PORTFOLIO CONCENTRATION AND THE PERFORMANCE OF INDIVIDUAL INVESTORS

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Abstract

This paper tests whether information advantages help explain why some individual investors concentrate their stock portfolios in a few stocks. Stock investments made by households that choose to concentrate their brokerage accounts in a few stocks outperform those made by households with more diversified accounts (especially among those with large portfolios). Excess returns of concentrated relative to diversified portfolios are stronger for stocks not included in the S&P 500 index and local stocks, potentially reflecting concentrated investors' successful exploitation of information asymmetries. Controlling for households' average investment abilities, their trades and holdings perform better when their portfolios include fewer stocks.

I. Introduction

Despite the longstanding and widespread financial advice to hold well-diversified portfolios, several studies have found that many individual investors instead tend to concentrate their portfolios in a small number of stocks.[1] There are a few key reasons why households might hold poorly diversified portfolios. First, fixed costs of trading securities make it uneconomical for households with limited wealth to hold a large number of stocks directly. Second, a lack of diversification could be prompted by behavioral biases such as familiarity[2] or overconfidence.[3] Third, individual investors might hold concentrated portfolios because they are able to identify stocks with high expected returns. Under such circumstances, rational investors would need to assess the trade-off between the benefits of higher stock returns with the costs of higher risk and the implications of combining such prospective investments with their existing portfolios. The main contribution of this paper is to compare the performance of investors with concentrated and diversified holdings and to ask whether information advantages can explain why some investors hold undiversified portfolios.

If underdiversification is driven solely by behavioral effects such as a familiarity bias or overconfidence, then concentrated household portfolios, on average, should not exhibit superior performance relative to portfolios held by diversified households. However, if households concentrate their stock portfolios because of favorable information, the stock-picking ability of concentrated households should be superior to that of diversified households; moreover, particularly strong returns should be generated by the investments that concentrated households

[1] See, for example, Blume and Friend (1975), Kelly (1995), Barber and Odean (2000), Grinblatt and Keloharju (2000, 2001), Dorn and Huberman (2005), Goetzmann and Kumar (2005), Kumar (2006), Polkovnichenko (2005), Calvet, Campbell, and Sodini (2006), and Campbell (2006).

[2] There is a body of evidence that investors tend to invest disproportionately in familiar assets. French and Poterba (1991) find that investors favor domestic over international stocks. Huberman (2001) shows that the shareholders of a Regional Bell Operating Company tend to live in the area that it serves. Zhu (2002) and Ivković and Weisbenner (2005) show that individuals exhibit considerable local bias. In the context of 401(k)-plan investing, participants on average have considerable holdings in own-company stock (Benartzi (2001) and Liang and Weisbenner (2002)).

[3] Odean (1999) and Barber and Odean (2000, 2001) show that individual investors tend to trade excessively and that such behavior is consistent with overconfidence.

make into stocks with greater information asymmetries (e.g., stocks not in the S&P 500 index, local stocks, stocks with limited analyst coverage).

Research in cognitive psychology suggests that there are limits to human capacity for processing information and conducting more than a limited number of tasks at a time and that such processing limitations might constrain human reasoning and problem solving.[4] Cognitive limitations notwithstanding, in reasonably efficient financial markets particularly insightful information may be scarce and difficult to identify, and the ensuing search costs may be prohibitive. Assuming that the availability of relevant information and information processing skills of investors are limited, households may be better off investing in the subset of stocks regarding which they have favorable information. Expansions of the portfolio beyond this limited subset into additional stocks will likely depress portfolio performance, either because the stocks about which one may possess superior information have already been tapped or because the increasing number of different investments lessens one's ability to effectively monitor them. Indeed, Van Nieuwerburgh and Veldkamp (2006) present a model in which optimal under-diversification results from increasing returns to scale in learning about individual companies.

Both hypotheses—that there is only a limited number of stocks regarding which an investor has favorable information, and that the ability to monitor investments declines with the number of holdings—suggest that portfolio performance may decline with the number of stocks in the portfolio. Accordingly, our measures of "concentrated" and "diversified" investor portfolios are based upon the number of stocks the investor holds. Throughout the paper, we use the term "concentrated" to refer to investors who hold only a few stocks in their brokerage accounts (one or two), and use the term "diversified" to refer to investors who are not highly focused with their portfolio (i.e., hold three or more stocks). Of course, as Goetzmann and Kumar (2005) point out, investors holding multiple stocks may not be truly diversified because the correlations in returns among stocks within such portfolios can be fairly high.

The empirical literature studying the performance of individual investors finds that, on average, households' stock investments perform poorly. For example, Odean (1999) reports that individual investors' purchases tend to underperform their sales by a significant margin. Barber and Odean (2000, 2001) further show that, on average, individual investors who hold common

[4] See, for example, Miller (1956), Kahneman (1973), Bachelder and Denny (1977), Chapman (1990), Just and Carpenter (1992), and Cantor and Engle (1993).

stocks pay a substantial penalty in performance for trading actively. These results are consistent with the hypothesis that individual investors are overconfident and trade excessively.

On the other hand, Coval, Hirshleifer, and Shumway (2005) document strong persistence in the performance of individual investors' trades, suggesting that some skillful individual investors might be able to earn abnormal profits. Ivković and Weisbenner (2005) find that households exhibit a strong preference for local investments and further show that, on average, individuals' investments in local stocks outperform their investments in non-local stocks, suggesting that investors are able to exploit local knowledge. They further find that this differential in performance is particularly large for stocks not included in the S&P 500 index, in regard to which information asymmetries between local and non-local investors may be the largest. Similarly, Massa and Simonov (2006) find that Swedish investors exhibit a strong tendency to hold stocks to which they are geographically or professionally close; such investments appear to be information-driven because, on average, they earn excess returns.

The issue of individuals' diversification decisions has received considerable attention in the finance literature. Blume and Friend (1975), Kelly (1995), and Polkovnichenko (2005) document that many households are poorly diversified. Goetzmann and Kumar (2005) show that individual investors not only hold a small number of stocks directly, but that the stocks that they do hold tend to be fairly highly correlated. They conclude that most investors pay considerable costs for their sub-optimal diversification choices. Kumar (2006) finds a substantial return spread between stocks held by less diversified and stocks held by more diversified investors, and argues that this spread is driven by sentiment-induced mispricing, asymmetric information, and narrow risk framing, among which the sentiment effect is the strongest. Campbell (2006) and Calvet, Campbell, and Sodini (2006) investigate the efficiency of Swedish households' investment decisions and find that a few households are very poorly diversified, but they argue that the costs of diversification mistakes are quite modest.

Our paper contributes to this literature by investigating the role of information asymmetries in the portfolio decisions made by individual investors. Using data on the investments a large number of individual investors made through a discount broker from 1991 to 1996, we study the relation between concentration of households' brokerage accounts and their performance, with a particular focus on households with substantial account balances. Households with large portfolios are a natural subset of investors to consider in this context

because such households have sufficient resources to diversify, if desired. After all, households with small portfolios are likely to be concentrated in a few holdings not because of superior information, but simply because fixed transactions costs make holding many stocks directly very costly. Thus, our key analyses will compare the performance of wealthy investors who choose to focus their holdings in a couple stocks with similarly wealthy investors who, by contrast, choose to spread their portfolio over many stocks. As a further test of the information-asymmetry hypothesis, we also analyze whether concentrated investors focus their picks on stocks in regard to which information symmetries are likely to be the largest.

These considerations lead to two predictions. First, there should be a much greater dispersion in the diversification levels of large portfolios relative to small portfolios. Second, among households with large portfolios, concentrated investors should be better stock pickers, as informed investors may be underdiversified, holding substantial positions in the stocks with the most promising prospects, whereas uninformed investors would rationally hold a more diversified portfolio. Large household portfolios indeed display more variation in their diversification levels, potentially in accordance with the degree of their information advantage.[5] On the other hand, households with small portfolios may hold very few stocks because of fixed commissions and other trading costs or because they have limited access to information, leading to no relation between performance and concentration for this group of investors.

Indeed, we find that, regardless of portfolio size, the purchases made by diversified households underperform the appropriate Fama and French (1992) benchmark portfolios based on size and book-to-market deciles by one to two percentage points in the year following the purchase. Whereas the purchases made by concentrated households with small portfolios (i.e., less than $25,000) also underperform by a similar magnitude, the purchases made by concentrated households with large portfolios do substantially better, exceeding the appropriate Fama and French benchmark portfolios by 1.3 percentage points for those with relatively large portfolios (i.e., at least $25,000) and by 2.2 percentage points for those with large portfolios (i.e., at least $100,000). Across all households, the stock picks made by concentrated investors

[5] Specifically, households with stock portfolios of at least $100,000 held 11.7 stocks on average, with the interquartile range of 4 – 16 stocks. The 10th and 90th percentiles were 2 and 24 stocks, respectively. However, households with stock portfolios less than $25,000 held only 2.4 stocks on average with the interquartile range of 1 – 3 stocks. Their 10th and 90th percentiles were 1 and 5 stocks, respectively.

outperform those made by more diversified investors by slightly less than one percentage point over the year following the purchase, with the difference in performance growing to three percentage points for households with relatively large portfolios (i.e., at least $25,000). However, the purchases made by concentrated households with small portfolios (i.e., less than $25,000) do not significantly outperform the purchases made by diversified households. These findings are all robust to further inclusion of momentum and industry controls.

Consistent with Odean (1999), we find that, on average, the stocks bought by individual investors underperform the stocks they sell by a wide margin. However, we find that the *reverse* is true for households with concentrated large portfolios. For this group of investors, their holdings and stock trades actually perform fairly well, earning superior returns.

The returns associated with concentration are stronger for investments in local stocks, stocks that are not included in the S&P 500 index, and stocks with less analyst coverage, potentially reflecting concentrated investors' ability to exploit information advantages. In sum, these findings are consistent with the hypothesis that skilled investors can exploit information asymmetries by concentrating their portfolios in the stocks about which they have favorable information. Thus, the "return to locality" for individual investors documented in Ivković and Weisbenner (2005) and Massa and Simonov (2006) seems to be consistent with, and indeed largely driven by, the performance of the local investments made by concentrated investors.

A particularly compelling result is that the trades made by concentrated households outperform the trades made by diversified households even after adjusting for household fixed effects, that is, after controlling for households' average investment abilities. Moreover, we find that the performance of the trades made by households that become more concentrated (that is, hold fewer stocks) improves, whereas the performance of the households that become less concentrated (that is, hold more stocks) deteriorates.

We run numerous robustness tests and obtain similar results by computing the performance of household holdings aggregated into concentrated and diversified portfolios, the performance of the individual purchase and sale transactions, or the performance of household-level returns. Moreover, our results are robust to different measures of concentration (e.g., the number of stocks held or a portfolio Herfindahl Index).

Our findings are consistent with those reported by Kacperczyk, Sialm, and Zheng (2005), who study the diversification of actively managed equity mutual funds. They show that mutual

funds that are concentrated in specific industries perform better than widely diversified mutual funds and attribute that difference to the skilled mutual fund managers' tendency to select their asset holdings from a limited number of industries, presumably because their expertise is linked to those industries. Thus, the "return to concentration" appears to be a broader phenomenon, extending over both professional money managers and individual investors.

Finally, we also consider the welfare implications of concentrated investment, particularly its risk-return tradeoff. Whereas we do find that concentrated household portfolios of directly held stocks perform significantly better than their diversified counterparts, we also find that the Sharpe ratios of the concentrated households' stock portfolios are lower. Sharpe ratios, however, are not relevant measures of total performance for households that hold substantial positions in other assets such as other equity (mutual funds), retirement accounts, fixed income, real estate, and human capital. Indeed, the Survey of Consumer Finances suggests that directly-held stocks constitute a fairly small fraction of households' net worth (around 10% for concentrated households and around 20% for diversified households).[6]

Consequently, an appropriate performance measure of household portfolios that aims at assessing the welfare implications of holding concentrated positions should reflect the contribution of the directly-held stocks to a broader household portfolio. Accordingly, we compare the concentrated households' and diversified households' information ratios (ratios of risk-adjusted performance and idiosyncratic risk; see Treynor and Black (1973)).

We find that the information ratios of concentrated household portfolios are higher than the information ratios of diversified household portfolios. This evidence, together with the fact that diversified households commit larger fractions of their total household net worth to directly-held stocks than concentrated households do, suggests that concentrated households' stock holdings might deliver risk-return tradeoffs that, when combined with the rest of their *total* portfolios, are superior to those of their more diversified counterparts.

The paper proceeds as follows. After describing the data sources and presenting summary statistics in Section II, in Section III we study the aggregate calendar-time performance of the holdings of concentrated and diversified households. Section IV analyzes the performance of the individual trades of households using a regression approach, which allows us to control for many

[6] See Section VI.B for a breakdown of net worth shares for concentrated stock investors based on the 1992 and 1998 Surveys of Consumer Finances.

additional characteristics of the investors and their stock investments. In Section V, we conduct numerous robustness checks, including checking for differences across concentrated and diversified investors in the access to, and exploitation of, inside information, the turnover in households' stock portfolios, and the volatility of transacted stocks, as well as considering alternative specifications, concentration measures, and methodologies. In Section VI, we discuss the risk-return tradeoff for concentrated households. Section VII concludes.

II. Data and Summary Statistics

The primary data source used in this study includes households' trades and monthly position statements over the period from January 1991 to November 1996. The data capture all the investments that 78,000 households made through a large discount broker, covering common stocks, mutual funds, bonds, foreign securities, and derivative securities. In this study we focus on the common stocks, which constitute nearly two-thirds of the total value of household investments in the sample. The data fields that describe the three million trades in the sample include the household identifier, the date of the transaction, the security identifier, the price per share at which the transaction was carried out, the number of shares associated with the transaction, the buy/sell indicator, and the total dollar value of the transaction. The data fields that describe monthly position statements include the household identifier, the date of the statement, the security identifier, the price per share as of the market close on the statement date, the number of shares held, and the total dollar value of the position in the security. The data also contain some additional information about the households such as their zip codes and, for around one-third of the households, self-reported net worth when the household's first brokerage account with the discount broker was opened. See Barber and Odean (2000) for further details.

We focus on the common stocks traded on the NYSE, AMEX, and NASDAQ markets. We use the Center for Research in Security Prices (CRSP) database to obtain information on stock prices and returns and COMPUSTAT to obtain several firm characteristics, including the location of the company headquarters. We exclude stocks that could not be matched with CRSP, which results, for example, in 5,478 distinct stocks in the sample at the end of 1991 (around 89% of the overall stock market capitalization).

A. Concentration of Stock Holdings

We present the basic stock portfolio characteristics of the households from our sample in Table 1. The seven end-of-year cross-sectional snapshots of portfolio holdings[7] together yield 268,734 household-year observations. A large fraction of brokerage accounts have relatively small balances. Around three-fifths of households have portfolio values of less than $25,000, with nine percent of households having portfolio values of at least $100,000.

Studies have found that households do not tend to diversify their account holdings across a large number of common stocks.[8] Indeed, in our sample households own on average 3.9 stocks in their brokerage account and the average Herfindahl Index of household stock portfolios[9] equals 0.62. The median portfolio includes two stocks and has a Herfindahl Index of 0.56. Slightly more than one-half of the households (52.9 percent) hold one or two stocks (one third of the households hold only one stock), but this concentration is driven by small accounts.

Perhaps not surprisingly, there is a large variation in the extent of portfolio diversification among households with larger portfolios. Focusing on households with a stock portfolio of at least $100,000, the 10th and 90th percentiles of the distribution of the number of stocks held are 2 and 24 stocks, respectively, while the 10th and 90th percentiles of the Herfindahl Index span from 0.07 to 0.93. The average number of stocks increases substantially and the average Herfindahl Index decreases with the size of the account balance. For example, households with portfolios of at least $100,000 own on average 11.7 stocks and have a Herfindahl Index of 0.33, with one-eighth of such households concentrating their stock portfolios in one or two stocks (7.5 percent concentrate all of their stock portfolios in only one stock).

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[7] The two exceptions to this convention are the January 1991 and November 1996 snapshots because portfolio holdings for December of 1990 and December of 1996 are not covered by the data.

[8] See, for example, Blume and Friend (1975), Kelly (1995), Barber and Odean (2000), Grinblatt and Keloharju (2000, 2001), Dorn and Huberman (2005), Goetzmann and Kumar (2005), Kumar (2006), Polkovnichenko (2005), Calvet, Campbell, and Sodini (2006), and Campbell (2006).

[9] The Herfindahl Index $HI_{h,t}$ of household h's stock portfolio at time t is defined as the sum of the squared weights of each stock i in the household stock portfolio ($w_{t,i}^{h}$):

$$HI_{h,t} = \sum_{i=1}^{N} \left(w_{t,i}^{h} \right)^2 .$$

The Herfindahl Index equals one if a household owns only one common stock, and an equally-weighted portfolio of N securities has a Herfindahl Index of $1/N$.

The aggregate holdings of households in the sample differ from the market portfolio. Households tend to overweight local stocks and stocks not included in the S&P 500 index. Slightly more than one-half of the holdings are held in stocks included in the S&P 500 index, whereas the S&P 500 index stocks represent around two-thirds of the total market capitalization of the U.S. stock market during the sample period. One-seventh of the holdings are held in stocks of companies headquartered less than 50 miles away from the respective households' residences, a figure substantially higher than the fraction that would be observed if individuals invested in the market portfolio.[10] The aggregate portfolio of wealthier households corresponds more closely to the market portfolio, but the bias towards local, non-S&P 500 stocks remains.

B. Comparison with the Survey of Consumer Finances

To gauge the extent to which our discount brokerage sample is representative of the overall population of U.S. individual investors, we compare some of the major characteristics of the portfolios of directly-held stocks that our sample investors hold with the broker with estimates of portfolio characteristics of *all* the directly-held stocks held by the general individual investor population. By comparing the two, we are able to ascertain whether the stock portfolios held with the discount broker likely represent most, if not all, of the households' *total* direct stock holdings. Table 2 compares basic household stock portfolio characteristics from our sample with total household stock portfolio characteristics from the Federal Reserve Board's Survey of Consumer Finances (SCF). It reports the number of stocks held in households' taxable accounts and their total value. Thus, for direct comparison, we report stock holdings in taxable accounts for our brokerage house sample.[11]

We compare the characteristics of our discount brokerage sample from December 1992 with the 1992 SCF in Panel A and our sample in November 1996 with the 1998 SCF in Panel B. In December 1992, the average common-stock account balance of households in our sample was $45,887, while the average account balance of the SCF households holding equity in a taxable

[10] See Zhu (2002) and Ivković and Weisbenner (2005).

[11] The SCF, conducted every three years, collects balance sheet, pension, income, and other demographic characteristics of a sample of U.S. households. The SCF over-samples wealthy households because these households own a disproportionate fraction of the financial assets; accordingly, we use the provided population weights to compute the distribution of the wealth and diversification levels. See Kennickell and Starr-McCluer (1994) for a detailed description of the SCF data set.

account was $66,810. On the other hand, the median household in our sample has a higher account balance ($14,250) than the median household in the SCF ($8,000), with the 75th percentiles of holdings being rather close ($36,425 in discount brokerage sample and $30,000 in SCF). Conditioning on a stock portfolio of at least $100,000, the median stock holdings of $181,808 in the sample corresponds very closely with the median of $181,000 in the SCF, and the inter-quartile range is also similar across the two groups. Panel B shows that account balances are larger during the latter time period. For all but the largest stock portfolios, the distribution of account balances at the 25th, 50th, and 75th percentiles for the discount brokerage sample matches the distribution for the general population fairly well.

The distribution of the number of stocks in the discount brokerage sample also closely resembles the distribution in the SCF. Households in the discount brokerage sample owned on average 4.0 stocks in December 1992, as did households in the 1992 SCF sample; in the latter period the average number of stocks held is 4.8 and 5.7, respectively. Moreover, the fraction of concentrated households (i.e., households that hold two or fewer stocks) matches up well across the two samples. These comparisons indicate that that the diversification of households' complete stock portfolios, as measured by the SCF sample, is not substantially different from the diversification of the stock portfolios held by households in the discount brokerage house sample. Ivković, Poterba, and Weisbenner (2005) further show that this sample matches the general population of investors along another important dimension: comparing the sample with the IRS data, they find that the distribution of the holding periods of stocks sold is remarkably similar to that of the broader investing public. Overall, there is a close match between the two samples along several important portfolio characteristics.

In unreported results, we study the fraction of total individual stock holdings held by concentrated investors. For example, whereas concentrated investors (those holding one or two stocks) make up 51.6% of total individual investors in the December 1992 brokerage data (61.8% using the 1992 SCF), they own 20.9% of individuals' total stock holdings according to the brokerage sample and 15.7% according to the 1992 SCF. This reflects that the vast majority of concentrated investors have relatively small portfolios. According to the brokerage sample from December 1992, wealthy concentrated investors make up a small fraction of the individual investor population (concentrated investors with portfolios of at least $25,000 represent 8.3% of all investors and concentrated investors with portfolios of at least $100,000 represent 1.3% of all

individual investors). However, these wealthy concentrated households own 14.0% and 7.2% of individuals' total stock holdings, respectively.[12]

In this paper, the term "household portfolio" specifically refers to the common-stock positions that the households in our sample hold in their accounts with this broker. Whereas the above comparison suggests that stock holdings with this broker likely represent the entire stock holdings for many households, we cannot observe the households' *overall* portfolios including, for example, employer-sponsored retirement plans, real estate, and human capital. Fortunately, omission of other assets from the portfolio most likely does not interfere with our ability to assess the households' stock-picking abilities. On the other hand, the possibility that households might hold other assets limits our ability to analyze the risk-related implications of holding concentrated stock portfolios, an issue that we revisit in Section VI.

III. Performance of Holdings

In this section, we analyze the performance of concentrated and diversified households by aggregating their holdings and thereby determining whether concentrated households as a group make superior stock investment decisions relative to diversified households.

A. Estimation Methodology

We form several portfolios by aggregating households according to the number of stocks held in their brokerage accounts. For each portfolio, the monthly returns are computed by value-weighting the returns corresponding to all the stock holdings at the end of the previous month by the size of their positions. This process is repeated for each of the 71 months of the sample period. Risk-adjusted monthly returns are calculated from a four-factor model, which accounts for the three Fama-French (1993) factors (market, size, and book-to-market factors), as well as the momentum factor (Carhart (1997)):

$$(1) \qquad R_{i,t} - R_{F,t} = \alpha_i + \beta_{i,M}(R_{M,t} - R_{F,t}) + \beta_{i,S} SMB_t + \beta_{i,V} HML_t + \beta_{i,m} MOM_t + e_{i,t},$$

[12] The 1992 SCF yields similar results, as concentrated investors with portfolios of at least $25,000 represent 6.3% of all investors and concentrated investors with portfolios of at least $100,000 represent 1.6% of all investors. Wealthy concentrated households constitute a significantly larger share of ownership—these two groups own 11.5% and 8.8% of individuals' total stock holdings, respectively, according to the 1992 SCF.

where the dependent variable is the return on portfolio i in month t minus the risk-free rate, and the independent variables are given by the returns of the standard four zero-cost factor portfolios.[13] The intercept α_i measures risk-adjusted performance. The computation of standard errors follows the Newey-West correction and takes into account autocorrelation up to three lags.

B. Estimation Results

Figure 1 depicts the risk-adjusted returns (alphas) of portfolios formed according to the number of stocks in households' brokerage accounts. We summarize the results for all households (black bars) and for the households with account values of at least $100,000 at the end of the previous month (gray bars). The risk-adjusted return for the portfolio formed using all the stocks held by households owning only one stock is 0.2 percent per month (about 2.4 percent per year), whereas it is 0.08 percent per month (about one percent per year) for the households holding two stocks. For households that hold more than two stocks, risk-adjusted returns are essentially zero.

Households might want to hold concentrated portfolios because they have superior information about a limited number of stocks or because fixed transactions costs make it uneconomical to hold a large number of stocks. Fixed transactions costs are more important for households with small account balances and concentration among such households is less likely to be related to information advantages. Therefore, we often focus our investigation on wealthy households, among which information is more likely to play an important role (with transactions costs no longer an impediment to holding many stocks directly, if desired). Accordingly, we find that the performance of concentrated households is particularly strong for households with stock portfolio sizes of at least $100,000 at the end of the previous month. Specifically, the risk-adjusted returns for portfolios of such households holding one (two) stocks are 0.46 (0.28)

[13] $R_{Mt} - R_{Ft}$ is the excess return of the market portfolio over the risk-free rate (the former is calculated as the value-weighted return on all NYSE, AMEX and NASDAQ stocks using the CRSP database, and the latter is obtained from Ibbotson Associates). *SMB* is the return difference between small and large capitalization stocks. *HML* is the return difference between high and low book-to-market stocks, and *MOM* is the return difference between stocks with high and low past returns. The size, value, and momentum factor returns are taken from Kenneth French's website:
`http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.`

percentage points per month, whereas there is essentially no risk-adjusted performance for portfolios of households holding three or more stocks.

In Table 3 we summarize the raw and the risk-adjusted returns of concentrated and diversified households, where concentrated households are defined as those holding one or two stocks and diversified households are defined as those holding three or more stocks.[14] The average raw monthly return of concentrated households is 1.50 percent, whereas the average raw monthly return of diversified households is 1.36 percent.

After adjusting for risk as in Carhart (1997), we find that the stocks held by concentrated households outperform the stocks held by diversified households by 0.16 percentage points per month (just under two percentage points per year). The coefficients on the factor loadings indicate that concentrated households tend to hold smaller stocks, whereas exposure to the broader market does not differ significantly between concentrated and diversified households.

The performance differential increases substantially among wealthy households. For example, the return of the holdings of concentrated households with account values of at least $100,000 at the end of the previous month exceeds the return of the holdings of wealthy diversified households by a statistically and economically significant margin of 0.38 percent per month (0.41 percent per month after controlling for risk via the four-factor model).

C. Information Asymmetries

Having demonstrated that the holdings of concentrated households perform considerably better than the holdings of diversified households, we investigate whether this result can be explained by information asymmetries. Table 4 reports risk-adjusted returns (alphas) to portfolios formed on the basis of aggregate household portfolio concentration levels, S&P 500 status of the stocks held in household portfolios, as well as the stocks' locality (the distance between the corporate headquarters and the household being less than 50 miles). The table also reports the estimates of the risk-adjusted returns to a zero-cost portfolio (its long position consists of the returns to the concentrated portfolio and its short position consists of the returns to the diversified portfolio). We present results, expressed in percentage points, for all households

[14] Thus, as discussed earlier, for purposes of exposition in this paper, our use of the term "diversified" is rather loose, as it refers to investors who do not concentrate their stock portfolios in one or two holdings. We also consider other thresholds for the definition of concentration, such as holding only one stock or holding three or fewer, and obtain similar results.

(Panel A) and households with portfolio values of at least $100,000 at the end of the previous month (Panel B). Each panel also features zero-cost portfolios based on all stocks, S&P 500 stocks, non-S&P 500 stocks, local stocks, non-local stocks, as well as the four interactions of S&P 500 status and locality.

Information asymmetries are generally more pronounced for stocks not included in the S&P 500 index and for local stocks. Coval and Moskowitz (2001) show that mutual fund managers' local investments outperform their non-local investments, while Ivković and Weisbenner (2005) suggest that asymmetric information among individual investors is more prevalent for stocks that are local to the households and are less likely to be widely known (i.e., not included in the S&P 500 index). It follows that, if the return to concentration indeed is driven by information asymmetries, it should be the strongest for these types of stocks.

Consistent with this hypothesis, whereas there is no significant difference in the performance of investments in S&P 500 stocks between concentrated and diversified investors, there is a notable difference of 50 basis points per month in the performance of the holdings of concentrated and diversified investors in non-S&P 500 stocks. This differential in performance increases further to 112 basis points for non-S&P 500 investments that are local to the households, for which information asymmetries are likely the largest. As shown in Panel B of Table 4, these results are substantially larger among the households that are more likely to have the means to exploit information asymmetries (i.e., those with portfolios of at least $100,000).

To verify the robustness of these results, we also employ another measure of information asymmetry—the number of analysts following the stock. We consider three cutoffs: whether a stock has been followed by more than three analysts, more than five analysts, and more than ten analysts. Table 5 presents the results. Panel A depicts the results for holdings based on all household portfolios, and Panel B focuses on the results based on the holdings by households with large portfolios (of at least $100,000). Each estimate reported in the table is the risk-adjusted return (alpha) to a zero-cost portfolio formed over a subset of household stock positions. The long side of the portfolio is generated from concentrated households' holdings and the short side is generated from diversified households' holdings. Portfolio returns associated with stock holdings that likely have lower levels of information asymmetry are presented in the first row and are labeled with "Yes" (these portfolios are comprised of stock holdings that belong to the S&P 500, stocks followed by more than 10 analysts, stocks followed by more than 5 analysts, or

stocks followed by more than 3 analysts, respectively). Analogously, portfolio returns associated with household stock holdings that likely have higher levels of information asymmetry are presented in the second row and are labeled with "No" (these portfolios are comprised of stock holdings that belong to the S&P 500, as well as stocks followed by more than 10, 5, and 3 analysts, respectively). In each panel, the first column, which corresponds to portfolios formed based on households' S&P 500 and non-S&P 500 holdings, comes directly from Table 4 (bottom estimate of "Difference" in the second and third columns of Table 4).

Both for S&P 500-based cutoffs and all three analyst coverage-based cutoffs, only the estimates associated with the stock holdings that likely have higher information asymmetry—those presented in the second row of each panel (i.e., the "No" row)—are large and statistically significant, be it across all observations (Panel A) or only across observations associated with holdings by households with portfolios of at least $100,000 (Panel B). For example, across all the asymmetric information classifications, there is no difference in the performance of the holdings of concentrated and diversified household among stock holdings that likely have little information asymmetry (i.e., S&P 500 stocks or stocks with broad analyst coverage). On the other hand, there is a striking difference in the performance of the holdings of concentrated and diversified household among stock holdings that likely *have* information asymmetry (i.e., stocks that do not belong to the S&P 500 index or stocks that do not have broad analyst coverage). Not surprisingly, the performance differentials across concentrated and diversified households' holdings of stocks with higher level of information asymmetry are stronger for households with larger portfolios and is larger as the definition of information asymmetry becomes less inclusive (i.e., moving from left to right columns in the table). Overall, Table 5 shows that the choice of methodology of classifying stock holdings according to likely levels of information asymmetry does not affect our results.

D. Results with Characteristic-Based Risk Adjustment

As a robustness check, we also compute the excess one-month returns for each position relative to the appropriate Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004) portfolio, formed according to size, book-to-market, and momentum quintiles.[15] We then

[15] The returns on these benchmark portfolios are available from Russ Wermers' website: `http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm`.

aggregate these one-month excess returns (weighting by the size of the position) into two portfolios (one for households holding one or two stocks, and the other for households holding three of more stocks) just as before. In unreported results, we find that this alternative risk adjustment yields portfolio excess returns very similar to the alphas presented in Tables 3 and 4.

For example, the excess returns (in excess of the appropriate benchmark portfolio formed based on size, book-to-market, and momentum quintiles) are 13 basis points per month for the portfolio of the holdings of all concentrated households, 16 basis points per month for the portfolio of the holdings of concentrated households with portfolios of at least $25,000, and 33 basis points per month for the portfolio of the holdings of concentrated households with portfolios of at least $100,000 (this corresponds to alphas of 15, 18, and 41 for these three groups displayed in Table 3, respectively), with the excess return of the wealthy concentrated household statistically significant. In contrast to the performance of the concentrated portfolios, the portfolios of households holding three or more stocks yield excess returns of no more than 1 basis point per month, regardless of portfolio size. The difference in the performance of the concentrated and diversified holdings is statistically significant across all portfolio groups, with the difference increasing when comparisons are restricted to wealthier households.

Finally, whereas there is a difference in excess returns, there is no meaningful difference in the benchmark returns for the concentrated and diversified portfolios (across the three portfolio-size breakdowns, the difference in benchmark returns is no more than 1 basis point per month), suggesting that the underlying risk of their investments does not differ much across the two types of investors.

E. Results with Investor Fixed-Effects

A potential concern with the previous analysis is that the superior performance of concentrated investors (particularly those with larger stock portfolios) may not be attributable to these investors' "focus" in investing, but, instead, might reflect some omitted household-specific attributes (e.g., education, financial sophistication, risk aversion, susceptibility to behavioral biases, etc.). Rather than attempting to model every possible investor trait that might be related to investment acumen, and then seeing whether, on the margin, portfolio concentration is still correlated with performance, we conduct a more stringent test. Namely, given a household's

average investment ability, we test whether the household's stock holdings perform better when the portfolio only has a couple stocks and perform worse when it contains three or more stocks.

In other words, we estimate a regression of the one-month return of a stock held by a household on whether that household is concentrated (one or two stocks in the portfolio) or diversified (three or more stocks in the portfolio), including a household fixed effects. Because we include household fixed effects in the regression, "return to concentration" will be identified from changes in the focus *within* a given household's portfolio over time rather than from differences *across* different types of investors in a given cross-section. The computation of standard errors takes into account heteroskedasticity as well as cross-sectional correlation by clustering on the month of the observations.[16] The average one-month performance of a stock holding (in excess of the appropriate benchmark portfolio formed based on size, book-to-market, and momentum quintiles) improves by 21.7 basis points per month (which, in light of the standard error of 7.2, is highly statistically significant) when the household switches from holding three or more stocks in its portfolio to instead focusing its portfolio on one or two stocks.

These results, obtained in a fixed-effects framework, are compelling and are consistent with the hypothesis that expanding the portfolio beyond a limited subset into additional stocks on average depresses portfolio performance (either because the stocks about which one may possess superior information have already been tapped or because the increasing number of different investments lessens one's ability to effectively monitor them).

IV. Performance of Trades

In this section, we analyze the performance of the trades made by concentrated and diversified households. Thus, we explore the active investment decisions that households made explicitly, which are more likely to be based on information. We use regression specifications that allow us to control for various characteristics of the stocks and the households.

A. Characteristics of Trades by Portfolio Concentration

We begin by comparing the characteristics of the trades made by households that own only one or two stocks at the beginning of the year ("concentrated" households) with the

[16] In the context of financial data, Petersen (2005) suggests such a methodology, that is, the use of a single pooled regression with clustered standard errors.

characteristics of the trades made by households that own more than two stocks ("diversified" households). For various subsamples defined by portfolio size, we summarize the portfolio characteristics for "diversified" households in the first column and show the difference between the two groups of portfolios in the second column.

Panel A of Table 6 reports the characteristics of total stock transactions for concentrated and diversified households. While 61.0 percent of diversified households purchase at least one stock in a given year, the same is true for only 36.5 percent of concentrated households. Moreover, the number of purchases is significantly lower for concentrated households than for diversified households even after conditioning on having at least one purchase in a given year.

The median total value of annual common-stock purchases made by the diversified households that made any common-stock purchases is $14,800. The value of the purchases increases significantly with the total household portfolio value at the beginning of the year. The median household with purchases in a given year tends to add funds to the account because the total costs of the purchases exceed the total proceeds from the sales. Concentrated households with relatively small balances (less than $25,000) tend to increase their portfolio values by larger amounts than the diversified households do. However, this tendency reverses as the account size increases. Specifically, the sale proceeds of the concentrated households with account values of at least $100,000 are actually slightly larger than the total purchase amounts, suggesting that these concentrated households did not tend to add to their existing stock holdings, but, rather, used the proceeds of sales of existing positions to finance their new stock purchases.

In the final two rows of Panel A, we report the distribution of annualized portfolio turnover over the next year for concentrated and diversified investors.[17] Consistently across various portfolio sizes, the median turnover across households is fairly small, particularly for households holding concentrated portfolios. Households with diversified portfolios have a median turnover of 16 percent on an annualized basis, whereas the corresponding median

[17] The turnover rates employed in this table are averages of the monthly turnover over the next year, subsequently converted to an annual basis. Our calculation of monthly turnover employs the methodology developed in Barber and Odean (2000, p. 781). Specifically, monthly portfolio turnover is the average of buy and sell turnover during the month, where buy turnover during month *t* is defined as the shares purchased during month *t-1* times the beginning-of-month *t* price per share divided by the total beginning-of-month value of the portfolio. Similarly, sell turnover during month *t* is calculated as the shares sold in month *t* times the beginning-of-month price per share divided by the total beginning-of-month market value of the household's portfolio.

turnover for households with concentrated portfolios is zero. However, consistent with Barber and Odean (2000), the mean turnover is higher, and, in contrast to the median turnover, the mean turnover is particularly high for concentrated households. For example, across various portfolio sizes, the mean portfolio annualized turnover for diversified portfolios is 40-50 percent, whereas for concentrated households, as portfolio sizes increase, average portfolio turnover increases to 80 percent annualized for the largest portfolio-size group.

Panel B of Table 6 provides a detailed description of the characteristics of individual purchases and the differences in the types of stocks purchased by concentrated and diversified households. The median purchase for all households is just below $5,000 and does not depend substantially upon the concentration level. Concentrated households with portfolio values of at least $25,000 tend to execute substantially larger but less frequent trades than diversified households do. For example, the median individual stock purchase by a diversified household with a portfolio value of at least $100,000 is $8,938, while the median purchase by such a concentrated household is about three times larger ($26,251). The most striking difference in the types of stocks purchased across the two groups of investors is in regard to local stocks (particularly local stocks with less national exposure). Consistent with the hypothesis that households may concentrate holdings in stocks with likely larger information asymmetries, concentrated households are significantly more likely to purchase local stocks that are not included in the S&P 500 index. There are no substantial differences in the purchases of concentrated and diversified investors across stock characteristics such as size, book-to-market, or momentum, or whether the investor is from California (i.e., California investors constitute the same proportion of trades made by both concentrated and diversified investors). Concentrated investors tend to be somewhat more likely to purchase technology stocks and somewhat less likely to purchase biotechnology/medical stocks (two industries that did well over the sample period). Our regressions that measure the performance of trades will carefully control for return differences attributable to the style of investing (through the inclusion of size, book-to-market, momentum, and fine industry controls) to insure that any differences in investing style, no matter how slight, will not confound our analysis of the "return to concentration."

B. Summary Statistics of Trade Performance

The results in Table 7 summarize the average one-year excess returns following purchases and sales for concentrated and diversified households with different account values.

For the purpose of these analyses, we define concentrated households as those holding one or two stocks and diversified households as those holding three or more stocks at the end of the previous year.[18]

Panel A of Table 7 suggests that, for households with moderately large portfolios (that is, at least $25,000), the raw returns following the purchases of concentrated households outperform those made by diversified households by a highly significant margin of 2.1 percentage points in the year following the transaction. However, there is no difference in performance of the purchases across the two household-portfolio types for households with small accounts.

The performance differential between concentrated and diversified households increases further if we measure returns relative to Fama and French (1992) size and book-to-market decile portfolios (Panel B of Table 7). Across all households, the stock picks made by concentrated investors outperform those made by diversified investors by 0.7 percentage points over the year following the purchase, with the difference in performance growing to 3.0 percentage points for households with moderately large portfolios (i.e., at least $25,000).

Regardless of portfolio size, the purchases made by diversified households underperform the Fama-French benchmark portfolios by 1.1 to 2.2 percentage points in the year following the purchase. Whereas the purchases made by concentrated households with small portfolios (less than $25,000) also underperform by a similar magnitude, the purchases made by concentrated households with large portfolios appear to do substantially better, exceeding the Fama and French benchmark portfolios by 1.3 percentage points (not statistically significant) for those with moderately large portfolios (i.e., at least $25,000) and by 2.2 percentage points (significantly different from zero at the 10 percent level) for those with large portfolios (i.e., at least $100,000). Because a sale decision can be driven by many factors besides information, such as liquidity needs, taxes, portfolio rebalancing, and the "disposition effect," it is not surprising that, across all account sizes, there is no significant difference in the one-year performance of stocks following their sale (as shown in the corresponding rows of Panels A and B in Table 7).

The bottom rows in Panels A and B of Table 7 report the return differential between the purchases and the sales for the different groups of households. Consistent with the above results,

[18] See Section V.G for results using several alternative return measurement horizons, ranging from one week to one year following the trade.

for the households with accounts of at least $25,000, the trades of concentrated households tend to outperform the trades of diversified households by a significant margin.

As a robustness check, we also compute excess returns relative to the appropriate Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004) portfolio, formed according to size, book-to-market, and momentum quintiles, and report the findings in Panel C of Table 7. The results are very similar to those in Panel B. For example, the average one-year return following purchases for concentrated households with portfolios of at least $25,000 exceeds its benchmark by 3.3 percentage points (compared to an excess return of 0.1 for their diversified counterparts).

We further confirm, in unreported analyses, that the results for the group of households with moderate-sized portfolios (at least $25,000) are not driven by the stock picks of the largest portfolios (at least $100,000). For example, focusing the one-year excess returns following purchases for concentrated households with portfolios between $25,000 and $100,000 is 3.0 percentage points, compared to 4.2 for those concentrated investors with the largest portfolios (as reported in Panel C of Table 7). This pattern holds throughout the table, as significant results obtained for the $25,000+ group also hold for the subgroup of households with portfolios of $25,000 to $100,000, with only a slight reduction in the magnitude of the return.

C. Regression Methodology

To study the relation between the performance of trades and the concentration of the household portfolio, we consider a key regression specification that relates the excess return of stock *i* bought or sold by household *h* at time *t* during the subsequent year ($X_{i,h,t+1 \text{ to } t+12}$) on the indicator variable $BUY_{i,h,t}$ that denotes whether the transaction was a buy or a sell, a continuous measure of portfolio concentration—the Herfindahl Index of the household's portfolio at the end of the previous year (denoted as $HI_{h,y-1}$)—along with an interaction between the two ($BUY_{i,h,t} \times HI_{h,y-1}$), as well as industry and momentum controls:

$$(2) \qquad X_{i,h,t+1 \text{ to } t+12} = \alpha + \beta_0 BUY_{i,h,t} + \beta_1 HI_{h,y-1} + \beta_2 BUY_{i,h,t} \times HI_{h,y-1} + \text{industry controls} + \text{momentum controls} + \varepsilon_{i,h,\, t+1 \text{ to } t+12}.$$

Thus, the unit of observation is a stock purchased or sold by a household at a specific point in time. The return is computed as the return during the year following the transaction.[19] The indicator variable $BUY_{i,h,t}$ equals one if the corresponding transaction is a purchase and zero if it is a sale. The average return of a purchase made by a household with a completely diversified portfolio ($HI = 0$) exceeds the average return of a sale made by a household with a completely diversified portfolio by β_0. The average return of a sale made by a household with a completely concentrated portfolio ($HI = 1$) exceeds the average return of a sale made by a household with a completely diversified portfolio ($HI = 0$) by β_1.[20]

The coefficient on the interaction term of the buy indicator variable and the Herfindahl Index of the portfolio, β_2, estimates the extent to which the trades (purchases and sales) made by concentrated households outperform those made by diversified households. Specifically, β_2 estimates the differential between (1) the difference between average performances of purchases and sales made by completely concentrated households and (2) the difference between average performances of purchases and sales made by completely diversified households. Thus, the coefficient β_2 can be interpreted as a measure of the "return to concentration."

In most analyses, excess returns $X_{i,h,t+1 \text{ to } t+12}$ are computed by subtracting the appropriate Fama and French (1992) benchmark portfolios formed according to size deciles and book-to-market deciles from the raw stock returns. In robustness tests, we also employ Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2004) benchmarks formed according to size, book-to-market, and momentum quintiles.

The industry and momentum controls are interacted with indicator variables for the transaction month to control for overall industry performance in the year following the transaction. We include in the regressions 5,183 industry-month fixed effects based on the 73 distinct two-digit SIC codes and the 71 months in which a transaction could occur (from January

[19] The calculation of the return over the year following the transaction starts on the first day of the next month, ending on the last day of the 12th month after the transaction. Hence, we will refer to the one-year return following the transaction as $X_{i,h,t+1 \text{ to } t+12}$. This timing convention might understate the performance of skilled investors as excess returns might begin to accrue immediately after their transactions, an issue we address in Section V.G.

[20] Of course, households cannot literally have a Herfindahl Index of zero because it ranges from $1/N$ and one, where N is the number of available securities. However, the Herfindahl Index can take on values very close to zero for portfolios consisting of many stocks.

1991 to November 1996). Thus, for each transaction we are controlling for industry performance (at the two-digit SIC code level) over the next year. To control for momentum effects, we include an interaction term between the lagged one-year return, that is, the return over the twelve months preceding the transaction, and indicator variables for the 71 time periods (this allows the relation between past one-year returns and future one-year returns to be different across each of the 71 months in the sample period). As in Section III, the computation of standard errors takes into account heteroskedasticity as well as cross-sectional correlation (by clustering on the month of the transaction).

D. Regression Results

The one-year returns following purchases and sales made by households with varying levels of concentration are summarized in Table 8. For each sample, the first column corresponds to the specification using excess returns relative to the Fama-French size and book-to-market decile portfolios and controlling for momentum and industry effects (as in Equation (2)). Starting with the first row, the coefficient associated with the "Buy indicator" (β_0) is significantly negative for all specifications and remains remarkably stable for various household portfolio sizes. On average, the buys made by completely diversified investors underperform their sales by 1.6 percent after the risk, industry, and style adjustments. These estimates are consistent with Odean's (1999) results that individual investors' purchases underperform their sales. The coefficient on the "Herfindahl Index" (β_1) is not significantly different from zero in any of the regressions, consistent with our previous result that the performance following stock sales does not differ between concentrated and diversified households.

The coefficient on the interaction term of the "Buy indicator" with the "Herfindahl Index" (β_2) is positive and significantly different from zero for all but the households with the smallest portfolios. Thus, the differential performance following purchases relative to sales is consistently higher for completely concentrated households: controlling for risk, industry, and style, the differential performance following purchases relative to sales for concentrated households is 0.8 percentage points per year[21] higher than that for diversified households, rising

[21] When computing standard errors, we considered multiple alternative correlation structures such as clustering on household-month, stock-month, and industry-month combinations. As a practical matter, these correlation structures all resulted in standard errors very similar to the reported 0.41 for the coefficient β_2 estimated for the full

to a difference of 2.4 percentage points for households with portfolios of at least $25,000, and 4.8 percentage points for those with portfolios of at least $100,000. Thus, the trades made by concentrated households perform significantly better than those of their more diversified counterparts.[22]

To verify robustness of these results, we employ an alternative measure of investors' sophistication and/or their ability to diversify their holdings if desired. The data set contains, among other data fields, self-reported net worth recorded at the time when the households opened their accounts with the broker. Self-reported net worth is only available for around 27,000 households.[23] Despite its availability for relatively few households, the robustness test based on investors' self-reported net worth provides an alternative means to identify investors who have the means to diversify if desired and/or could be financially sophisticated. Limiting our sample to only the households that have self-reported net worth, we consider households' trades based on three cutoffs: those made by households with net worth less than $250,000, those made by households with net worth of at least $250,000, and those made by households with net worth of at least $500,000, and replicate the key results associated with the analyses of trades. The results are very consistent with those based on portfolio size. Specifically, the performance of trades made by concentrated households with very large net worth (of at least $500,000) is superior to the performance of trades made by diversified households with very large net worth by 4.3 percentage points per year (SE = 2.2). Table 8 suggests that the corresponding differential associated with very large stock portfolios (of at least $100,000) is very similar (4.8 percentage points; SE = 1.1). On the other hand, performance of trades made by concentrated households with small net worth (of less than $250,000) is statistically indistinguishable from the performance of trades made by diversified households with small net worth by (0.9 percentage

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sample (i.e., they range from 0.36 to 0.45), and, therefore, did not affect statistical inference. The same pattern holds throughout the rest of our analyses reported in the paper.

[22] Throughout the paper, we use the Herfindahl Index of the household's stock portfolio at the end of the prior year as our primary measure of concentration. An alternative concentration measure, the inverse of the number of stocks in the portfolio, yields very similar results (see Section V.F).

[23] Because 27,000 households constitute only around one-third of the households in the sample and the information regarding net worth likely is noisy, we regard the investors' positions in their common-stock investments as a more accurate and relevant measure of investors' sophistication and/or their ability to diversify their holdings if desired.

points; SE = 0.7). Once again, Table 8 suggests that the corresponding differential associated with small portfolios (of less than $25,000) is very similar (0.5 percentage points; SE = 0.6).

Returning to our main results that rely upon cutoffs based on the household stock portfolio size, as in Table 7, employing alternative benchmark portfolios when constructing excess returns yields virtually the same results. In unreported analyses we also compute excess returns relative to the appropriate Daniel, Grinblatt, Titman, and Wermers (1997), and Wermers (2004) portfolio, formed according to size, book-to-market, and momentum quintiles. These alternative benchmarks account for momentum effects by matching the stock with the appropriate benchmark portfolio (at the cost of less precise matches based on size and book-to-market, because these portfolios are based on quintiles rather than deciles). The differential performance following purchases relative to sales for concentrated households is 0.8 percentage points per year higher than that for diversified households, rising to a difference of 2.7 percentage points for households with portfolios of at least $25,000, and 4.7 percentage points for those with portfolios of at least $100,000. Thus, the two excess return specifications yield virtually identical results and, for brevity, we henceforth report only the results based on the Fama-French benchmarks with momentum controls included in the regression.

We further confirm that the significant results obtained for the $25,000+ group also hold for the subgroup of households with portfolios of $25,000 to $100,000 and, therefore, are not driven by the households with portfolios of at least $100,000. For example, the performance of the trades of concentrated relative to diversified households is greatest for households with the largest portfolios, but it is also present for households with portfolios between $25,000 and $100,000 (the coefficient estimate is 1.6 percentage points, statistically significant at the five percent level). Accordingly, the results for this subgroup are henceforth not reported for brevity.

How can these findings of superior performance by concentrated investors be reconciled with the extant literature that finds, on the one hand, that most households hold just a few stocks and, on the other hand, that most households' investments perform poorly? First, whereas it is true that households on average hold few stocks, this is driven in large part by the fact that most households have relatively small stock portfolios (e.g., in our sample about three-fifths of households have stock portfolios balances less than $25,000). The superior performance of the concentrated investors in not driven by these numerous concentrated, but small investors, but rather by the investors who hold large portfolios, and thus have the resources to diversify, if

desired, yet still choose to hold very concentrated positions. In the aggregate, however, the superior performance of this group of wealthy, concentrated investors would go unnoticed, as it would be dominated by the poor performance of typical, small investors.[24]

In concluding this section, we note that we do not analyze the impact of trading costs explicitly. However, Table 6 suggests that including trading costs would likely further widen the differential performance between concentrated and diversified households, as the median purchase amount is larger for concentrated households, indicating that their trading costs are relatively smaller than the trading costs faced by diversified households.[25]

E. Controlling for Household Fixed Effects

As highlighted in Section III.E, a concern with any cross-sectional analysis is that some omitted household-specific attribute can explain the observed correlation. To control for household-specific attributes such as education, financial sophistication, risk aversion, susceptibility to behavioral biases, as well as any other observable or unobservable household characteristic that does not change over the sample period, we augment the previous specifications with household-level fixed effects. Specifically, we estimate specifications based upon Equation (2) with the addition of household fixed effects (separately for purchases and sales) and thus control for the average stock-picking ability of the household. Consequently, the "Buy indicator" is not included in the regression because it is absorbed in the household fixed effects.

Assuming that the availability of relevant information or the information processing skills of households is limited, investors may be better off investing in a subset of the limited number of stocks with information asymmetries. The specification that includes fixed effects is suitable

[24] In concurrent work, Goetzmann and Kumar (2005) show that a vast majority of individual investors are under-diversified and that such households are subject to a stronger familiarity bias and greater overconfidence. They argue that the high idiosyncratic risk in the portfolios of poorly diversified households results in a welfare loss and report, in general, a negative relation between portfolio concentration and performance. However, their result regarding returns appears to be driven by the preponderance of small household portfolios in the sample, among which one would not necessarily even expect that concentration might reflect superior stock-picking.

[25] Barber and Odean (2000) estimate an average bid-ask spread of 0.31 percentage points for purchases and 0.69 percentage points for sales. Moreover, the average commission of purchases and sales equals 1.58 and 1.45 percentage points for trades in excess of $1,000. Thus, the total trading costs for a roundtrip transaction are estimated at around four percentage points on average.

for testing the hypothesis that expanding the portfolio beyond this limited subset into additional stocks will likely depress portfolio performance (either because the stocks about which one may possess superior information have already been tapped or because the increasing number of different investments lessens one's ability to effectively monitor them).

The second column associated with each sample in Table 8 reports the regression results with separate household fixed effects that control for the average performance following household purchases and sales, respectively, over the full sample of 52,661 households. In short, all the major conclusions hold. The return to concentration remains large and positive—in fact, it is even larger than the estimates based on specifications that do not include household fixed effects. For example, focusing on excess returns, trades made by concentrated households outperform those made by diversified households by 2.4 percentage points over the year following the transaction (compared to 0.8 percentage points, respectively, in the specification without household fixed effects). The magnitude of the return to concentration with fixed effects increases further if we only analyze households with account values of at least $25,000 or $100,000, respectively, though it is no longer significant for the latter group. The strong return to concentration obtained from fixed-effect specifications constitutes a particularly compelling result because it suggests that, even after controlling for a household's average investment ability, the household's trades perform better as the household's portfolio includes fewer stocks.

An alternative approach to testing whether the performance of the trades of households that become more concentrated improves, whereas that of households that become less concentrated deteriorates, is to analyze how the performance of trades responds to a *change* in the concentration of a household's portfolio. In unreported analyses, we replace the Herfindahl Index in Equation (2) with the *change* in the Herfindahl Index relative to the previous year ($\Delta HI_{h,y-1} = HI_{h,y-1} - HI_{h,y-2}$). Thus, whereas in Table 8 we related the performance of trades in year t, to the concentration of the household's portfolio at the end of year t-1, we now relate the performance of trades in year t to the change in the concentration of a household's portfolio from the end of year t-2 to the end of year t-1. We find that the performance of the trades of households that become more concentrated improves relative to that of the trades made by households that become less concentrated (i.e., the coefficient on "Buy indicator * Change in Herfindahl" is positive and significant). For example, a household that changes from being fully diversified (i.e., "Herfindahl Index" is zero) to being fully concentrated (i.e., "Herfindahl Index"

is one), on average, will experience a 1.4 percentage point improvement in the performance of its trades (one-year return following buys minus one-year return following sales). Consistent with earlier results, the magnitude of this effect is substantially larger when we focus on the households with larger account balances (3.3 percentage point improvement).[26]

Finally, in further unreported analyses, we separate the sample of trades depending on whether the Herfindahl Index (i.e., concentration of the household's stock portfolio) increased or decreased in the previous year. We find a positive relation between a change in concentration and the performance of trades in both subsamples (in fact, we cannot reject that the coefficient on "Buy indicator * Change in Herfindahl" is statistically the same across the two subsamples), indicating that the performance of the trades made by households that become more concentrated improves, whereas that of households that become less concentrated deteriorates subsequently. The results regarding trades presented in this section complement well our earlier findings regarding positions. "The return to concentration" is also found *within* a household's trades over time (and is not identified solely from differences in the performance of trades *across* different types of investors).

F. Interactions with Measures of Asymmetric Information

In this section we investigate whether the finding that the trades of concentrated households perform significantly better than the trades of diversified households can be explained by information asymmetries. Table 9 reports the estimated excess returns for the trades of completely concentrated and completely diversified households based on the specification from Equation (2). The first column reports the excess returns of the trades for all households with a known location.[27] For example, for all households with a known location, the trades made

[26] An alternative concentration measure, the inverse of the number of stocks in the portfolio, yields very similar results. For example, the trades of completely concentrated households outperform those of completely diversified households by 1.8 percentage points (SE = 0.8) over the year following the transaction in a fixed effects specification using the inverse of the number of stocks measure (compared to the estimate of 2.3 when using the portfolio Herfindahl Index). Likewise, using the inverse of the number of stocks measure in the "change" regression suggests that, on average, a household that changes from being fully diversified to being fully concentrated will experience a 1.0 percentage point (SE = 0.6) improvement in the performance of its trades (compared to the estimate of 1.3 when using the change in the portfolio Herfindahl Index).

[27] These estimates differ slightly from those reported in Table 8 because the sample used in Table 9 excludes households with unknown locations.

by concentrated households outperform those made by diversified households by 1.4 percentage points per year.

We observe larger differences between the excess returns of trades of completely concentrated and diversified households along a dimension of potential information asymmetry—membership in the S&P 500 index (the second and third columns). The second column of Table 9 shows that, among investments in S&P 500 stocks, which have much greater analyst coverage and national media attention, there is virtually no difference in the performance of the trades of concentrated versus diversified investors across all portfolio-value cutoffs.

By contrast, the third column shows that the differential performance of the trades made by concentrated investors relative to the trades made by diversified ones is present among non-S&P 500 stocks; across all investors, it is 2.4 percentage points per year (and is highly statistically significant). The magnitude of the coefficient increases monotonically with portfolio size, from the insignificant 2.0 percentage points per year associated with non-S&P 500 trades made by investors holding portfolios of less than $25,000, to a much larger and statistically significant differential of 4.8 percentage points per year generated by households holding somewhat larger portfolios of at least $25,000, to a still larger and statistically significant differential of 9.5 percentage points per year generated by households holding large portfolios of at least $100,000.[28]

Another dimension of potential information asymmetry is investors' geographic proximity to the company headquarters. Trades of stocks local to the household (the fourth

[28] As a robustness test, we consider the number of analysts following the stock as an alternative measurement of information asymmetry. Similarly to the analyses reported in Section III.C, we define an indicator variable that splits the universe of trades into those for which the underlying stock was followed by five or fewer analysts at the time of the trade and those for which it was followed more than five analysts, with a likely higher degree of information asymmetry associated with the former. The regression results, based on the specification analogous to Equation (2), but based upon a different indicator variable capturing information asymmetry, are very similar to those based upon S&P 500 membership. For example, across all households, the difference in the performance of the trades across concentrated and diversified households is 2.7 percentage points per year (SE = 1.0) when focusing only on the trades of the stocks followed by five or fewer analysts. On the other hand, the difference in the performance of the trades across concentrated and diversified households is only 0.7 (SE = 0.4) when focusing only on the trades of the stocks followed by more than five analysts. Moreover, the differential is even larger when we restrict the sample to the households with larger portfolios. Finally, results based on cutoffs involving three and ten analysts are similar.

column) perform substantially better than their non-local counterparts (the fifth column). For example, focusing on all households with a known location, the trades made by concentrated households outperform those made by diversified households by 5.0 percentage points, whereas there is essentially no difference for non-local trades (the point estimate is only 0.8 and is statistically insignificant).

The sixth and seventh columns suggest that the differential performance along the dimension of locality does not hold in regard to investment in S&P 500 stocks, likely because information asymmetry is scarce among S&P 500 stocks and the firm-headquarter proximity to the household does not help. The superior performance of the trades made by concentrated investors is particularly pronounced for local stocks not included in the S&P 500 index (the eighth column), indicating that exploiting information asymmetries may play an important role in the return to concentration. These results for trades are very consistent with the results for holdings presented earlier in Table 4.

Thus, the "return to locality" for individual investors documented by Ivković and Weisbenner (2005) and Massa and Simonov (2006) seems to be consistent with, and indeed largely driven by, the performance of the local investments made by concentrated investors.

V. Robustness Tests

The results presented in Tables 8 and 9 suggest that the trades made by concentrated households perform significantly better than those made by diversified households, with the difference being particularly striking when the comparison is made across households with large portfolios. Whereas consistent with the hypothesis that concentrated households, particularly those with large portfolios, are better stock pickers, this finding could potentially also be attributed to alternative explanations such as differences across the two groups of investors in market-timing ability or the access to, and exploitation of, inside information; the turnover in households' stock portfolios; and the volatility of transacted stocks. In this section we examine and rule out these alternative explanations, as well as conduct several robustness tests such as differentiating between industry-level and stock-level concentration, exploring alternative measures of concentration, and considering alternative investment horizons, and testing for robustness of the "return to concentration" across California and non-California investors.

A. Return to Concentration and Holding Non-Stock Assets

In this section we explore whether investment ability differs across households with and without non-stock assets (e.g., mutual funds) held with this brokerage house. Clearly, concentrated stock investments have larger consequences for households whose portfolios consist only of few stocks than for those whose portfolios also contain a broad-based equity mutual fund. Presumably, rational investors would not concentrate their entire portfolio in one or a few stocks unless they were very confident in their investment ability and the quality of the information they acquired. On the other hand, if such undiversified investments are a manifestation of overconfidence, the trades made by these households will not earn excess returns.[29]

Results reported in Table 10 suggest that there potentially is a "courage in your convictions" effect because the return to concentration documented throughout this paper is concentrated in the group of investors who do not hold assets other than common stocks with this brokerage house. Estimated over the full sample, there is no difference between the performance of trades among households with concentrated stock portfolios and those with diversified stock portfolios if the households also hold other, non-stock assets (shown in row 2). However, the trades made by concentrated households outperform those made by diversified households by 2.1 percentage points for the sample of households that own only stocks, and the performance of the trades is increasing with the size of the portfolio (shown in row 3). The difference in the return to concentration between the sample of households that do not hold other assets and those that do is two to four percentage points and is significant across the full sample as well as the subsamples of households with large portfolios. Thus, it appears that households with superior information concerning a stock act upon this information by not only tilting their stock portfolio towards it, but by concentrating the bulk of their holdings with this brokerage house into the stock.

[29] In general, among stock investors, we find that concentrated households are significantly *less* likely to hold other asset classes in their account(s) with this brokerage house, as 59 percent of diversified households and 36 percent of concentrated households own other asset classes in their account(s) with this broker. Whereas the fraction of households with diversified stock portfolios that hold other types of assets rises with the size of the stock portfolio (from 53 percent for households with stock portfolios less than $25,000 to 73 percent for households with stock portfolios of at least $100,000), the fraction of households with concentrated stock portfolios that hold other types of assets actually declines with the size of the stock portfolio (from 38 percent for households with stock portfolios less than $25,000 to 29 percent for households with large stock portfolios of at least $100,000).

Finally, we also provide another test of the "courage in your convictions" effect by utilizing the self-reported net worth (available for around one-third of the sample households). Specifically, we estimate the return to concentration for households whose initial stock portfolio represents a large share (i.e., at least 50%) of their self-reported household net worth relative to the return to concentration for households whose initial stock portfolio represents a smaller share (i.e., less than 50%) of their self-reported household net worth (and thus the performance of stock portfolio is less "important" for the household). Once again, the return to concentration is larger across all portfolio size groups for households whose stock investments represent a larger share of their net worth (as shown in rows 4 and 5 of Table 10).

B. Does Return to Concentration Reflect Market-Timing Ability or the Exploitation of Inside Information?

In rows 6 and 7 of Table 10 we replace the actual one-year return of the stocks bought and sold with either the return of the market (row 6) or the return of the appropriate benchmark portfolio formed based on the size, book-to-market, and momentum quintiles (row 7). This enables us to test whether the performance of the trades of concentrated households is attributable to specific stock-picking ability or to broader market timing. The results suggest the former, as the market and the appropriate benchmark portfolio perform slightly *worse* following the trades of concentrated households relative to those of diversified households. Thus, the return to concentration is driven by concentrated households' stock-picking, rather than by timing the broad equity market.

In the last three rows of Table 10 (rows 8 through 10), we exclude from household portfolios the stock(s) that represent the largest dollar-purchase or sale, the stock(s) that have the largest return following a purchase or the smallest return following a sale, and the stock(s) that have the greatest number of purchases or sales, respectively. All three screens serve as indicators that the individual has access to inside information for this particular stock, with the last exclusion similar to that made by Coval, Hirshleifer, and Shumway (2005). In each case, we not only exclude the particular transaction that is the largest in value or has the largest return, but we also drop any other household transactions involving that stock. Because we do this both for purchases and sales, at most the transactions involving two distinct stocks will be excluded from the sample for each household.

Whereas these exclusions do reduce the return to concentration, it still remains at about one-half to four-fifths of its original size for households with sizeable portfolios (i.e., at least $25,000). For example, focusing on households with portfolios of at least $100,000, the differential return of trades for concentrated households exceeds that for diversified households by 3.1 to 4.0 percentage points per year across the samples in which we exclude certain stock transactions, compared to 4.8 percentage points estimated over all trades. Thus, the superior performance of the concentrated investments in large portfolios is not predominantly attributable to concentrated households transacting in the same stock over time. This result suggests that simply exploiting inside information is not likely the source of the return to concentration. We provide additional tests that address the issue of inside information in Section V.G.

C. Industry-Level and Stock-Level Concentration

Throughout the paper, we use the term "concentrated" to refer to investors who hold just a few stocks in their brokerage account. Such a breakdown is motivated by potential limits in the availability of relevant information and investors' information processing skills, both of which likely decline with the number of different stocks in their portfolios. However, whereas some households may hold many stocks, those stocks may all be concentrated in a single industry, perhaps reflecting broad investment ability to pick across sectors in the economy.

To test whether concentration in a broad industry group, controlling for the number of stocks in the household's portfolio, is indicative of better stock picks, we estimate regressions containing Herfindahl Indices based on both the number of stocks in the portfolio as well as the number of broad industry groups the stock portfolio spans. Focusing on the households with the largest portfolios (i.e., at least $100,000), in unreported results we find that, after controlling for the number of stocks in the portfolio, the stock purchases of households whose portfolios are concentrated in one industry perform no better than those of households with more diverse industry allocations. That is, the return to concentration based on the number of stocks in the portfolio remains after the inclusion of the industry Herfindahl Index. Thus, the superior performance of concentrated households with large portfolios reflects individual stock-picking ability rather than an ability to select across industries.

D. The Role of Household Portfolio Turnover

Table 6 shows that, whereas the mean household portfolio turnover is higher among concentrated households, median household portfolio turnovers are higher among diversified investors: households with diversified portfolios have a median annualized turnover of 16 percent, whereas the corresponding turnover for households with concentrated portfolios is zero. Barber and Odean (2000) find that "trading is hazardous to your wealth," that is, households with greater portfolio turnover tend to earn lower returns both before and after transaction costs. Thus, if the turnover of a portfolio is negatively related to its concentration, the return to concentration may not reflect households' stock-picking skill, but instead may simply be an artifact of the differential turnover across the two groups of households.

To address this issue, for each household we calculate its average monthly household portfolio turnover across the entire sample period. We then, in unreported analyses, conduct a "horse race" between portfolio concentration and average portfolio turnover by re-estimating Equation (2) with two additional regressors: the household's average monthly portfolio turnover over the sample, and an interaction of that term with the Buy indicator $BUY_{i,h,t}$. The inclusion of the household's average portfolio turnover, while generally significant in it own right, does not diminish the return to concentration.[30] For example, our return to concentration measure, β_2 ("Buy * Herfindahl"), changes little in the presence of turnover controls (0.8 percentage points without turnover controls and 0.6 percentage points with turnover controls), and does not change at all for the sample of trades made by households with the largest portfolios (4.8 percentage points both with and without turnover controls).[31]

[30] Including the household's turnover during the year preceding the transaction, rather than the average of the household's portfolio turnover throughout the sample, does not affect the relation between trade performance and portfolio concentration.

[31] In another unreported analysis, we break the sample of trades into thirds according to the households' average portfolio turnover. The differential return following trades of concentrated relative to diversified households (i.e., the return to concentration) with portfolios of at least $25,000 is 0.2 (SE = 0.9) percent for the low turnover group, 3.3 (SE = 1.4) for the medium turnover group, and 2.8 (SE = 0.9) for the high turnover group. For households with portfolios of at least $100,000, the comparable returns to concentration across the three turnover groups are 3.2 (SE = 1.3), 6.9 (SE = 2.7), and 4.8 (SE = 1.9), respectively. The fact that the return to concentration is higher for the high portfolio turnover group than for the low portfolio turnover group is consistent with findings reported in Goetzmann

E. Stock Volatility

Throughout the paper we report arithmetic averages. A potential concern with the return to concentration is that it could be a manifestation of concentrated households investing in riskier stocks. Indeed, if stock returns are log-normally distributed, then two stocks with the same average logarithmic returns will have different simple arithmetic returns if their standard deviations differ (higher volatility leads to a higher average arithmetic return). In this case, the higher-volatility investments held by concentrated investors would mechanically have higher average one-year simple arithmetic returns, even if these investors had no investing skill relative to diversified households, just by virtue of the skewness of the return distribution.

The purchases made by concentrated households do have a higher monthly volatility than those of diversified households, although the difference is slight (13.1 vs. 12.5 for all households and 12.8 vs. 12.0 for households with accounts of at least $100,000). However, concentrated households are also more likely to sell slightly more volatile stocks as well (13.1 vs. 12.4 for all households and 12.5 vs. 11.8 for households with the accounts of at least $100,000). Given that our return to concentration measure is the differential performance of trades (performance of purchases minus performance of sales) across the two household-portfolio types (concentrated vs. diversified), the level of volatility should not mechanically affect this difference in returns. Because both the stocks bought and sold have the same volatility on average for both groups of households, any bias in arithmetic returns is effectively differenced out.

Nonetheless, to test for this potential alternative explanation for the return to concentration we conduct a "horse race" between portfolio concentration and volatility of the transacted stock. In unreported analyses, we re-estimate Equation (2) with the addition of the monthly volatility over the past 24 months and an interaction of that term with the "Buy indicator". Including the volatility of the transacted-stock in the return regression actually has little effect on the return to concentration, suggesting that focusing on the differential performance of trades across household groups mitigates any potential bias in average raw returns that can result from greater volatility.

Yet another way to address the potential role volatility can play in boosting the mean simple return is to use logarithmic returns instead of simple returns in the regression. In

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and Kumar (2005), although for the large portfolios the return to concentration is significant regardless of the portfolio turnover grouping.

unreported analyses we find that a regression using log returns estimates that, among portfolios of at least $100,000, the differential performance following purchases relative to sales for concentrated households is 3.3 percentage points per year higher than that for diversified households, a figure similar to the estimates based on simple returns (as presented in Table 8).

F. Alternative Specifications and Concentration Measures

In this section, we report the results of fitting four alternative specifications. The first focuses on transactions above $10,000, the second weights each observation by the total value of the transaction, the third replaces the Herfindahl Index with the inverse of the number of stocks held in the household portfolio, and the fourth caps the distribution of returns following transactions at the top one percent to test if these extreme returns affect our results. In sum, the return to concentration persists in all four alternative specifications: the positive relation between portfolio concentration and trade performance remains robust both in terms of magnitude and statistical significance. For example, for households with portfolios of at least $100,000, the trades made by concentrated households outperform those made by diversified ones by 2.7 – 4.7 percentage points (depending on the specification), a range similar to the baseline estimate of 4.8.

G. Alternative Return Horizons

The analyses reported thus far have considered one-year returns starting from the beginning of the month following the month of the transaction. This timing convention might understate the performance of skilled investors because excess returns might begin to accrue immediately after their transactions. To address this issue, we consider one-year returns that begin accruing immediately after the day of the transaction, as well as over a variety of horizons: one week, one month, three months, and six months. Examination of holding periods shorter than a year enables us to better determine whether the return to concentration accrues primarily over the first few days or weeks following a stock purchase, or over a longer horizon. In estimating the specifications that require the computation of excess returns, we use the six daily Fama-French (1992) benchmarks formed according to two size and three book-to-market groupings.[32]

[32] We use the six daily benchmarks because the 100 Fama-French portfolios based on size and book-to-market deciles are not available with daily frequency. The returns on these six benchmark portfolios are also obtained from Kenneth French's website: `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.`

Aside from different horizons and slightly different computations of excess returns, the specification is quite analogous to that from Equation (2).

The unreported results suggest that the return to concentration is not attributable to individuals' short-term stock timing (i.e., excess returns do not accrue immediately after the transaction). Generally, beginning with returns over the week following the transaction, returns to concentration are only detectable starting at the three-month horizon and keep increasing proportionately to the duration of the horizon. For example, across the transactions made by all households, the trades of concentrated households outperform those made by diversified households by 30, 70, and 100 basis points over the first three months, six months, and one year after the transaction, respectively, whereas the differential performance of trades is 1.5, 2.9, and 5.7 percentage points over these horizons for households with large portfolios, respectively. This suggests that, on average, the return to concentration builds up gradually; it is not a consequence of information revealed shortly after the stock purchase.

We also study the relation between concentration and the performance of trades using longer investment horizons. In unreported results, we find that the magnitude of the differential performance following purchases relative to sales tends to increase with the investment horizon, but the estimates are no longer statistically significant beyond the three-year horizon. Most of the return to concentration occurs within the first year after the transaction.

H. California and Non-California Households

Around one-quarter of the sample households reside in California. This raises the potential concern that California households investing in only a few technology stocks, which happened to perform well during the sample period, might be driving the results. To address this concern, we estimate Equation (2) separately for California and non-California households and find that the results are very similar (perhaps not surprisingly, given that the specification already includes two-digit industry controls and that we obtained a "return to concentration" in a specification that included household fixed effects). For California households, the differential performance following purchases relative to sales for concentrated households is 1.7 percentage points per year higher than that for diversified households, rising to a difference of 2.8 percentage points for households with portfolios of at least $25,000 and 5.1 percentage points for those with portfolios of at least $100,000. For non-California households, the differential performance following purchases relative to sales for concentrated households is 0.6 percentage

points per year higher than that for diversified households, rising to a difference of 2.3 percentage points for households with portfolios of at least $25,000 and 4.7 percentage points for those with portfolios of at least $100,000.

VI. Risk-Return Tradeoff for Concentrated Investors

Our analysis up to this point suggests that the stock holdings and trades of concentrated investors, particularly those with account balances large enough to diversify, if desired, earn superior returns (both in the absolute sense and, particularly, relative to the holdings and trades of diversified investors). In this section, we further explore the risk-return tradeoff of individuals' direct stock investments.

A. Sharpe Ratios of Household Portfolios of Directly-Held Stocks

To gauge the extent to which pursuing concentrated strategies affects the risk-return tradeoff, we once again consider the time series of monthly household portfolios returns for "concentrated" and "diversified" households. Consistent with our convention from previous sections, concentrated households are defined as those whose beginning of month portfolio contains one or two stocks, while diversified households are defined as those whose beginning of month portfolio contains three or more stocks. We calculate the Sharpe ratio[33] for each of the 44,144 households that have at least 24 months of household portfolio returns[34] as either a concentrated or a diversified household over the period from February 1991 to December 1996, and report the summary of the cross-sectional distribution in Panel A of Table 11.

Concentrated households' average monthly excess returns surpass those of the diversified households by 0.17 percentage points per month (similar in magnitude to the excess returns of

[33] The Sharpe ratio is defined as the ratio between the average excess return of a household's stock portfolio and the standard deviation of the excess return. The market portfolio corresponds to the value-weighted index of all companies included in the CRSP database.

[34] Requiring household returns for 24 months does not bias our results. In our sample, we find no evidence that individual investors systematically liquidated their positions because of poor performance. Specifically, in unreported analyses, we regress the probability of a household liquidating its account during the year on the household's prior one-year portfolio return separately for each year. In no year was there a significantly negative relation between the prior portfolio return and the probability of liquidating the account.

the holdings portfolios in Table 3).[35] The difference between the median stock-portfolio returns among concentrated households and the median stock-portfolio returns among diversified households is 0.09 percentage points per month (just above one percent per year). However, the average monthly standard deviation incurred in the stock portfolios held by concentrated households exceeds that of diversified household stock portfolios by a substantial margin. Indeed, the average monthly standard deviation incurred by concentrated households exceeds the one incurred by diversified households by 4.5 percentage points (difference in medians is 3.2 percentage points). The sheer fact that the concentrated stock portfolios consist of only one or two stocks almost mechanically implies that their idiosyncratic risk is much larger than the diversified stock portfolios' idiosyncratic risk.

The cross-sectional distributions of concentrated and diversified households' stock portfolio Sharpe ratios, presented in Panel A of Table 11, suggests that the increased portfolio risk offsets the larger portfolio returns, resulting in a poorer risk-return tradeoff for concentrated households: the average Sharpe ratio is 0.12 for concentrated investors, as compared to 0.17 for diversified investors.

B. Distribution of Net Worth According to the SCF

Sharpe ratios of the directly-held stock portfolios, however, are not relevant measures of total performance for households that hold substantial positions in other assets such as other equity (mutual funds), retirement accounts, fixed income, real estate, and human capital.

Indeed, an assessment of the marginal contribution that direct stock investments made to their households' overall risk-return profiles would require data on *overall* household portfolios. In the absence of such precise data concerning the overall asset holdings of households in our brokerage account sample, we resort to the Survey of Consumer Finances (SCF) to better understand how large these stock holdings likely are relative to *total* household net worth.

For the average household that owns one or two stocks, these stocks represent about ten percent of their overall net worth (both in 1992 and 1998)—a relatively small fraction. Specifically, in 1992 and 1998, the average percentage of net worth invested in directly held

[35] Restricting the sample to households with large account balance, as one would expect based on earlier results, yields a higher return differential between concentrated and diversified households, but reduces the sample of households considerably.

stocks for those investors who held one or two stocks was 8.2 and 11.8 percentage points, respectively.[36] As for the distribution of stock shares for diversified stock owners, the stock share of total net worth ranges from 15.9 (1992) to 18.7 (1998) percent of total net worth, about double the share for the average concentrated investor. Moreover, these calculations, based on the SCF, ignore annuitized wealth (that is, the present discounted value of future payments from defined benefit plans and Social Security) and the investors' human capital, both of which would further reduce the importance of investors' direct stock holdings relative to their total net worth.[37]

These statistics indicate that households with concentrated stock portfolios seem to reduce their total risk exposure by diversifying across various asset classes, and appear to do so, on average, to a larger extent than the households with diversified stock portfolios do (as witnessed by larger weights of directly-held stocks in diversified portfolios).

C. Assessing Concentrated and Diversified Households' Information Ratios

In light of the relatively low weights of directly-held stock investments in overall household portfolios (as proxied for by the breakdown of net worth available from the SCF), an appropriate risk-return measure that aims at assessing the welfare implications of holding concentrated positions should reflect the contribution of the directly-held stocks to a broader household portfolio. Although it is not feasible to model the exact breakdown of household net worth (we do not have that information for the investors in our brokerage data sample), we can compare the concentrated households' and diversified households' information ratios (ratios of risk-adjusted performance and idiosyncratic risk; see Treynor and Black (1973)) and thus obtain a rough assessment of which group of investors, on average, produces better "active" portfolios that would be desirable additions to a substantial position in the total stock market.

As before, concentrated (diversified) households are defined as those whose beginning-of-month portfolio contains one or two (three or more) stocks. The information ratios are calculated for each of the 44,144 households that have at least 24 months of household portfolio

[36] If weighted by households' net worth, these averages are 5.9 and 10.2 percentage points, respectively.

[37] Using the Health and Retirement Study (HRS), Poterba, Rauh, Venti, and Wise (2003) estimate the wealth holdings of households with a male at retirement age (i.e., between 63 and 67). Annuitized wealth is $240,800 for the median household with less than a high school education and $375,500 for those with at least a college degree.

returns as either a concentrated of a diversified household over the period from February 1991 to December 1996.

Panels B and C of Table 11 present cross-sectional distributions of information ratios of concentrated and diversified household stock portfolios. Panel B is based upon a single-factor model, whereas Panel C is based on the four-factor model (Carhart (1997)). In short, concentrated portfolios' information ratios are larger than diversified portfolios' ones. This is true of the cross-sectional mean (the difference between the two means is 0.025 in Panel B and 0.016 in Panel C), as well as all the major quantiles of the distribution.

This evidence, together with the fact that diversified households commit larger fractions of their total household net worth to directly-held stocks than concentrated households do, suggests that concentrated households' stock holdings might deliver risk-return tradeoffs that, when combined with the rest of their *total* portfolios, are superior to those of their more diversified counterparts. Of course, the relative contributions directly-held stock portfolios of concentrated and diversified households, based on information ratios, depend on the extent to which the benchmarks employed in Panels B and C constitute a reasonable representation of what goes on in the unobservable remainder of household portfolios. Nonetheless, the superiority of concentrated portfolios' information ratios suggests that concentrated households potentially could generate better combinations of their directly-held stocks and the remainders of their portfolios than their more diversified counterparts.

Unfortunately, data limitations preclude more precise statements and a definitive assessment of the welfare implications of concentration. However, the analyses we present in this section portray plausible scenarios under which well-informed investors could choose to hold highly concentrated portfolios of directly-held stocks and succeed in attaining favorable risk-return tradeoffs of their overall portfolios, of which directly-held stocks constitute a relatively small fraction.

VII. Conclusion

This study provides a detailed insight into the relation between portfolio concentration and the performance of individual investors. As found by Odean (1998, 1999) and Barber and Odean (2000, 2001), many individual investors make poor investment decisions (e.g., the stocks they purchase underperform the stocks they sell). However, our results indicate that, among

households with portfolios large enough to diversify among many stocks, *if desired*, the holdings and trades made by those focusing their attention on a few securities tend to perform significantly better than the investments made by those diversifying across many stocks.

A particularly compelling result is that the trades made by concentrated households outperform the trades made by diversified households even after adjusting for household fixed effects, that is, after controlling for households' average investment abilities. Moreover, we find that the performance of the trades made by households that become more concentrated improves, whereas that of the trades made by households that become less concentrated deteriorates. We also find that the "return to concentration" appears to be the strongest for the stocks that likely have greater information asymmetries. Indeed, the "return to locality" for individual investors documented in Ivković and Weisbenner (2005) and Massa and Simonov (2006) seems to be largely driven by the performance of the local investments made by concentrated investors.

Our robustness tests suggest that the "return to concentration" results are not driven by specialization in a particular industry, inside information, broad market timing, repeated trades in a particular stock, or regional differences across investors. Rather, the results seem to reflect that wealthy households who concentrate their holdings in a few stocks tend to have the ability to identify superior stock picks.

Another issue is whether these investments add value for a particular investor in the mean-variance sense. Whereas concentrated household portfolios on average outperform diversified ones, their levels of total risk are larger and the Sharpe ratios of their stock portfolios are lower. However, given that household surveys find that directly-held stock investments likely represent only ten percent of total net worth for the typical concentrated stockowner (and about twenty percent for the typical diversified stockowner), a more pertinent finding is that concentrated households' information ratios, on average, are superior to diversified households' information ratios. This suggests that concentrated households' stock holdings might deliver risk-return tradeoffs that, when combined with the rest of their *total* portfolios, are superior to those of their more diversified counterparts.

Table 1: Summary Statistics of Distribution of Portfolio Value, Number of Stocks, and Herfindahl Index by Portfolio Size

The table summarizes the distribution of portfolio values, the number of the stocks held, and the portfolio Herfindahl Index for households with portfolios of various sizes. The statistics are based on seven end-of-year cross-sectional snapshots of portfolio holdings (the two exceptions to this convention are the January 1991 and November 1996 snapshots, used because portfolio holdings for December 1990 and December 1996 are not covered by the data). The Herfindahl Index is defined as $HI_h = \sum(w_{h,i})^2$ (where $w_{h,i}$ is the weight of stock i held by household h at time t). The table also reports the proportion of households holding two or fewer stocks and the proportion of portfolios invested in S&P 500 and local stocks (i.e., stocks of corporations headquartered within 50 miles from the household).

	All Households			*Portfolio at Least $25,000*			*Portfolio at Least $100,000*		
	Portfolio Value ($)	No. of Stocks	Herf. Index	Portfolio Value ($)	No. of Stocks	Herf. Index	Portfolio Value ($)	No. of Stocks	Herf. Index
Mean	45,604	3.9	0.62	119,130	7.0	0.43	322,035	11.7	0.33
(std. dev.)	(234,902)	(5.2)	(0.33)	(398,442)	(7.7)	(0.31)	(744,697)	(12.1)	(0.30)
Percentiles									
10th	2,243	1.0	0.18	28,425	1.0	0.11	110,250	2.0	0.07
25th	5,750	1.0	0.33	35,018	3.0	0.18	130,538	4.0	0.11
50th	13,865	2.0	0.56	53,492	5.0	0.32	184,000	9.0	0.21
75th	34,700	5.0	1.00	103,441	9.0	0.61	313,677	16.0	0.46
90th	86,625	8.0	1.00	228,187	14.0	1.00	588,900	24.0	0.93
% of HHs holding two or fewer stocks		52.9			24.3			13.4	
% of holdings in S&P 500 stocks		53.2			56.7			59.3	
% of holdings in local stocks		14.7			13.1			11.1	
% of holdings in non-S&P 500, local stocks		7.6			6.3			5.1	
# HH-year observations		268,734			88,836			23,073	
# HH-stock-year observations		1,046,282			618,756			269,298	

Table 2: Comparison of Stock Portfolio Size and Concentration in Sample with Survey of Consumer Finances

The table presents a comparison between stock portfolio values and the number of stock holdings in the discount brokerage sample and the Survey of Consumer Finances (SCF) for households with various initial portfolio levels. The two reported comparisons are between the December 1992 sample and the 1992 SCF and between the November 1996 sample and the 1998 SCF. For direct comparison with the SCF, the table reports stock holdings only in taxable accounts for the brokerage house sample.

Panel A: Comparison of 12/1992 Sample with 1992 Survey of Consumer Finances						
	All Households		*Portfolio at least $25,000*		*Portfolio at least $100,000*	
	Sample	SCF	Sample	SCF	Sample	SCF
Portfolio Value ($)						
Mean	*45,887*	*66,810*	*117,670*	*213,145*	*306,941*	*465,515*
25th percentile	5,700	2,000	35,749	35,000	129,925	120,000
50th percentile	14,250	8,000	54,650	70,000	181,808	181,000
75th percentile	36,425	30,000	105,631	150,000	306,988	400,000
Number of Stocks						
Mean	*4.0*	*4.0*	*7.1*	*8.6*	*11.8*	*12.4*
25th percentile	1.0	1.0	3.0	3.0	4.0	4.0
50th percentile	2.0	2.0	5.0	6.0	9.0	10.0
75th percentile	5.0	4.0	9.0	10.0	15.0	15.0
Percent hold 1-2 stocks	*51.6*	*61.8*	*24.5*	*21.4*	*14.6*	*14.1*
Panel B: Comparison of 11/1996 Sample with 1998 Survey of Consumer Finances						
	All Households		*Portfolio at least $25,000*		*Portfolio at least $100,000*	
	Sample	SCF	Sample	SCF	Sample	SCF
Portfolio Value ($)						
Mean	*91,503*	*160,697*	*189,350*	*351,327*	*445,079*	*783,228*
25th percentile	6,490	4,000	39,354	45,000	141,037	150,000
50th percentile	20,974	18,000	66,984	70,000	214,475	251,000
75th percentile	60,473	63,000	148,748	175,000	401,261	600,000
Number of Stocks						
Mean	*4.8*	*5.7*	*7.8*	*9.8*	*12.3*	*15.6*
25th percentile	1.0	1.0	3.0	3.0	5.0	4.0
50th percentile	3.0	2.0	5.0	6.0	9.0	10.0
75th percentile	6.0	6.0	10.0	11.0	16.0	20.0
Percent hold 1-2 stocks	*47.8*	*51.4*	*22.5*	*23.9*	*11.4*	*17.6*

Table 3: Raw and Risk-Adjusted Monthly Portfolio Returns, Concentrated vs. Diversified Holdings

The table reports raw and risk-adjusted returns (alphas) to zero-cost portfolios formed on the basis of aggregate household portfolio concentration levels. Households are classified as concentrated (if they hold one or two stocks) and diversified (if they hold three or more stocks). For each portfolio, the monthly returns are computed by value-weighting the returns corresponding to all the stock holdings at the end of the previous month by the size of their positions (for all the households that meet the portfolio inclusion criterion that month). This process is repeated for each of the 71 months of the sample period. Risk-adjusted monthly returns are calculated from a four-factor model, which accounts for the three Fama-French (1993) factors (market, size, and book-to-market factors), as well as the momentum factor (Carhart (1997)). Standard error computation follows the Newey-West correction and takes into account autocorrelation up to three lags. Results, expressed in percentage points, are presented for all households, households with portfolio positions of at least $25,000, and households with portfolio positions of at least $100,000 at the end of the prior month.

	All Households			Household Portfolio at Least $25,000			Household Portfolio at Least $100,000		
	Concentrated	Diversified	Difference	Concentrated	Diversified	Difference	Concentrated	Diversified	Difference
Raw return	1.50*** (0.38)	1.36*** (0.34)	**0.14 (0.10)**	1.53*** (0.38)	1.35*** (0.34)	**0.18* (0.11)**	1.74*** (0.41)	1.36*** (0.34)	**0.38** (0.19)**
Alpha	0.15 (0.13)	–0.01 (0.08)	**0.16* (0.09)**	0.18 (0.15)	–0.01 (0.08)	**0.19* (0.11)**	0.41* (0.23)	–0.00 (0.08)	**0.41** (0.20)**
Market	1.11*** (0.04)	1.09*** (0.03)	0.02 (0.03)	1.11*** (0.05)	1.08*** (0.03)	0.03 (0.04)	1.09*** (0.07)	1.08*** (0.03)	0.01 (0.06)
Size	0.30*** (0.07)	0.13*** (0.05)	0.17*** (0.03)	0.26*** (0.07)	0.11** (0.05)	0.16*** (0.04)	0.29*** (0.09)	0.07 (0.04)	0.22*** (0.06)
Book-to-Market	–0.09 (0.08)	–0.08* (0.04)	–0.02 (0.05)	–0.15* (0.08)	–0.09** (0.04)	–0.06 (0.05)	–0.24** (0.11)	–0.10*** (0.03)	–0.14* (0.08)
Momentum	–0.15*** (0.05)	–0.07** (0.03)	–0.07** (0.03)	–0.10* (0.06)	–0.06** (0.03)	–0.04 (0.04)	–0.06 (0.08)	–0.04 (0.03)	–0.02 (0.07)

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 4: Risk-Adjusted Monthly Portfolio Holding Returns by Concentration and Investment Type (S&P 500 Status and Locality)

The table reports risk-adjusted returns (alphas) to portfolios formed on the basis of aggregate household portfolio concentration levels, S&P 500 status of the stocks held in household portfolios, as well as the stocks' locality (the distance between the corporate headquarters and the household being less than 50 miles). Households are classified as concentrated (if they hold one or two stocks) and diversified (if they hold three or more stocks). The table also reports the estimates of the risk-adjusted returns to a zero-cost portfolio (its long position consists of the returns to the concentrated portfolio and its short position consists of the returns to the diversified portfolio). For each portfolio, the 71 monthly returns are computed by value-weighting the returns corresponding to all the stock holdings at the end of the previous month by the size of their positions (for all the households that meet the portfolio inclusion criterion that month). Risk-adjusted monthly returns are calculated from a four-factor model, which accounts for the three Fama-French (1993) factors (market, size, and book-to-market factors), as well as the momentum factor (Carhart (1997)). The computation of standard errors follows the Newey-West correction and takes into account autocorrelation up to three lags. Results, expressed in percentage points, are presented for all households (Panel A) and households with portfolio positions of at least $100,000 at the end of the prior month (Panel B). Each panel features portfolios based on all stocks, S&P 500 stocks, non-S&P 500 stocks, local stocks, non-local stocks, as well as the four interactions of S&P500 status and locality.

	All Stocks	S&P 500	Non-S&P 500	Local	Non-Local	S&P 500, Local	S&P 500, Non-Local	Non-S&P 500, Local	Non-S&P 500, Non-Local
Panel A: All Households									
Alpha, Concentrated	0.15 (0.13)	0.21 (0.13)	0.19 (0.22)	0.63 ** (0.30)	0.09 (0.14)	0.34 (0.24)	0.19 (0.14)	1.01 ** (0.52)	–0.10 (0.24)
Alpha, Diversified	–0.01 (0.08)	0.17 ** (0.09)	–0.31 * (0.17)	0.12 (0.19)	–0.00 (0.08)	0.30 * (0.17)	0.15 * (0.08)	–0.11 (0.29)	–0.32 ** (0.15)
Difference	**0.16 * (0.09)**	**0.04 (0.08)**	**0.50 *** (0.20)**	**0.51 * (0.28)**	**0.09 (0.08)**	**0.04 (0.11)**	**0.03 (0.09)**	**1.12 * (0.67)**	**0.22 (0.15)**
Panel B: Household Portfolio at Least $100,000									
Alpha, Concentrated	0.41 * (0.23)	0.24 (0.19)	0.88 * (0.49)	1.28 ** (0.57)	0.25 (0.25)	0.47 (0.36)	0.24 (0.23)	2.09 ** (1.05)	0.23 (0.46)
Alpha, Diversified	–0.00 (0.08)	0.16 * (0.08)	–0.31 * (0.18)	0.11 (0.21)	–0.00 (0.07)	0.30 * (0.18)	0.14 * (0.08)	–0.11 (0.35)	–0.31 * (0.16)
Difference	**0.41 ** (0.20)**	**0.08 (0.15)**	**1.20 ** (0.50)**	**1.17 ** (0.58)**	**0.25 (0.20)**	**0.17 (0.24)**	**0.10 (0.20)**	**2.20 * (1.24)**	**0.54 (0.39)**

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 5: Risk-Adjusted Zero-Cost Portfolio Holding Returns by Concentration and Measures of Information Asymmetry (in percent per month)

The table reports risk-adjusted returns (alphas) to zero-cost portfolios formed on the basis of aggregate household portfolio concentration levels and various measures of information asymmetry. Households are classified as concentrated (if they hold one or two stocks) and diversified (if they hold three or more stocks). The long position of each zero-cost portfolio consists of the returns to the concentrated portfolio and its short position consists of the returns to the diversified portfolio. For each portfolio, the 71 monthly returns are computed by value-weighting the returns corresponding to all the stock holdings at the end of the previous month by the size of their positions (for all the households that meet the portfolio inclusion criterion that month). Risk-adjusted monthly returns are calculated from a four-factor model, which accounts for the three Fama-French (1993) factors (market, size, and book-to-market factors), as well as the momentum factor (Carhart (1997)). The computation of standard errors follows the Newey-West correction and takes into account autocorrelation up to three lags. Results, expressed in percentage points, are presented for all households (Panel A) and households with portfolio positions of at least $100,000 at the end of the prior month (Panel B). Each panel features portfolios based on several measures of information asymmetry: S&P 500 membership status (the first column replicates regression estimates from the second and third columns of Table 4) and four measures based on analyst coverage (any analyst coverage, coverage by > 10 analysts, coverage by > 5 analysts, and coverage by > 3 analysts).

	Stock Belongs to S&P 500?	**Analyst Coverage**		
		Stock Covered by > 10 Analysts?	**Stock Covered by > 5 Analysts?**	**Stock Covered by > 3 Analysts?**
		Panel A: All Households		
Yes	0.04 (0.08)	0.02 (0.08)	0.03 (0.08)	0.04 (0.08)
No	0.50 *** (0.20)	0.69 *** (0.23)	0.95 *** (0.37)	1.16 *** (0.45)
		Panel B: Household Portfolio at Least $100,000		
Yes	0.08 (0.15)	0.05 (0.14)	0.08 (0.14)	0.09 (0.14)
No	1.20 ** (0.50)	1.65 *** (0.55)	2.14 *** (0.84)	2.72 *** (1.02)

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 6: Characteristics of Households' Yearly Stock Trades, Differences by Portfolio Concentration

The table summarizes the characteristics of the trades made by households with various portfolio values and concentration levels at the end of the year preceding the transaction. For each subsample, the first column summarizes the average characteristics for households that initially hold more than two stocks (i.e., the "Baseline") and the second column summarizes the differences between the average characteristics of concentrated (i.e., hold two or fewer stocks) and diversified households.

	All Households		*Portfolio < $25,000*		*Portfolio ≥ $25,000*		*Portfolio ≥ $100,000*	
	Baseline (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)
Panel A: Total Household-Level Stock Transactions During a Given Calendar Year								
% of HHs with at least one stock purchase during year	61.0	–24.5***	53.2	–17.6***	68.2	–27.1***	75.6	–28.7***
# of buys per HH (mean)	4.1	–2.8***	2.2	–1.0***	6.0	–3.8***	10.1	–6.2***
# of buys conditional on at least one purchase (mean)	6.8	–3.2***	4.1	–0.8***	8.8	–3.4***	13.3	–5.1***
Total buys conditional on purchase (median, $)	14,800	–4,988***	7,438	813***	27,063	6,413***	67,488	34,950***
Total buys – total sales given purchase (median, $)	1,988	763***	1,850	975***	2,300	–425**	3,663	–4,263***
Annualized turnover over next year (median, %)	16.3	-16.3***	14.6	-14.6***	17.9	-12.9***	17.3	-10.0***
Annualized turnover over next year (mean, %)	45.9	9.3***	42.0	11.2***	49.6	17.5***	52.0	28.1***

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 6: Characteristics of Households' Yearly Stock Trades, Differences by Portfolio Concentration (continued)

	All Households		*Portfolio < $25,000*		*Portfolio ≥$25,000*		*Portfolio≥$100,000*	
	Baseline (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)	**Baseline** (hold > 2 stocks)	**Difference** (when hold 1-2 stocks)
Panel B: Individual Stock Purchases								
Amount/purchase (median, $)	4,950	113***	2,750	1,375***	6,118	6,782***	8,938	17,313***
Locality, S&P Status								
% S&P 500	39.9	–0.4	37.4	1.8***	40.8	–0.2	40.9	0.3
% Local	13.1	5.1***	13.9	3.9***	12.7	6.8***	11.9	8.5***
% Local, S&P 500	4.4	1.6***	4.5	0.1***	4.4	2.2***	4.1	2.3**
% Non-Local, S&P 500	35.3	–2.4***	32.8	0.4	36.3	–4.1***	37.4	–5.5**
% Local, Non-S&P 500	8.6	3.5***	9.4	2.5***	8.3	4.6***	7.7	6.2***
% Non-Local, Non-S&P 500	51.7	–2.8***	53.3	–0.4***	51.0	–2.7**	50.8	–3.0
Size Quintiles								
% Bottom Size Quintile	17.5	0.2	21.6	–3.1***	16.2	–0.6	14.9	–2.2*
% 2nd Size Quintile	13.2	–0.1	14.0	–0.9***	12.9	0.2	12.9	0.8
% 3rd Size Quintile	12.3	0.6***	12.3	0.5**	12.3	0.7	12.3	1.4
% 4th Size Quintile	15.7	–0.6***	14.3	0.4*	16.1	–0.0	16.8	–0.8
% Top Size Quintile	41.3	–0.1	37.9	3.0***	42.5	–0.3	43.1	0.8
B/M Quintiles								
% Bottom B/M Quintile (G)	38.6	1.2***	37.7	1.5***	38.9	2.7***	39.2	5.8***
% 2nd B/M Quintile	17.9	–1.1***	17.7	–0.7***	18.0	–1.8***	18.1	–2.0**
% 3nd B/M Quintile	17.0	–0.9***	16.6	–0.2	17.1	–2.0***	17.4	–3.3***
% 4th B/M Quintile	14.2	0.5***	14.9	–0.1	14.0	0.7*	13.7	0.8
% Top B/M Quintile (V)	12.3	0.3	13.1	–0.5**	12.0	0.4	11.6	–1.2
Momentum Quintiles								
% Bottom Mom12 Quintile	22.0	2.0***	24.2	0.2	21.3	1.6***	20.1	1.6
% 2nd Mom12 Quintile	12.6	0.0***	13.1	–0.3	12.4	–0.6	12.1	–1.2
% 3nd Mom12Quintile	12.9	–0.4**	13.0	–0.4*	12.9	–0.8**	12.7	–1.3*
% 4th Mom12 Quintile	15.0	–0.7***	15.1	–0.5**	15.0	–1.3***	14.9	–1.8**
% Top Mom12 Quintile	37.4	–0.9***	34.6	1.0**	38.4	1.0	40.2	2.7
Industry								
% Technology	30.8	0.9*	27.4	3.1***	32.0	3.3***	33.6	8.0***
% Biotechnology / Medical	16.2	–0.8***	16.4	–0.5**	16.2	–1.8***	15.7	–3.3***
% Tech. or Biotech.	47.1	0.1	43.9	2.5***	48.2	1.5	49.4	4.7*
California								
% California	23.7	0.9	23.1	1.0*	23.9	2.1*	23.3	3.4

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 7: Summary of the Performance of Household Trades, Differences by Portfolio Concentration

The table summarizes the average one-year raw (Panel A) and excess (Panels B and C) returns following stock purchases and stock sales. In Panel B, excess returns are computed relative to the appropriate Fama and French (1992) portfolio, formed according to size and book-to-market deciles. In Panel C, excess returns are computed relative to the appropriate Daniel, Grinblatt, Titman, & Wermers (1997) and Wermers (2004) portfolio, formed according to size, book-to-market, and momentum quintiles. The table summarizes the performance of trades for households with various portfolio values at the end of the year preceding the transaction (all households, those with a stock portfolio value of less than $25,000, those with a stock portfolio value of at least $25,000, and, finally, households with a stock portfolio value of at least $100,000). For each subsample, the first column summarizes the performance of trades for households that initially hold one or two stocks ("Conc."), the second column summarizes the performance of trades for households that initially hold three or more stocks ("Div."), and the third column ("Diff.") summarizes the difference across the two groups of investors.

	All Households			*Portfolio < $25,000*			*Portfolio ≥ $25,000*			*Portfolio ≥ $100,000*		
	Conc.	Div.	Diff.	Conc.	Div.	Diff.	Conc.	Div.	Diff.	Conc.	Div.	Diff.
Panel A: Raw Returns One Year Following a Stock Trade (in percent)												
Return Following a Buy	14.8***	14.6***	**0.2**	14.2***	14.1***	**0.1**	16.8***	14.7***	**2.1*** **	17.7***	15.6***	**2.1*** **
Return Following a Sale	17.2***	16.9***	**0.3**	17.1***	16.9***	**0.2**	17.4***	16.8***	**0.5**	16.4***	17.0***	**–0.6**
Return Following Trades (Buy minus Sale)	–2.4***	–2.3***	**–0.1**	–2.9***	–2.8***	**–0.2**	–0.6	–2.1***	**1.5*** **	1.3	–1.4***	**2.7** **
Panel B: Excess Returns One Year Following a Stock Trade (in percent), Relative to Benchmark Formed Based on Size and Book-to-Market Deciles												
Return Following a Buy	–1.1	–1.8**	**0.7** **	–1.9***	–2.2***	**0.4**	1.3	–1.7**	**3.0*** **	2.2*	–1.1	**3.3*** **
Return Following a Sale	0.7	0.1	**0.6** **	0.5	0.2	**0.3**	1.1	0.0	**1.1** **	0.3	–0.0	**0.3**
Return Following Trades (Buy minus Sale)	–1.8***	–1.9***	**0.1**	–2.4***	–2.5	**0.1**	0.2	–1.7***	**1.9*** **	2.0	–1.1	**3.0*** **
Panel C: Excess Returns One Year Following a Stock Trade (in percent), Relative to Benchmark Formed Based on Size, Book-to-Market, & Momentum Quintiles												
Return Following a Buy	1.1**	0.1	**1.0*** **	0.4	0.3	**0.1**	3.3***	0.1	**3.2*** **	4.2***	0.6	**3.6*** **
Return Following a Sale	2.4***	1.6***	**0.8*** **	2.3***	2.1***	**0.1**	2.7***	1.4***	**1.3*** **	2.3*	1.3**	**1.0**
Return Following Trades (Buy minus Sale)	–1.2***	–1.4***	**0.2**	–1.8***	–1.8***	**–0.0**	0.6	–1.3***	**1.9*** **	1.9	–0.7**	**2.6** **

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 8: One-Year Stock Excess Returns Following Purchase or Sale and Household Portfolio Concentration at Prior-Year End

The table reports the estimates of regression specifications relating excess returns with household portfolio concentration levels (Equation (2)) for four samples of households (all households, as well as those with common stock portfolios less than $25,000, at least $25,000, and at least $100,000 at prior-year end, respectively). The excess returns are computed by subtracting the appropriate Fama and French (1992) benchmark portfolios formed according to size deciles and book-to-market deciles from the raw stock returns. Specifications also feature the interaction terms between the stocks' two-digit SIC codes and indicator variables for the 71 months during which a transaction could occur, and momentum effects, measured by the return of the stock during the previous 12 months, again interacted with indicator variables for the 71 months. The Herfindahl Index is defined as $HI_{h,y-1} = \sum(w_{h,i,y-1})^2$ ($w_{h,i,y-1}$ is the weight of stock i held by household h at the end of the year preceding the year in which the transaction took place). The "Buy indicator" variable ($BUY_{i,h,t}$ in Equation (2)) captures whether a transaction was a buy or a sell transaction. The first specification for each sample is exactly as in Equation (2). The second one also features separate household fixed effects for purchases and sales, respectively, thus controlling for the average stock-picking ability (both for purchases and sales) of the household. The "Buy indicator" variable ($BUY_{i,h,t}$ in Equation (2)) is not included in these regressions by itself, as it is absorbed in the household fixed effects. Standard errors, given in parentheses, take into account heteroskedasticity and cross-sectional correlation. All the returns are expressed in percentage points.

Variable	*All Households*		*Portfolio < $25,000*		*Portfolio ≥ $25,000*		*Portfolio ≥ $100,000*	
Buy indicator *(performance of buys – sells of diversified households)*	–1.6*** (0.3)	absorbed	–1.8*** (0.5)	absorbed	–1.8*** (0.3)	absorbed	–1.8*** (0.4)	absorbed
Herfindahl Index *(performance of sells of concentrated households relative to performance of sells of diversified households)*	0.1 (0.3)	0.3 (0.6)	–0.4 (0.5)	1.8** (0.9)	0.5 (0.5)	–1.6 (1.1)	–1.1 (0.8)	–5.6** (2.6)
Buy indicator * Herfindahl ***(performance of buys – sells of concentrated households relative to performance of buys – sells of diversified households)***	**0.8**** **(0.4)**	**2.4***** **(0.7)**	**0.5** **(0.6)**	**0.3** **(1.3)**	**2.4***** **(0.6)**	**3.8***** **(1.2)**	**4.8***** **(1.1)**	**3.2** **(3.2)**
Household Fixed Effects, Separately for Buys and Sales, Included?	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	1,091,385		412,526		678,859		309,671	

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 9: One-Year Excess Returns Following Transactions, Differential Between Purchases and Sales, Interaction with S&P 500 Status and Locality of Stock

The table reports the estimates of the regression specification relating returns and concentration levels (Equation (2)). The dependent variable is the excess return of stock *i* purchased or sold by household *h* at time *t* during the subsequent year ($X_{i,h,t+1 \text{ to } t+12}$). The excess returns are computed by subtracting the appropriate Fama and French (1992) benchmark portfolios formed according to size deciles and book-to-market deciles from the raw stock returns. The specification also include the interaction terms between the two-digit SIC codes and indicator variables for the 71 months during which a transaction could occur, and momentum effects, measured by the return of the stock during the previous 12 months, again interacted with indicator variables for the 71 months. The Herfindahl Index is defined as $HI_{h,y-1} = \sum(w_{h,i,y-1})^2$ ($w_{h,i,y-1}$ is the weight of stock *i* held by household *h* at the end of the year preceding the year in which the transaction took place). The indicator variable $BUY_{i,h,t}$ captures whether a transaction was a buy (as opposed to a sell) transaction. The table presents our measure of the return to concentration, β_2 (the regression coefficient associated with Buy indicator * Herfindahl), for various samples of transactions formed on the basis of the stock's S&P 500 status and the locality to the investor. Stocks headquartered within 50 miles of the investor are classified as local stocks. The standard errors, given in parentheses, take into account heteroskedasticity and cross-sectional correlation. All the returns are expressed in percentage points.

Sample	All Stocks (given know HH Location)	S&P 500	Non-S&P 500	Local	Non-Local	S&P 500, Local	S&P 500, Non-Local	Non-S&P 500, Local	Non-S&P 500, Non-Local
All Households	1.4*** (0.5)	0.4 (0.5)	2.4*** (0.8)	5.0*** (1.5)	0.8 (0.5)	1.3 (1.1)	0.0 (0.5)	6.9*** (2.3)	1.7** (0.8)
Portfolio Less than $25,000	1.1 (0.8)	–0.1 (0.6)	2.0 (1.2)	4.3** (2.0)	0.7 (0.7)	2.4 (2.0)	–0.7 (0.6)	4.7 (3.0)	1.8 (1.2)
Portfolio at Least $25,000	3.2*** (0.8)	1.3* (0.7)	4.8*** (1.4)	8.6*** (3.1)	2.1*** (0.7)	1.9 (2.0)	1.2* (0.7)	13.0*** (5.0)	3.0** (1.3)
Portfolio at Least $100,000	5.7*** (1.5)	1.2 (1.0)	9.5*** (2.7)	11.6* (6.8)	4.5*** (1.5)	–1.1 (3.2)	1.6 (1.0)	18.0* (10.2)	7.4*** (2.6)

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 10: Sensitivity of Return to Concentration to Specific Stocks and Non-Stock Holdings

The table reports the estimates of the regression specification relating returns and concentration levels (Equation (2)) for various subsamples. The dependent variable is the excess return of stock *i* purchased or sold by household *h* at time *t* during the subsequent year ($X_{i,h,t+1 \text{ to } t+12}$). The excess returns are computed by subtracting the appropriate Fama and French (1992) benchmark portfolios formed according to size deciles and book-to-market deciles from the raw stock returns. The specification also includes the interaction terms between the two-digit SIC codes and indicator variables for the 71 months during which a transaction could occur, and momentum effects, measured by the return of the stock during the previous 12 months, again interacted with indicator variables for the 71 months. The Herfindahl Index is defined as $HI_{h,y-1} = \sum(w_{h,i,y-1})^2$ ($w_{h,i,y-1}$ is the weight of stock *i* held by household *h* at the end of the year preceding the year in which the transaction took place). The table reports estimates of the "return to concentration," that is, differential returns following trades (purchases minus sale returns) of completely concentrated households relative to completely diversified households ("Buy * Herfindahl"). The first row displays differential returns for the full sample across various portfolio-value cutoffs. Rows (2) and (3) present differential returns for the subsamples of households that hold, or do not hold, assets other than common stocks with this brokerage house. The next two rows display differential returns for subsamples of households based on the ratio of their initial stock portfolio in the sample to their self-reported net worth when they opened a brokerage account (about one-third of the sample households provided this net-worth estimate). Rows (6) and (7) replace a stock's excess return the year following a trade with either the overall market return or the return of the appropriate portfolio based on size, book-to-market, and momentum quintiles. The last three rows feature differential returns for the subsamples that exclude stocks according to three criteria: largest transactions, largest (smallest) subsequent returns, and largest number of transactions. The standard errors, given in parentheses, take into account heteroskedasticity and cross-sectional correlation. All the returns are expressed in percentage points.

Sample	*All Households*	*Portfolio Less than $25,000*	*Portfolio at Least $25,000*	*Portfolio at Least $100,000*
(1) Full Sample	0.8**	0.5	2.4***	4.8***
	(0.4)	(0.6)	(0.6)	(1.1)
(2) Household holds assets other than common stocks (e.g., mutual funds)	–0.1	0.5	0.8	3.5***
	(0.5)	(0.8)	(0.8)	(1.4)
(3) Household holds only common stocks	2.1***	0.6	4.6***	7.2***
	(0.6)	(1.0)	(0.9)	(1.8)
(4) Households with initial stock portfolio less than 50% of net worth	0.7	0.6	2.0	5.4**
	(0.7)	(1.0)	(1.3)	(2.7)
(5) Households with initial stock portfolio at least 50% of net worth	5.0***	8.3	5.6***	8.4***
	(1.6)	(5.5)	(1.8)	(2.7)
(6) Replace stock's excess return with market return	–0.3***	–0.6***	–0.3**	–0.3
	(0.1)	(0.1)	(0.1)	(0.2)
(7) Replace stock's excess return with appropriate portfolio return	–0.8***	–0.8*	–0.9**	–1.2**
	(0.3)	(0.5)	(0.4)	(0.5)
(8) Exclude stock(s) that had the largest (in $) purchase and/or sale	0.2	1.0	1.3**	3.1**
	(0.4)	(0.6)	(0.7)	(1.3)
(9) Exclude stock(s) that had the largest (smallest) return purchase (sale)	0.2	0.6	1.3**	3.8***
	(0.4)	(0.6)	(0.6)	(1.0)
(10) Exclude stock(s) that had the largest number of purchases and/or sales	0.3	0.6	1.5**	4.0***
	(0.5)	(0.9)	(0.8)	(1.4)

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 11: Household Stock Portfolio Sharpe Ratios and Information Ratios by Portfolio Concentration

The table presents cross-sectional distributions of Sharpe ratios in Panel A (ratios of returns in excess of the risk-free rate and the standard deviations of returns) and information ratios in Panels B and C (ratios of risk-adjusted returns and idiosyncratic standard deviations of returns based on the single-factor model and the four-factor model, respectively) of concentrated and diversified household stock portfolios. Concentrated (diversified) households are defined as those whose beginning-of-month portfolio contains one or two (three or more) stocks. The ratios are calculated for each of the 44,144 households that have at least 24 months of household portfolio returns as either a concentrated of a diversified household over the period from February 1991 to December 1996.

Distribution	*Concentrated Households*	*Diversified Households*	*Difference*
	Panel A: Sharpe Ratios		
Mean	**0.121**	**0.168**	**–0.047*****
95th %	0.396	0.412	–0.017***
90th %	0.328	0.358	–0.030***
75th %	0.231	0.268	–0.037***
Median	*0.125*	*0.173*	*–0.048****
25th %	0.015	0.069	–0.054***
10th %	–0.093	–0.031	–0.062***
5th %	–0.164	–0.095	–0.069***
	Panel B: Information Ratios, Single-Factor Model		
Mean	**0.010**	**–0.015**	**0.025*****
95th %	0.290	0.276	0.014***
90th %	0.226	0.206	0.020***
75th %	0.122	0.100	0.022***
Median	*0.012*	*–0.010*	*0.022****
25th %	–0.101	–0.129	0.028***
10th %	–0.209	–0.242	0.031***
5th %	–0.279	–0.315	0.036***
	Panel C: Information Ratios, Four-Factor Model		
Mean	**0.014**	**–0.002**	**0.016*****
95th %	0.337	0.327	0.010***
90th %	0.263	0.251	0.012***
75th %	0.144	0.131	0.013***
Median	*0.013*	*0.001*	*0.012****
25th %	–0.111	–0.128	0.017***
10th %	–0.235	–0.255	0.020***
5th %	–0.323	–0.344	0.019***

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

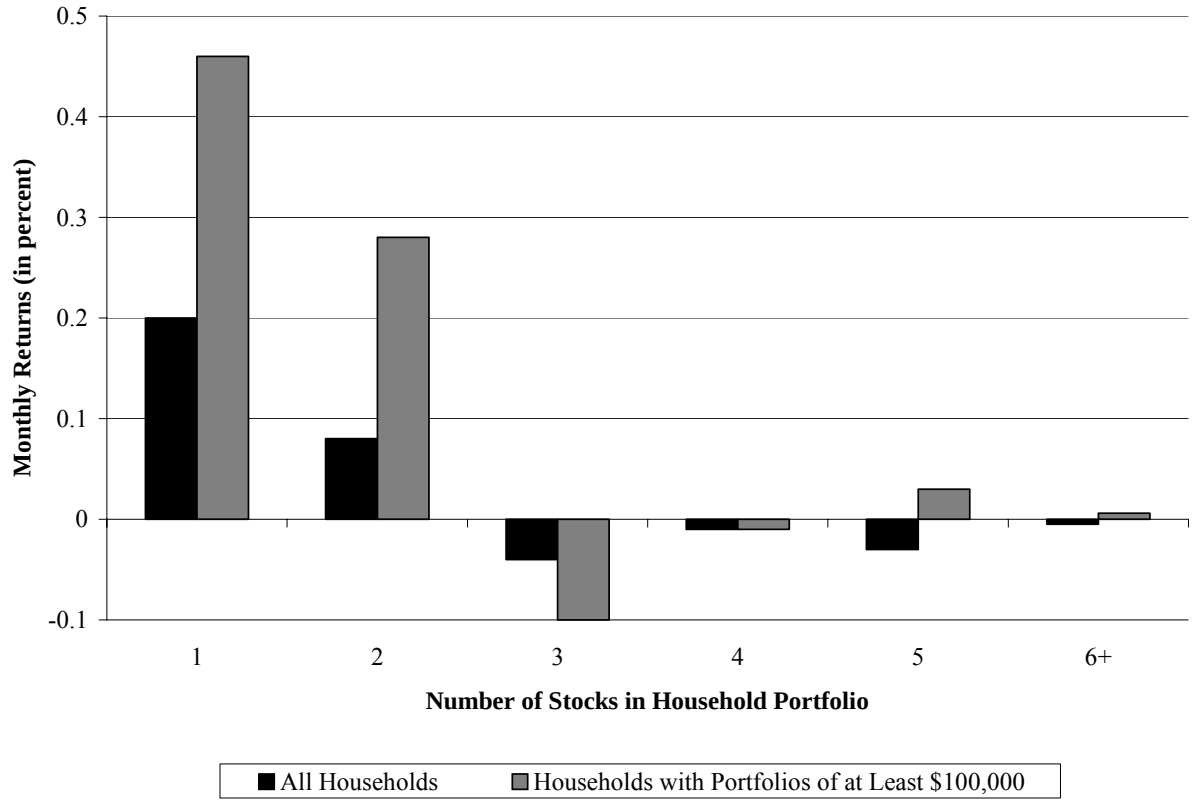

Figure 1: Monthly Risk-Adjusted Portfolio Returns by the Number of Stocks Held

The figure depicts the risk-adjusted returns (alphas) of portfolios formed according to the number of stocks in households' brokerage accounts. For each portfolio, the monthly returns are computed by value-weighting the returns corresponding to all the stock holdings at the end of the previous month by the size of their positions (for all the households that meet the portfolio inclusion criterion that month). This process is repeated for each of the 71 months of the sample period. Risk-adjusted monthly returns are calculated from a four-factor model, which accounts for the three Fama-French (1993) factors (market, size, and book-to-market factors), as well as the momentum factor (Carhart (1997)):

$$(1) \qquad R_{i,t} - R_{F,\,t} = \alpha_i + \beta_{i,M}(R_{M,t} - R_{F,t}) + \beta_{i,S}\,SMB_t + \beta_{i,V}\,HML_t + \beta_{i,m}\,MOM_t + e_{i,t},$$

where the dependent variable is the return on portfolio i in month t minus the risk-free rate, and the independent variables are given by the returns of the standard four zero-cost factor portfolios. The intercept of the model, α_i, is the measure of risk-adjusted performance. The computation of standard errors follows the Newey-West correction and takes into account autocorrelation up to three lags. The results, expressed in percentage points, are summarized for all households (black bars) and for the households whose account values are at least $100,000 at the end of the previous month (gray bars).

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