Investor Sophistication and the Home Bias, Diversification, and Employer Stock Puzzles

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Abstract

Using data from the April 2005 Survey of Consumers, we develop an index of investor sophistication from a set of 14 quiz-like questions. We correlate our measure of sophistication with holdings of international investments, measures of diversification, and holdings of an employer's stock. We find that each of these variables is correlated with sophistication, with more sophisticated investors consistently behaving the way that financial economists would recommend. More sophisticated investors also appear more likely to participate in the stock market. We argue that since sophistication is correlated with each of these anomalous behaviors, the most likely explanation for each behavior is that unknowledgable investors simply make mistakes. We also regress sophistication on some simple measures of financial education, finding evidence that financial education is associated with greater sophistication.

Households appear to exhibit a number of puzzling investment behaviors. Among households that participate in the stock market, many hold undiversified portfolios, hold large amounts of the the stock of an employer, or hold only domestic stocks. Many do not participate in the stock market at all, despite the large equity premium that stockholders have historically earned. Researchers have attempted to explain each of these behaviors in various ways. In this paper, we test the hypothesis that financially unsophisticated households are particularly likely to exhibit each of these behaviors.

The home bias, diversification, and employer stock puzzles have been studied extensively, with an academic literature discussing each of them. Researchers explain these puzzles with information asymmetries, costs, and nonpecuniary motives to invest. Very little research attempts to link these puzzles together. This is somewhat surprising, since all three of these puzzles seem likely to stem from a misunderstanding of how multiple assets combine to yield a portfolio's overall risk and return. Holding an employer's stock and neglecting to hold foreign stocks can both be thought of as specific ways to fail to diversify. If the puzzles result from misunderstanding, then more sophisticated investors who have greater understanding should be less subject to each of them. Finding that the puzzles are related to investor sophistication bolsters the argument that they are all manifestations of the same type of mistake instead of well-informed investment strategies.

We test our hypothesis with data from the April 2005 Survey of Consumers. In this survey, respondents were asked many quiz-like questions about various investment topics. We use the responses to 14 of these questions to construct an index of investor sophistication. We correlate our measure of sophistication with the responses to survey questions about holdings of international investments, measures of diversification, and holdings of an employer's stock. We also correlate sophistication with participation.

There are at least three significant advantages to using survey data to examine our hypothesis. One advantage is that we can measure an investor's susceptibility to multiple puzzles simultaneously. A second advantage is that by directly asking an investor about her holdings we can get a picture of her entire portfolio, including retirement accounts, savings in bank accounts, and stocks held directly. Existing data sets based on transactions or holdings records typically provide a picture of only part of a portfolio. A third advantage is that we can measure investors' attitudes about financial concepts as well as the degree to which their portfolios reflect the concepts. We believe that these advantages of survey data outweigh any general concerns researchers might have about survey data.

The home bias puzzle, first document by French and Poterba (1991), is the stylized fact that despite the diversification gains investors can achieve by holding stocks of foreign companies, they frequently hold only domestic stocks. One potential explanation of this fact is that investors have more information about companies that are close to them geographically than they do about foreign companies. Van Nieurburgh and Veldkamp (2007b) argue that this sort of information effect can be large even when it is possible to learn about foreign companies. Consistent with this information hypothesis, Coval and Moskowitz (1999) show that mutual fund managers are particularly likely to hold stocks of companies with headquarters that are geographically close. Another potential explanation of the home bias maintains that investors have a preference for holding domestic stocks because they feel a certain affinity for their home country (Morse and Shive, 2006). To get evidence that bears on the question of whether the existing level of home bias is at least in part a mistake, we test whether particularly unsophisticated investors are more likely to exhibit home bias.

Goetzmann and Kumar (2005) and Ivkovich, Sialm and Weisbenner (2005) show that investors are generally not well diversified. Using data from a large discount brokerage firm in the U.S., the median number of stocks held in an account is two. While Goetzmann and Kumar (2005) relate this lack of diversification to some measures of investor sophistication, Ivkovich, Sialm and Weisbenner find that individuals that are less diversified have better average returns. Van Nieuwerburgh and Veldkamp (2007b) argue that costly information can cause investors to hold relatively few assets. Thus, one potential explanation of a lack of diversification is potentially costly asymmetric information. Again, we look at the correlation with financial sophistication to test whether the lack of diversificaition is simply a mistake that many investors make.

The employer stock puzzle has been documented by Benartzi (2001). An information-based explanation of this puzzle has been proposed by Van Nieuwerburgh and Veldkamp (2006). It also seems reasonable to think that some sort of company loyalty motivates people to hold their employers' stocks. Finally, it may be the case that employers frequently offer company stock as a primary option for retirement savings, so individuals hold company stock by default (see Choi, Laibson, Madrian and Metrick, 2004). We test whether sophistication is correlated with attitudes about holding an employer's stock.

The stylized fact that many households do not hold stocks has been named the participation puzzle, and has been documented by Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Campbell (2006) and several other authors. Explanations for this phenomenon include the existence

of fixed costs of investing (Vissing-Jørgensen, 2002) and holdings of nonfinancial risky assets. The fixed cost to investing can be thought of as the cost of becoming sufficiently financially sophisticated to learn how to invest. We test whether sophistication can explain participation, making an effort to control for the likely endogeneity of sophistication in this context.

We find that the puzzles that we examine appear to be correlated with each other. Investors that hold only domestic stocks are also likely to be undiversified, for example. We also find that sophistication is correlated with each of the puzzling behaviors we examine, with more sophisticated people participating in the market, holding foreign stocks, avoiding their employers' stocks and diversifying their portfolios. Finally, we present some evidence that financial education is correlated with sophistication.

While we believe that we are the first researchers to examine investor sophistication in such detail and relate it to the home bias, diversification and employer stock puzzles, several other authors have discussed sophistication recently. Hilgert, Hogarth Beverly (2003) analyze the responses to several sophistication questions asked in an earlier Survey of Consumers, but they do not relate sophistication to portfolio decisions. Several of the questions on the April 2005 Survey of Consumers are modeled after their sophistication questions. Lusardi and Mitchell (2007) relate financial literacy to the adequacy of savings set aside by baby boomer investors, and Rooij, Lusardi and Alessie explain participation with literacy. Calvet, Campbell and Sodini (2007) find that wealthier and more educated Swedish investors appear to be better diversified.

The paper proceeds as follows. In the next section, we discuss our data and the methods that we use to make our statistical inferences. In the subsequent section, we discuss our empirical results in detail. Finally, we conclude with some thoughts about the implications of our research and some directions for future work.

I.   Data and Methods

To test our hypothesis, we use the responses to a special module we helped design on the April 2005 Survey of Consumers administered by the Survey Research Center at the University of Michigan. The Survey of Consumers is a monthly survey that uses a nationally representative sample of approximately 500 people to gauge consumers' attitudes about current economic conditions. The Survey Research Center publishes several Consumer Sentiment Indexes using data collected in this

survey. The survey started in the 1940s, and has been conducted monthly since 1977. The text of the survey questions that we use are listed in the Appendix, along with a brief description of how we coded the responses to create our variables of interest. We divide the variables into three categories: dependent variables, sophistication variables, and controls and instruments. Summary statistics for each of the variables appear in Tables 1 through 3.

A.   Dependent Variables

Our nine dependent variables measure the puzzling behavior that we want to explain. We code each of our dependent variables so that the "correct" response is associated with a higher variable value. Three variables, Partic, StkFrac and SFrac>0 are related to the participation puzzle. Partic is simply an indicator variable that equals one if the respondent holds any stocks. StkFrac measures the fraction of a respondent's portfolio that consists of stock, including respondents that hold no stock. When respondents are asked about their stock holdings, they are given a number of categories to describe their holdings, and StkFrac is inferred from these categories.[1] SFrac>0 is the same as StkFrac, except that it is missing for investors that have no stocks. In our sample, 65 percent[2] of the respondents participate in the stock market. Among all respondents, the average fraction of total assets in stock is 20 percent, and the fraction is 32 percent among stockholders. We hypothesize that each of these participation measures will increase with investor sophistication.

We have two dependent variables that measure respondents' propensity to invest in the stock of the company that employs them. Our most direct measure, EmpStk, is equal to one for respondents who hold stocks and work for companies with publicly traded stock, and do not hold company stock. It is equal to zero for those who work for a publicly traded company, hold stock, but do not hold their own company's stock. It is treated as "missing" for anyone who does not work for a publicly traded company *or* does not hold stock of any kind. Since a respondent must work for a publicly traded firm and hold stock for this measure to be defined, it is only available for 88 respondents. Those 88

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[1]Responses of "less than a tenth" are assigned 5%, "between a tenth and a quarter" get 17.5%, "between a quarter and a half" get 37.5%, "between a half and three quarters" get 62.5% and "more than three quarters" get 80%.

[2]This is somewhat higher than the 50.3 percent of U.S. households estimated to be stock holders by the Investment Company Institute (2005). This may be due to the nature of the question asked on the Survey of Consumers, which asks whether "any memeber of your family living there" has any investments in the stock market. Almost 80 respondents did not answer the subsequent question that asks about how much of a family's financial assets are invested in stocks or stock funds, despite having indicated some investments in the stock market in the participation question. This potential problem with the participation variable makes our analysis of the StkFrac and SFrac>0 particularly important.

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respondents seem quite likely to hold company stock, with 62 percent of them reporting that they hold stock in the company that employs them. However, the question that asks about company stock is not perfectly designed (it asks about employer stock in mutual funds, for example) and it is not defined for the majority of respondents. Our second company stock dependent variable, ESAtt, measures respondents' attitude about holding the stock of an employer. Asked whether "employees should have the majority of their retirement funds in their current employers stock," 2% strongly agreed and 17% agreed. Again, ESAtt is coded so that higher values correspond to more correct answers, so disagreeing with the statement generates higher values of ESAtt. Given the way we code our variables, we hypothesize that both EmpStk and ESAtt will increase with sophistication.

We also have two variables that measure respondents' propensity to hold investments in companies located in other countries. Our direct holdings variable, Internat, is set to one for investors that report holding global or international mutual funds. Our attitude measure, InAtt, measures the degree to which investors *disagree* with the statement "it is best to invest in domestic stock." We hypothesize that both of these variables will covary positively with sophistication.

Finally, we have two dependent variables that measure the diversification of respondents. Our stock diversification variable, StkDiv, measures the number of individual stocks held by an investor and is then calculated as one minus the inverse of this number. This allows the variable to be increasing and concave in the number of stocks held, just as the actual benefit of diversification is increasing and concave in the number of different assets held. Investors that hold stock mutual funds are assumed to be holding an equivalent of 5 different individual stocks, but our results are not sensitive to that particular assumption. We also measure respondents' diversification across different classes of assets by simply counting the number of different asset types held for investment purposes (stocks, bonds, real estate) in a variable called NAssets.

Before discussing our other variables, we first describe the correlations between our various dependent variables reported in Table 2. Looking at the table, it is immediately clear that many of the correlations are significantly positive, but none of them are significantly negative. While some of these correlations are positive almost by construction (for example, StkFrac and SFrac>0), it is noteworthy that respondents who hold more stocks are more likely to hold international stocks (and think it is a good idea to do so), but less likely to think it is a good idea to hold an employer's stock. Investors who hold more stock are also likely to be more diversifed. The two diversification measures—which are not mechanically linked—have a positive correlation. Finally, those who

actually hold stock are less likely to think it is a good idea to hold employer stock. Note also that those who think it is a good idea to hold international stock are more likely to do so, justifying our interest in this attitudinal measure. Our most direct measure of company stock holdings (EmpStk) is not significantly related to any of the other variables, presumably because it is not measured for a very large sample of respondents. These correlations are our first preliminary evidence that the puzzles we examine are related.

B.   Sophistication Variables

[USE BRIEF VERBAL LABELS IN THIS SECTION INSTEAD OF "QUESTION N"]

Our sophistication variables are designed to measure the financial sophistication of respondents. Each of the variables represents the response to a quiz-like statement. Some of the quiz-like statements ask for a true or false response, while others ask for a degree of agreement, for example strongly disagree, disagree, neither agree nor disagree, and so forth. The variables we use are listed in the appendix, and some summary statistics that describe them appear in Table 3.

The first two sophistication questions are simple true or false questions about the institutional features of bank accounts and mutual funds. Most respondents agreed that "a mutual fund combines the money of many investors to buy a variety of stocks or bonds," but 15 percent of respondents disagreed with this statement and another 7 percent indicated that they did not know whether the statement was true or refused to answer. For the purpose of constructing our sophistication index, respondents that refused to answer a question or indicated that they did not know the answer are assigned the value of the question that we consider to be incorrect[3]. For example, in question 1, responses of "don't know" (DK) are given the same code as "false" responses. In question 2, DK responses to the statement "checking accounts earn a higher rate of return than other types of investments purchased from a bank," are assigned the same code as "true" responses. Our results are robust to classifying the DK responses to "neither agree nor disagree."

Questions 3 and 4 examine investors' knowledge about the efficiency of financial markets. A relatively large number of people gave responses that are not consistent with market efficiency to the statements that "I can usually tell when it is a good time to buy or sell stock," and "there is

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[3]For the most part, our determination of "correct" responses to the sophistication statements is what we imagine an investor would conclude after reading an academic-oriented investment book, such as Malkiel (1996).

an ideal time of the year to invest." Question 13 is also designed to address market efficiency: " If you are smart, it is easy to make money in the stock market."

Questions 8 and 10 are designed to examine understanding of diversification fairly directly. The remaining questions largely address particular attitudes or behavioral biases that appear to be prevalent among investors. For example, question 5, "only brokers make money in the stock market" is designed to identify respondents who believe that brokers or others will take advantage of them if they try to invest. Similarly, question 9 is supposed to identify respondents with excessive risk aversion. Question 6, "if a stocks value is down, it will eventually come back up," is designed to examine the disposition effect. Questions 7 and 12 test whether respondents understand life-cycle investment considerations and compounding. Finally, question 14, "to do well in the stock market, you have to buy and sell your stocks often," is designed to identify respondents who think excessive trading is necessary to achieve good market performance.

Of course, not all financial economists would agree with our designation of correct and incorrect responses to the sophistication questions that we use. We construct our sophistication index by performing a principal components analysis on the responses to these questions. Thus, if a particular question is a bad indicator of sophistication, as long as most of the questions measure something like sophistication, the principal components analysis will simply give a low weight to the responses to that question. Even if our questions are not perfect, they should give us a good measure of sophistication when combined into an index.

C.   Controls and Instruments

Our controls and instruments are variables that measure the demographic and economic characterstics of our respondents. Notable among our controls and instruments is Fin Educ, which is a very basic measure of financial education. Respondents are asked whether they have ever taken a class, read a book, participated in a workshop, or taken an online course on investing. Fin Educ is then the sum of the different types of financial education investors have received. Both the mean and the median of this variable are 1.

Other notable variables include the instruments we use to try to adjust for potential endogeneity in our inferences. These include education and "Fraction of Focal Probabilities" (FFP), the fraction of the four probabilistic questions in the survey that the respondent answers with focal probabilities of either 0, 50, or 100 percent. (This index was first developed by Lillard, Lee A. and Robert J.

Willis, "Cognition and Wealth: The Importance of Probabilistic Thinking," July 2001, unpublished. [**ADD TO REFERENCES**])

II.   Results

In this section we present and discuss our empirical results. First we discuss the construction of our sophistication index, then we describe regressions relating sophistication to our dependent variables. We also discuss some results that control for the potential endogeneity of sophistication, and we present some results on the relation of financial education to sophistication.

A.   Principal Components Analysis

Summary statistics about each of our 14 quiz-like sophistication questions appear in Table 3. For each question, Column 2 lists the percentage of respondents that gave the "correct" answer, and Column 3 reports the percentage that either claim to not know the answer or refused to answer the question. Most respondents seem to understand that diversification is a good idea (question 8). Most know the definition of a mutual fund (question 1), and that checking accounts don't generally pay high rates of interest. However, almost half of the respondents agree with the statement that "if a stock's value is down, it will eventually come back up," and a majority agree with "you should always put your money into the safest investment you can find." Overall, the responses to our sophistication questions appear close to what we might expect. Using 14 such questions, each with significant numbers of both correct and incorrect responses, gives us some confidence that we will be able to measure sophistication with some accuracy.

In order to construct an index of financial sophistication, we need to somehow aggregate individuals' responses to the sophistication questions. While we could simply sum up each respondents' correct responses to the questions, this simple method ignores any correlation between the responses and assumes that each question provides the same amount of information about respondents' sophistication. Rather than take this approach, we analyze the responses to our questions with a principal components analysis. The first two factors that our principal components analysis identifies are described in Columns 4 and 5 of Table 3.

The first factor that results from the principal components analysis is what we consider to be investor sophistication. The first factor explains about 29 percent of the variation in the responses

to the sophistication questions. This factor gives positive weight to the four question variables that we viewed as true statements and negative weight to the ones we viewed as false, confirming the reasonableness of that coding. While most of the statements that we use for our analysis are "false," the survey included a large number of statements, about half of which we viewed as true. [**USE VERBAL LABELS. ALSO, REMEMBER TO STANDARDIZE EACH QUESTION**]Questions 8, 9, 10, 11, and 14 have the largest coefficients in our sophistication index. It is noteworthy that our two diversification questions (8 and 10) both load relatively heavily in measuring sophistication. Apparently relatively unsophisticated investors like extremely safe investments and perceive banks quite favorably. Our index is scaled to have a mean of zero and a standard deviation of one.

The second factor that results from the analysis appears to be large for respondents who understand institutions but do not believe in market efficiency. For lack of a better label, we call this factor the "stock jock" index. People that load heavily on the stock jock index believe that they can tell when it is a good time to buy or sell stock, that there is an optimal time of year to invest, that stocks that have declined in value will eventually come back, and that investing in one type of stock makes sense. They also believe that it is easy to make money in the market if you are smart. While the stock jock factor is interesting, it does not have strong enough explanatory power for us to be able study it effectively in such a small sample.

B.   Relating the Puzzles to Sophistication

Table 4 contains the results of several OLS regressions that relate our dependent variables to sophistication. The first panel of the table contains simple regressions of the dependent variables on sophistication alone. As can be seen from Panel A, all of these regressions, except the regression for EmpStk, generate significantly positive coefficient estimates on our sophistication variable. Since these are univariate regressions, the economic significance of the coefficients can be determined by looking at the R^2 of each regression, reported in the penultimate row of the table. Sophistication explains almost 24 percent of the participation variable, and about 17 percent of attitudes toward holding an employer's stock. Sophistication explains about 12 percent of international asset holdings, but it has little explanatory power for respondents' attitudes about international assets. It also has economically significant explanatory power for diversification.

The second panel of Table 4 reports the results of regressions that include a large number

of control variables. These controls include regional dummy variables, race dummy variables, polynomial terms in age and income category, demographic variables such as gender, marital status, and children, pension variables and expectation variables. Even after controlling for these variables, our sophistication index is significantly related to all of our dependent variables except EmpStk and SFrac>0. Since EmpStk is not significantly related to sophistication in univariate regressions, it is not surprising that it is still not significantly related to sophistication in the regression with controls. The coefficient on sophistication in the SFrac>0 regression is somewhat smaller than the coefficient in the univariate regression, but it is still of the correct sign and of a reasonable magnitude.

The economic significance of the coefficients in Table 4 can be assessed by recalling that our sophistication factor is scaled to have a mean of zero and a standard deviation of one. Thus, altering sophistication by one standard deviation increases participation by about 14 percent. Since Partic is an indicator variable, this means that a standard deviation of sophistication increases the odds of holding stocks by approximately 14 percent, which is quite a large effect. Performing similar calculations for each of the other dependent variables, it is clear that statistically significant coefficients in this regression are generally also economically significant.

Looking at the statistical significance of the coefficients on the control variables in Panel B of Table 4, most of the coefficients are not significant in most of the regressions. Some notable exceptions include the variable that measures financial education, which has significant explanatory power for the Internat variable and for market participation, and the income and pension variables, which again have some power for the participation variables. The stock jock variable is not statistically significant in any of the regressions.

C. Correcting for Possible Endogeneity

While the results of Table 4 are quite striking, it is possible that sophistication is endogenously related to some of our dependent variables. Suppose, for example, that some respondents are exogenously endowed with portfolios of stocks (perhaps by inheritance) and that owning stocks causes them to read books about investing and become sophisticated. In such a scenario, our results relating sophistication to participation will not be due to sophistication causing investors to participate, but will be due to participation causing sophistication. This type of endogeneity story seems to be most compelling for the participation variables, but we attempt to control for potential

endogeneity in all of our regressions. Indeed, the concern about endogeneity is one of the reasons we think it is important to look at outcome variables other than stock market participation. But we also think it is useful to attempt an instrumental variable approach, which we report in Table 5.

A good instrument needs to be correlated with sophistication but uncorrelated with the residuals from regressions like those in Table 4. Intuitively, they must be quantities that cannot be correlated with the dependent variables by an endogeneity story like the story discussed in the previous paragraph. We choose to use education, region and FFP as instruments. As described previously, when respondents are asked probabilistic questions, people that are not mathematically sophisticated tend to answer with focal probabilities. FFP measures the "fraction of focal probabilities" given by respondents, or the fraction of four survey questions that are answered with focal probabilities of 0, 50 or 100 percent. Each of our instruments seems unlikely to be driven by our dependent variables. In the case of our region variables, the results in Table 4 confirm that these variables are not generally significantly related to our dependent variables when sophistication is included in the regression. We exclude financial education and the stock jock index from the second stage regressions.

In our first-stage regression (not reported) education is a very significant predictor of financial sophistication, but FFP and our region variables are not significant. Our second-stage results, reported in Table 5, make it clear that using two-stage least squares decreases the power of our tests somewhat. However, the participation variable and the employer stock attitude variable are still significantly related to financial sophistication, and the home bias variable is almost significantly related to sophistication. Since the endogeneity story discussed above probably makes the most sense for participation, this is evidence in favor of our hypothesis.

D.   Explaining Sophistication

Having successfully measured sophistication and related it to several puzzling behaviors, it is natural to ask "What drives sophistication?" This question is interesting, but difficult to answer unambiguously because of the possible endogeneity of many variables that we might use to explain sophistication. Nevertheless, we make an attempt at answering this question with the regression reported in Table 6.

The regression reported in Table 6 explains sophistication with all of the controls and instru-

ments used in the rest of the paper except for Fin Educ. Instead of Fin Educ, the components of Fin Educ are included as separate regressors in the analysis. These components include a dummy variable that indicates whether the respondent has taken an online investment course, one that corresponds to a classroom-based course, one that corresponds to participating in an investment workshop, and one that indicates whether the respondent has read books and/or articles on investing. The regression also includes several variables that control for whether the respondent relies on advice from other people or sources to make investing decisions. The variables labeled "Consult" followed by Media, Professional, Colleague, Friend and Family all indicate whether respondents consult regularly with these particular people or sources. [**REVERSE THE CODING**] These variables are coded with a value of 1 for respondents that "always" consult with the given source, they are coded with a 3 for "sometimes" consultations, and they are coded with a value of 5 when respondents indicate that they "never" consult the given source.

While we need to interpret these results with caution, the estimates in Table 6 indicate that respondents with more education tend to be more financially sophisticated. Furthermore, those who read books or articles about investing and those who regularly consult with investment professionals also tend to be more sophisticated. The coefficient on market expectations is significantly positive in this regression, which may indicate that more sophisticated individuals are more optimistic about future returns than others. Overall, we interpret this as suggestive evidence that financial education and investment professionals might help investors to become more financially sophisticated.

III.   Conclusion

We present survey evidence that the participation, home bias, diversification and employer stock puzzles are significantly related to each other and to investor sophistication. Using data from the April 2005 Survey of Consumers, we construct an index of investor sophistication using responses to 14 quiz-like questions. We relate our sophistication index to investment behavior and attitudes about investment, finding that relatively sophisticated investors consistently behave the way that financial economists would expect them to. Regressing sophistication on several measures of financial education, we find suggestive evidence that financial education might help investors to become more sophisticated.

As positive economics, our results could be important by providing a unified explanation for

the various puzzling behaviors that we observe in individuals' portfolio choices. If all of these puzzles are related to each other, and if relatively unsophisticated investors are particularly likely to exhibit these behaviors, it is unlikely that perfectly rational, frictionless models will ever be able to completely explain them.

Normatively, one can interpret our estimates as measures of the potential benefit of making individuals more financially sophisticated. While a complete analysis of the welfare consequences of each of the puzzles we address is beyond the scope of this paper, our findings indicate that more sophistication will bring investors closer to an economist's view of ideal portfolio holdings. If there is an affordable way to make people more financially sophisticated—or to help the unsophisticated make better financial decisions—that appears to be a goal worth pursuing.

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Appendix: Survey Questions

We use the responses to a number of questions from the April 2005 Survey of Consumers for our sample. The survey was asked of 499 people at least 18 years of age. The survey's sample is carefully designed to be nationally representative. In this appendix, we list some of the questions asked on the survey and then, in brackets, a brief description of how we code the variable used in the study.

A   Dependent Variable Questions

Partic: The next questions are about investments in the stock market. First, do you (or any member of your family living there) have any investments in the stock market, including any publicly traded stock that is directly owned, stocks in mutual funds, stocks in any of your retirement accounts, including 401(K)s, IRAs, or Keogh accounts?
   [yes = 1, no = 0]

StkFrac: Roughly speaking, what fraction of your (familys) financial assets, including any savings in retirement plans, is invested in stocks or stock mutual funds - would you say less than a tenth, between a tenth and a quarter, between a quarter and a half, between a half and three quarters, or more than three quarters?
   [midpoint of range cited if Partic = 1 and stated value of investments > $5,000, zero otherwise]
SFrac>0
   [= StkFrac; only defined if Partic = 1]

EmpStk: Do you own stock, including stock in 401ks, 403bs, or mutual funds, in the company you work for?
   [yes = 0, no = 1; only defined if Partic = 1]

ESAtt: Employees should have the majority of their retirement funds in their current employers stock. (Would you say you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree?)
   [strongly agree = 1, agree = 2, ..., strongly disagree = 5]

Internat: (Including whats in your retirement accounts,) do you have global or international mutual funds?
   [yes = 1, no = 0; only defined if Partic = 1]

InAtt: It is best to invest in domestic stock. (Would you say you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree?)
   [strongly agree = 1, agree = 2, ..., strongly disagree = 5]

StkDiv: You said you have money invested in stocks, not including mutual funds. In how many different companies do you hold stocks?
   [num-stocks = number reported]
Including what's in your retirement account, do you have stock mutual funds?
   [if yes then add 5 to num-stocks; StkDivr = 1 - 1/num-stocks; only defined if Partic = 1]

NAssets:
   [from three separate questions, identify if respondents hold stocks, bonds, and real estate (excluding primary residence) - sum number of asset classes held]

B Sophistication Questions

Survey respondents were read a number of statements, and they were asked to indicate whether the statements were true or false, or whether the agreed with the statements or not. The statements used to measure investor sophistication are listed below, with indicators of how we scored each question. Questions with responses on a 5 point scale are scored as follows: 1 = strongly agree, 2 = agree 3 = neither agree nor disagree, 4 = diagree, 5 = strongly disagree. Table 2 reports a principal components analysis of the data generated by these questions.

1. A mutual fund combines the money of many investors to buy a variety of stocks or bonds.
    [true = 1, false = 2, DK or NA = 2]

2. Checking accounts earn a higher rate of return than other types of investments purchased from a bank.
    [true = 1, false = 2, DK or NA = 1]

3. I can usually tell when it is a good time to buy or sell stock.
    [5 point scale, DK or neither agree nor disagree = 1]

4. There is an ideal time of the year to invest.
    [5 point scale, DK or neither agree nor disagree = 1]

5. Only brokers make money in the stock market.
    [5 point scale, DK or neither agree nor disagree = 1]

6. If a stocks value is down, it will eventually come back up.
    [5 point scale, DK or neither agree nor disagree = 1]

7. Investments with high risk are best for younger individuals.
    [5 point scale, DK or neither agree nor disagree = 5]

8. Investing in only one type of stock, like tech stocks, makes sense.
    [5 point scale, DK or neither agree nor disagree = 1]

9. You should always put your money into the safest investment you can find.
    [5 point scale, DK or neither agree nor disagree = 1]

10. Choosing to invest in both small and large companies at the same time is wise.
    [5 point scale, DK or neither agree nor disagree = 5]

11. Investments offered by a bank are the best investments you can buy.
    [5 point scale, DK or neither agree nor disagree = 1]

12. The earlier in life that you invest, the better off you will be financially.
    [5 point scale, DK or neither agree nor disagree = 5]

13. If you are smart, it is easy to make money in the stock market.
    [5 point scale, DK or neither agree nor disagree = 1]

14. To do well in the stock market, you have to buy and sell your stocks often.
    [5 point scale, DK or neither agree nor disagree = 1]

C   Control Variables and Instruments

Variable	Definition
Black	1 if respondent identifies self as black
Hispanic	1 if respondent identifies self as hispanic
Asian	1 if respondent identifies self as asian
Caucasian	1 if respondent identifies self as caucasian
Age	age of respondent in years
Male	1 if respondent is male
Married	1 if respondent is married, 0 otherwise
Kids	number of kids under 18 years in household
Fin Educ	number of types of financial education (e.g. books, courses, online)
Education	number of years of school
Region 1	1 if respondent lives in the West
Region 2	1 if respondent lives in the Midwest
Region 3	1 if respondent lives in the Northeast
Region 4	1 if respondent lives in the South
Home Owner	1 if respondent owns a home
Income	SCA coding of reported income into brackets
Pension	1 if respondent has a pension but no 401k plan
Has 401k	1 if respondent has a 401k plan
Market Exp	respondents probability that market returns are positive in next year
Sentiment	consumer sentiment value - calculated from 5 questions
FFP	fraction of 4 probability questions answered with 0, 50, or 100 percent

Table 1: Summary Statistics

Table 1 reports summary statistics for all the variables used in the regressions below. The data are from the April 2005 Survey of Consumers, by telephone interviews conducted by researchers in the Survey Research Center at the University of Michigan. Each of the variables is described in the Appendix. The first nine variables are dependent variables in subsequent regressions, and the rest of the variables are either control variables or instruments.

Variable	Mean	Median	Std Dev	Minimum	Maximum	Obs
Dependent Variables						
Partic	0.645	1.0	0.479	0.0	1.0	499
StkFrac	20.036	5.0	25.557	0.0	80.0	411
SFrac>0	32.294	17.5	25.630	0.0	80.0	255
EmpStk	0.375	0.0	0.487	0.0	1.0	88
ESAtt	3.728	4.0	1.029	1.0	5.0	485
Internat	0.417	0.0	0.494	0.0	1.0	276
InAtt	3.041	3.0	0.909	1.0	5.0	482
StkDiv	0.711	0.7	0.234	0.0	1.0	253
NAssets	1.640	2.0	0.696	1.0	3.0	253
Controls and Instruments						
Black	0.072	0.0	0.259	0.0	1.0	499
Hispanic	0.072	0.0	0.259	0.0	1.0	499
Asian	0.034	0.0	0.182	0.0	1.0	499
Caucasion	0.798	1.0	0.402	0.0	1.0	499
Age	49.768	49.0	16.443	18.0	90.0	499
Male	0.465	0.0	0.499	0.0	1.0	499
Married	0.561	1.0	0.497	0.0	1.0	499
Kids	0.699	0.0	1.120	0.0	9.0	499
Fin Educ	0.995	1.0	0.926	0.0	4.0	499
Education	14.168	14.0	2.832	4.0	18.0	499
Region 1	0.222	0.0	0.416	0.0	1.0	499
Region 2	0.271	0.0	0.445	0.0	1.0	499
Region 3	0.178	0.0	0.383	0.0	1.0	499
Region 4	0.329	0.0	0.470	0.0	1.0	499
Home Owner	0.776	1.0	0.418	0.0	1.0	499
Income	9.149	10.0	3.912	1.0	16.0	464
Pension	0.186	0.0	0.390	0.0	1.0	499
Has 401k	0.475	0.0	0.500	0.0	1.0	499
Market Exp	50.233	50.0	29.302	0.0	100.0	480
Sentiment	72.945	76.0	39.139	-12.8	135.2	499
FFP	0.311	0.3	0.231	0.0	0.8	499

Table 2: Correlations

Table 2 reports correlation coefficients for all of the dependent variables used throughout the paper. The variables are defined in the appendix. One asterisk indicates statistical signficance at the 5% level and two asterisks indicates signifcance at the 1% level.

Variable	Partic	StkFrac	SFrac>0	EmpStk	ESAtt	Internat	InAtt	StkDiv
StkFrac	61.4**							
EmpStk	-	-6.3	-6.3					
ESAtt	19.4**	22.6**	16.2**	4.8				
Internat	-	18.7**	18.7**	-9.6	11.5			
InAtt	-2.8	10.7*	18.7**	3.5	10.9*	20.4**		
StkDiv	-	26.4**	26.4**	3.5	11.9	20.0**	2.6	
NAssets	23.6**	13.6*	4.0	-11.6	10.5	3.8	3.8	17.8**

Table 3: Sophistication Index

Table 3 describes the inputs to the Sophistication and Stock Jock indexes that we relate to the dependent variables described above. The indexes were calculated by performing principal components analysis on the responses to fifteen quiz-like questions about financial topics. The questions are listed in the Appendix. For each question, the percentage of responses that we consider correct is given in the second column, while the number of "don't know" or "refuse to answer" responses is recorded in the third column. The fourth and fifth columns report the coefficients generated by the principal components analysis for the first two factors recoverable in the data. Throughout the paper we call the first factor "Sophistication" and we call the second factor "Stock Jock." Both factors are scaled to have zero mean and unit variance. The first factor accounts for 29 percent of the variance in the data, and the second factor accounts for 10 percent of the variance.

Question	Percent "Correct"	Percent DK or NA	Sophistication Coefficient	Stock Jock Coefficient
1	85.0	7.2	0.117	0.222
2	84.0	4.4	-0.145	-0.088
3	67.3	12.6	-0.049	0.301
4	51.3	22.9	-0.088	0.389
5	75.8	8.2	-0.129	-0.134
6	38.1	17.0	-0.088	0.420
7	39.1	11.8	0.097	0.124
8	87.8	7.0	-0.179	0.026
9	46.7	9.6	-0.152	-0.019
10	73.0	13.8	0.159	0.164
11	73.7	14.6	-0.170	-0.020
12	85.0	6.4	0.137	0.223
13	54.3	16.2	-0.116	0.373
14	64.1	13.6	-0.170	-0.017

Table 4: OLS Regressions

Table 4 presents the results of regressing our dependent variables on our sophistication index and several control variables. T-statistics are in parentheses. The regressions reported in Panel B include region dummies, but their coefficients are excluded from the table for space considerations. The sample size and adjusted R^2 of each regression are reported in the last two rows of the table.

Panel A: Simple Regressions

Independent Variable	Dependent Variable								
	Partic	StkFrac	SFrac>0	EmpStk	ESAtt	Internat	InAtt	StkDiv	NAssets
Intercept	0.656	0.202	0.283	0.350	3.669	0.308	3.030	0.767	1.451
	(35.1)	(17.7)	(14.5)	(6.83)	(85.4)	(9.05)	(72.8)	(39.3)	(38.5)
Sophistication	0.233	0.104	0.126	-0.028	0.560	0.286	0.116	0.114	0.153
	(12.5)	(9.55)	(4.55)	(-0.38)	(9.99)	(6.06)	(2.14)	(4.32)	(2.94)
Adj. R^2	24.4	18.0	7.9	-0.9	17.0	11.6	0.7	6.6	2.9
No. Obs.	489	411	244	96	485	274	482	253	253

Table 4: OLS Regressions (continued)

Panel B: Regressions with Controls

Independent Variable	Partic	StkFrac	SFrac>0	EmpStk	ESAtt	Internat	InAtt	StkDiv	NAssets
Intercept	0.220	-0.081	0.179	0.562	3.669	-0.731	2.551	0.394	0.437
	(1.22)	(-0.65)	(0.80)	(0.71)	(7.48)	(-1.67)	(5.47)	(1.81)	(0.85)
Sophistication	0.138	0.047	0.063	0.116	0.544	0.174	0.143	0.062	0.141
	(6.06)	(3.12)	(1.82)	(1.16)	(7.36)	(2.99)	(2.03)	(2.02)	(2.10)
Stock Jock	-0.031	-0.005	0.011	-0.015	0.119	-0.013	0.078	-0.009	-0.032
	(-1.79)	(-0.41)	(0.58)	(-0.24)	(2.52)	(-0.43)	(1.73)	(-0.55)	(-0.88)
Black	0.023	-0.039	-0.047	0.112	-0.546	-0.019	0.582	-0.086	0.089
	(0.35)	(-0.82)	(-0.55)	(0.65)	(-3.02)	(-0.15)	(3.38)	(-1.21)	(0.51)
Hispanic	0.150	0.000	-0.115	0.212	0.002	0.059	0.219	0.068	0.100
	(2.16)	(-0.01)	(-1.76)	(0.98)	(0.01)	(0.53)	(1.18)	(1.00)	(0.65)
Asian	-0.039	0.016	0.015	-0.203	-0.291	0.114	0.047	0.130	-0.038
	(-0.41)	(0.27)	(0.16)	(-0.47)	(-1.14)	(0.65)	(0.19)	(1.47)	(-0.16)
Age	-0.006	0.003	0.004	-0.010	-0.007	0.023	0.023	0.007	0.024
	(-0.87)	(0.71)	(0.57)	(-0.37)	(-0.37)	(1.60)	(1.37)	(1.02)	(1.40)
Age^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.77)	(-0.45)	(-0.33)	(0.28)	(0.54)	(-1.74)	(-1.22)	(-0.99)	(-1.08)
Home	0.064	0.009	-0.031	0.230	-0.006	0.002	-0.136	0.056	-0.033
	(1.35)	(0.26)	(-0.56)	(1.56)	(-0.04)	(0.02)	(-1.11)	(1.09)	(-0.25)
Male	0.016	0.005	0.008	-0.137	0.069	0.131	-0.090	0.049	0.105
	(0.46)	(0.22)	(0.24)	(-1.20)	(0.73)	(2.24)	(-1.00)	(1.59)	(1.55)
Income	0.054	-0.015	-0.036	0.043	0.015	0.054	-0.043	0.000	0.038
	(2.81)	(-1.17)	(-1.29)	(0.42)	(0.29)	(1.09)	(-0.87)	(-0.02)	(0.66)
Inc^2	-0.002	0.002	0.002	-0.002	-0.001	-0.001	0.004	0.001	0.000
	(-1.79)	(2.51)	(1.79)	(-0.46)	(-0.31)	(-0.32)	(1.53)	(0.57)	(-0.10)
Market Exp.	0.001	0.001	0.001	0.000	0.001	0.002	0.001	0.000	0.000
	(1.50)	(2.83)	(2.09)	(0.06)	(0.53)	(1.66)	(0.60)	(-0.80)	(-0.14)
Sentimnt	-0.001	0.000	0.000	0.001	-0.001	-0.001	-0.001	0.000	-0.002
	(-1.59)	(-0.47)	(0.05)	(0.52)	(-0.46)	(-1.60)	(-0.60)	(0.22)	(-1.91)
Married	0.043	0.011	0.014	0.114	0.205	0.066	0.074	0.004	-0.116
	(1.07)	(0.41)	(0.37)	(0.79)	(1.90)	(0.96)	(0.72)	(0.12)	(-1.39)
Kids	-0.021	0.008	0.008	-0.106	-0.054	-0.026	0.011	-0.007	0.032
	(-1.24)	(0.75)	(0.44)	(-1.77)	(-1.11)	(-0.86)	(0.23)	(-0.45)	(0.93)
Pension	0.046	0.016	-0.002	-0.220	-0.096	0.009	-0.160	-0.015	0.004
	(1.24)	(0.62)	(-0.06)	(-1.73)	(-0.97)	(0.15)	(-1.69)	(-0.49)	(0.05)
Has 401k	0.279	0.075	-0.014	-0.232	0.021	-0.097	-0.107	0.060	0.050
	(6.88)	(2.68)	(-0.33)	(-1.53)	(0.19)	(-1.33)	(-1.03)	(1.62)	(0.61)
Fin. Educ.	0.037	0.032	0.027	-0.057	-0.042	0.093	0.037	0.022	-0.014
	(1.83)	(2.29)	(1.45)	(-0.87)	(-0.76)	(2.84)	(0.71)	(1.33)	(-0.38)
Adj. R^2	44.1	31.1	8.9	3.0	19.7	21.4	4.4	12.3	5.4

Table 5: Two-Stage Least Squares Regressions

Table 5 presents the results of regressing our dependent variables on our sophistication index and several control variables, adjusting for possible endogeneity of sophistication by using two-stage least squares. The adjusted R^2 from our first-stage regression is 42.2 percent.

Independent Variable		Dependent Variable							
	Partic	StkFrac	SFrac>0	EmpStk	ESAtt	Internat	InAtt	StkDiv	NAssets
Intercept	0.343	-0.071	0.281	0.421	4.685	-0.396	2.163	0.238	0.571
	(1.38)	(-0.41)	(0.81)	(0.40)	(5.67)	(-0.59)	(2.84)	(0.78)	(0.80)
Sophistication	0.203	0.067	0.142	0.030	0.960	0.426	-0.039	-0.041	0.156
	(2.88)	(1.46)	(0.88)	(0.08)	(3.08)	(1.83)	(-0.14)	(-0.21)	(0.52)
Black	0.053	-0.026	0.029	0.057	-0.383	0.149	0.510	-0.087	0.060
	(0.74)	(-0.51)	(0.21)	(0.25)	(-1.65)	(0.86)	(2.38)	(-1.06)	(0.32)
Hispanic	0.212	0.009	-0.107	0.266	0.110	0.064	0.177	0.045	0.066
	(2.26)	(0.14)	(-1.51)	(1.02)	(0.54)	(0.55)	(0.93)	(0.59)	(0.40)
Asian	-0.023	0.019	0.027	0.099	-0.222	0.155	-0.026	0.066	-0.017
	(-0.25)	(0.32)	(0.28)	(0.19)	(-0.85)	(0.80)	(-0.11)	(0.63)	(-0.07)
Age	-0.009	0.003	-0.001	-0.007	-0.030	0.005	0.036	0.012	0.021
	(-1.20)	(0.65)	(-0.03)	(-0.21)	(-1.14)	(0.20)	(1.53)	(0.97)	(0.82)
Age^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(1.14)	(-0.41)	(0.17)	(0.19)	(1.23)	(-0.26)	(-1.44)	(-0.97)	(-0.64)
Home Owner	0.062	0.008	-0.031	0.212	0.010	0.075	-0.147	0.083	-0.027
	(1.33)	(0.24)	(-0.56)	(1.39)	(0.07)	(0.74)	(-1.18)	(1.60)	(-0.21)
Male	0.031	0.013	0.012	-0.165	0.068	0.175	-0.096	0.057	0.104
	(0.89)	(0.56)	(0.38)	(-1.48)	(0.70)	(2.77)	(-1.07)	(1.81)	(1.55)
Income	0.053	-0.014	-0.033	0.044	-0.033	0.049	-0.037	0.002	0.036
	(2.49)	(-1.05)	(-1.20)	(0.46)	(-0.57)	(0.91)	(-0.69)	(0.07)	(0.61)
Inc^2	-0.002	0.002	0.002	-0.002	0.000	-0.001	0.004	0.001	0.000
	(-1.84)	(2.50)	(1.49)	(-0.43)	(0.07)	(-0.50)	(1.67)	(0.57)	(-0.07)
Market Exp	0.001	0.001	0.001	0.000	-0.001	0.001	0.001	0.000	0.000
	(1.49)	(2.93)	(1.83)	(0.06)	(-0.26)	(0.91)	(0.72)	(-0.78)	(-0.12)
Sentiment	-0.001	0.000	0.000	0.001	-0.001	-0.001	-0.001	0.000	-0.002
	(-1.38)	(-0.43)	(-0.07)	(0.61)	(-1.09)	(-1.16)	(-0.80)	(0.41)	(-1.86)
Married	0.052	0.012	0.015	0.120	0.217	0.078	0.067	0.001	-0.112
	(1.23)	(0.41)	(0.38)	(0.86)	(1.93)	(1.08)	(0.64)	(0.01)	(-1.27)
Kids	-0.017	0.009	0.003	-0.100	-0.041	-0.030	0.013	-0.006	0.028
	(-0.96)	(0.81)	(0.17)	(-1.75)	(-0.81)	(-0.93)	(0.29)	(-0.38)	(0.82)
Pension	0.047	0.018	-0.002	-0.232	-0.145	0.032	-0.151	-0.011	0.025
	(1.24)	(0.70)	(-0.06)	(-1.68)	(-1.41)	(0.52)	(-1.58)	(-0.32)	(0.35)
Has 401k	0.278	0.080	-0.001	-0.221	-0.082	-0.035	-0.084	0.076	0.064
	(6.41)	(2.65)	(-0.03)	(-1.30)	(-0.70)	(-0.44)	(-0.77)	(2.02)	(0.79))
Adj. R^2	40.2	29.0	7.8	3.3	10.4	16.1	3.3	8.1	3.5

Table 6: Explaining Sophistication

Table 6 presents the results of regressing our sophistication index on all of our control variables and instruments plus some variables that measure financial education and financial advice. The sample size is 407n and the adjusted R^2 is 35.6 percent. The variables about financial education (Online Course, Class, Workshop, Books/Articles) are indicator variables that are equal to one if the respondent indicates that he or she has learned about investments form such a source. The variables about consulting are equal to 1 if the respondent indicates that he or she always consults with the given source, is equal to 3 for sometimes consults, and is equal to 5 if the respondent indicates that he or she never consults with the given source.

Dependent Variable: Sophistication

Variable	Mean	Coefficient	T-statistic
Intercept	1.000	-3.348	-6.54
Black	0.059	-0.716	-4.36
Hispanic	0.059	-0.314	-1.89
Asian	0.029	-0.319	-1.38
Male	0.477	-0.018	-0.22
Married	0.592	0.041	0.45
Kids	0.703	0.011	0.28
Home Owner	0.818	-0.095	-0.84
Income	9.727	-0.030	-0.59
Inc^2	106.985	0.004	1.40
Pension	0.199	0.032	0.26
Has 401K	0.555	0.062	0.60
Market Exp.	51.405	0.004	2.69
Sentiment	74.618	0.001	1.00
Education	14.604	0.069	3.75
Region 1	0.221	0.045	0.42
Region 2	0.278	0.111	1.12
Region 3	0.182	0.069	0.61
FFP	0.302	-0.059	-0.33
Age	49.39	0.064	4.19
Age^2/1000	2.685	-0.572	-3.82
Online Course	0.027	-0.349	-1.47
Class	0.197	0.064	0.61
Workshop	0.199	0.191	1.87
Books/Articles	0.690	0.331	3.56
Consult Media	3.752	-0.024	-0.76
Consult Professional	3.133	-0.056	-2.05
Consult Colleague	4.002	0.037	0.84
Consult Friend	3.821	0.058	1.26
Consult Family	3.364	0.044	1.48