0.042)
Child		0.027 (0.215)	0.009 (0.162)		0.036** (0.017)	0.028** (0.019)	0.024** (0.023)
Home owner		0.474*** (0.000)	0.078** (0.011)		0.063*** (0.000)	0.078** (0.043)	0.081** (0.037)
Retired			-0.379*** (0.000)			-0.074*** (0.005)	-0.087*** (0.006)
Dual career			0.124*** (0.000)			0.124* (0.096)	0.125* (0.076)
Age			-0.008*** (0.000)			-0.000 (0.690)	-0.001 (0.171)
Race			-0.279*** (0.000)				
Log(Equity Investment)			0.206*** (0.000)			0.253*** (0.000)	0.270*** (0.000)
Equity Portfolio Return							-0.000 (0.895)
Equity Portfolio Risk							0.073*** (0.000)
Observation	16,952	16,952	16,952	55,433	55,433	55,433	35,206
Pseudo R-square	0.150	0.170	0.220	0.010	0.070	0.090	0.180

Table 3 Cost of Time and Mutual Fund Investment Probability

For the Probit regressions, the dependent variable equals to 1 if a household invests in equity mutual fund and 0 otherwise. For the SCF data, Log(income) is the natural logarithm of the household income in the year prior to the survey. Professional is a dummy variable that equals to 1 if the household head's occupation is 'managerial/technical' and 0 otherwise. Married is a dummy variable that equals to 1 if the household head is married or live with spouse/partner and 0 otherwise. Child is a dummy variable that equals to 1 if there is at least one child under the age of 18 living with the household and 0 otherwise. Homeowner is a dummy variable that equals to 1 if the household owns its primary residence and 0 otherwise. Retired is a dummy variable that equals to 1 if the household head is older than the age of 65 and not employed and 0 otherwise. Dual career is a dummy variable that equals to 1 if both adults are full-time employed and 0 otherwise. Race is a dummy variable that equals to 1 if the respondents report to be not White or Hispanic and 0 otherwise. Log(Equity investment) is the natural logarithm of the total equity investment by each household. For the large discount broker data, income is backed out from income categories in Infobase. Equity portfolio return is the monthly Fama-French three-factor alpha for household portfolio between 1991 and 1996. Equity portfolio risk is the standard deviation of raw monthly portfolio return for each household. Other variables are similarly defined as for the SCF data and obtained from Infobase. T-statistics are provided in parentheses. *, **, and *** indicate significant at the 10, 5, and 1 percent, respectively. P-values are provided in parentheses.

	Survey of Consumer Finance (1992-2001)					Large Discount Brokerage Firm (1991-1996)				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Intercept	-2.985*** (0.000)	-2.675*** (0.000)	-2.536*** (0.000)	-2.059*** (0.000)	-1.861*** (0.000)	-1.3001 (0.000)	-1.621 (0.000)	-1.629*** (0.000)	-1.696*** (0.000)	-1.481*** (0.000)
Log(Income)	0.248*** (0.000)	0.159*** (0.000)	0.165*** (0.000)	0.033*** (0.000)	0.046*** (0.000)		0.01568** (0.028)	0.027** (0.018)	0.024** (0.016)	0.018** (0.017)
Professional	0.416*** (0.000)	0.409*** (0.000)	0.282*** (0.000)	0.191*** (0.000)			0.0761*** (0.000)	0.071*** (0.000)	0.067*** (0.000)	0.045*** (0.000)
Married		0.292*** (0.000)	0.205*** (0.000)	0.120*** (0.000)	0.239*** (0.000)			0.025** (0.035)	0.026** (0.026)	0.025** (0.027)
Child		0.0504** (0.026)	-0.138*** (0.000)	-0.091*** (0.002)	-0.092** (0.013)			0.076* (0.062)	0.079* (0.053)	0.075* (0.071)
Home Owner		0.625*** (0.000)	0.716*** (0.000)	0.341*** (0.000)	0.495*** (0.000)			0.028* (0.082)	0.0252* (0.061)	0.020* (0.091)
Retired			-0.599*** (0.000)	-0.434*** (0.000)	-0.410*** (0.000)				-0.090*** (0.000)	-0.069*** (0.000)
Dual career			0.227*** (0.000)	0.234*** (0.000)	0.115*** (0.001)				0.037* (0.053)	0.036** (0.033)
Equity Portfolio Return x 1,000						0.035 (0.606)				0.028 (0.694)
Equity Portfolio Risk x 1,000						0.458*** (0.000)				0.492*** (0.000)
Age				-0.011*** (0.000)	0.001 (0.803)		-0.003*** (0.000)	-0.003*** (0.000)	-0.001* (0.082)	-0.011** (0.038)
Race				-0.358*** (0.000)	-0.429*** (0.000)					
Log(Equity Investment)				0.153*** (0.000)	0.068*** (0.000)	0.111*** (0.000)	0.152*** (0.000)	0.152 (0.000)	0.152*** (0.000)	0.124*** (0.000)
Observation	16,952	16,952	16,952	16,952	5,079	60,897	44,590	44,590	44,590	35,206
Pseudo R-square	0.046	0.061	0.072	0.088	0.096	0.053	0.043	0.044	0.044	0.057

Table 4 Cost of Time and Fraction invested in Mutual Funds

For the Tobit regressions, the dependent variable is the fraction invested in equity mutual fund, defined as the total equity investment through equity mutual funds divided by the total equity investment. For the SCF data, Log(income) is the natural logarithm of the household income in the year prior to the survey. Professional is a dummy variable that equals to 1 if the household head's occupation is 'managerial/technical' and 0 otherwise. Marriage is a dummy variable that equals to 1 if the household head is married or live with spouse/partner and 0 otherwise. Child is a dummy variable that equals to 1 if there is at least one child under the age of 18 living with the household and 0 otherwise. Homeowner is a dummy variable that equals to 1 if the household owns its primary residence and 0 otherwise. Retired is a dummy variable that equals to 1 if the household head is older than the age of 65 and not employed and 0 otherwise. Dual career is a dummy variable that equals to 1 if both adults are full-time employed and 0 otherwise. Race is a dummy variable that equals to 1 if the respondents report to be not White or Hispanic and 0 otherwise. Log(Equity investment) is the natural logarithm of the total equity investment by each household. For the large discount brokerage data, Income is backed out from income categories from Infobase. Equity portfolio return is the Fama-French three-factor alpha for household portfolio between 1991 and 1996. Equity portfolio risk is the standard deviation of raw monthly portfolio return for each household. Other variables are similarly defined as for the SCF data and obtained from Infobase. T-statistics are provided in parentheses. *, **, and *** indicate significant at 10, 5, and 1 percent, respectively. P-value are provided in parentheses.

	Survey of Consumer Finance (1992-2001)			Large Discount Brokerage Firm (1991-1996)			
	(1) Frequency of Stock Trades	(2) Number of Unique Funds	(3) Number of Unique Stocks	(4) Stock Turnover	(5) Mutual Fund Turnover	(6) Number of Unique Stocks	(7) Number of Unique Funds
Intercept	-3.626*** (0.000)	4.981*** (0.000)	-5.806*** (0.000)	-0.072*** (0.000)	-0.098*** (0.000)	-18.62*** (0.000)	-4.382*** (0.000)
Log(Income)	-0.019 (0.599)	-0.042*** (0.000)	0.654** (0.049)	-0.005* (0.054)	-0.002* (0.087)	0.131 (0.354)	0.132*** (0.000)
Professional	-0.099 (0.371)	-0.104*** (0.000)	0.331 (0.165)	-0.003 (0.161)	0.002 (0.143)	0.070 (0.533)	0.153*** (0.000)
Married	0.265** (0.044)	-0.013 (0.691)	-0.227* (0.064)	-0.001 (0.803)	0.001 (0.841)	-0.089** (0.041)	0.083** (0.019)
Child Dummy	0.176 (0.142)	-0.027 (0.355)	-0.336 (0.181)	-0.016 (0.491)	-0.040*** (0.000)	-0.135 (0.238)	-0.019 (0.592)
Home Owner	0.290* (0.077)	-0.232* (0.095)	-0.569*** (0.009)	-0.056** (0.041)	-0.003* (0.083)	-0.047* (0.075)	-0.148** (0.002)
Retired	-0.201 (0.284)	-0.012 (0.810)	0.638* (0.094)	0.017 (0.167)	0.002 (0.377)	0.051 (0.981)	-0.315*** (0.000)
Dual career	0.266** (0.035)	-0.760* (0.099)	-1.161*** (0.000)	-0.004 (0.326)	-0.002* (0.095)	-0.166** (0.372)	-0.050 (0.405)
Equity Portfolio Return x 1,000				-0.195 (0.779)	-0.017 (0.848)	0.073 (0.906)	-0.965 (0.713)
Equity Portfolio Risk x 1,000				-0.005** (0.039)	0.036 (0.134)	-0.489*** (0.001)	-0.075 (0.713)
Age	-0.002 (0.714)	-0.000 (0.745)	0.004 (0.407)	-0.000 (0.189)	0.000 (0.778)	-0.015*** (0.008)	-0.001 (0.611)
Race	0.203 (0.183)	0.510 (0.151)	0.236 (0.437)				
Log(Equity Investment)	-0.010*** (0.007)	-0.0321*** (0.000)	0.295*** (0.000)	0.012*** (0.000)	0.014*** (0.000)	2.895*** (0.000)	0.644*** (0.000)
Observation	16952	16952	16952	27,004	26,470	33,964	34,519
Adjusted R-square	0.022	0.014	0.019	0.013	0.072	0.129	0.094

Table 5 Cost of Time, Investment Choice, and Portfolio Turnover

Specification (1) runs ordered logistic regression and all other specifications run OLS regression. For specification (1), the dependent variable is a categorical variable that equals 1 through 6, corresponding to categories of reported trading frequency (1 corresponds to daily (most frequently) and 6 corresponds to annually (least frequently)). For specification (2) and (3), the dependent variables are the self-reported number of unique stocks and mutual funds that each household invests in. For specification (4) and (5), the dependent variables are the turnover rate of stock and mutual fund part of a household's portfolio. Turnover is the average of the buying and selling turnover, defined as the average of monthly dollar value of buying/selling trades divided by the end-of-month/start-of-month average dollar value of household portfolio. For specification (6) and (7), dependent variables are the number of unique stocks and mutual funds that each household invests in. For Survey of Consumer Finance (SCF), Log(income) is the natural logarithm of the household income in the year prior to the survey. Professional is a dummy variable that equals to 1 if the household head's occupation is 'managerial/technical' and 0 otherwise. Marriage is a dummy variable that equals to 1 if the household head is married or live with spouse/partner and 0 otherwise. Child is a dummy variable that equals to 1 if there is at least one child under the age of 18 living with the household and 0 otherwise. Homeowner is a dummy variable that equals to 1 if the household owns its primary residence and 0 otherwise. Retired is a dummy variable that equals to 1 if the household head is older than the age of 65 and not employed and 0 otherwise. Dual career is a dummy variable that equals to 1 if both adults are full-time employed and 0 otherwise. Race is a dummy variable that equals to 1 if the respondents report to be not White or Hispanic and 0 otherwise. Log(Equity investment) is the natural logarithm of the total equity investment by each household. For large discount brokerage data, equity portfolio return is the Fama-French three-factor alpha for household portfolio between 1991 and 1996. Equity portfolio risk is the standard deviation of raw monthly portfolio return for each household. T-statistics are provided in parentheses. *, **, and *** indicate significant at 10, 5, and 1 percent, respectively. P-value are provided in parentheses.

	Tobit				
	1992	1995	1998	2001	W/O high net-worth
Intercept	-2.844*** (0.000)	-2.646*** (0.000)	-1.495*** (0.000)	-0.810*** (0.000)	-5.731*** (0.000)
Log(Income)	0.038** (0.027)	0.053** (0.017)	0.033* (0.066)	0.052*** (0.003)	0.186*** (0.000)
Professional	0.354*** (0.000)	0.498*** (0.000)	0.292*** (0.000)	0.057* (0.089)	0.184*** (0.000)
Married	0.120** (0.015)	0.179** (0.031)	-0.015 (0.890)	0.131** (0.013)	0.046* (0.092)
Child	-0.169** (0.014)	-0.082 (0.237)	-0.126** (0.016)	-0.024 (0.617)	-0.148*** (0.000)
Home owner	0.336*** (0.000)	0.391*** (0.000)	0.442*** (0.000)	0.289*** (0.000)	0.338*** (0.000)
Retired	-0.626*** (0.000)	-0.300*** (0.010)	-0.261*** (0.004)	-0.307*** (0.000)	-0.524*** (0.000)
Dual career	0.477*** (0.000)	0.371*** (0.000)	0.380*** (0.000)	-0.005 (0.919)	0.249*** (0.000)
Age	0.002 (0.468)	-0.012*** (0.000)	-0.010*** (0.000)	-0.018*** (0.000)	-0.016*** (0.000)
Race Dummy	-0.466*** (0.000)	-0.274*** (0.000)	-0.390*** (0.000)	-0.310*** (0.000)	-0.349*** (0.000)
Log(Equity Investment)	0.124*** (0.000)	0.149*** (0.000)	0.111*** (0.000)	0.189*** (0.000)	0.374*** (0.000)
Observation	3,906	4,299	4,305	4,442	14,716
Pseudo R-square	0.094	0.086	0.097	0.093	0.124

Table 6 Cost of Time and Mutual Fund Investment (Robustness Check)

For the Tobit regressions, the dependent variable is the fraction invested in equity mutual fund, defined as the total equity investment through indirect investment divided by the total equity investment. Log(income) is the natural logarithm of the household income in the year prior to the survey. Professional is a dummy variable that equals to 1 if the household head's occupation is 'managerial/technical' and 0 otherwise. Marriage is a dummy variable that equals to 1 if the household head is married or live with spouse/partner and 0 otherwise. Child is a dummy variable that equals to 1 if there is at least one child under the age of 18 living with the household and 0 otherwise. Homeowner is a dummy variable that equals to 1 if the household owns its primary residence and 0 otherwise. Retired is a dummy variable that equals to 1 if the household head is older than the age of 65 and not employed and 0 otherwise. Dual career is a dummy variable that equals to 1 if both adults are full-time employed and 0 otherwise. Race is a dummy variable that equals to 1 if the respondents report to be not White or Hispanic and 0 otherwise. Log(Equity investment) is the natural logarithm of the total equity investment by each household. There are 3,906, 4,299, 4,305, and 4,442 observations for the 1992, 1995, 1998 and 2001 survey. The sub-sample without high net worth households exclude households with total assets greater than 5 million dollars and include 14,716 households. T-statistics are provided in parentheses.

*, **, and *** indicate significant at 10, 5, and 1 percent, respectively. P-value are provided in parentheses.