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A Stock Holdings Perspective

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Changing Institutional Preferences and Investment Performance: A Stock Holdings Perspective

Abstract

Institutional investors have rapidly increased their percentage holdings of US equities in recent years. In this paper we update previous research on the nature of institutional stock ownership, extending the evidence by twelve years to the end of 2008. In contrast to previous research, we find that institutions, and particularly hedge funds, have increased their holdings of smaller stocks and decreased their holdings of larger stocks over this period. Institutions as a whole now underweight the largest stocks and overweight the smallest stocks relative to market weights. We examine the implications of these patterns in institutional stock ownership for institutional investment performance.

1. Introduction

The proportion of equities managed by institutional investors hovered around five percent from 1900 to 1945. But after World War II, institutional ownership started to increase, reaching 68 percent by the end of 2008. The importance of institutional investors to the economy has led to an extensive academic literature documenting the overall growth in their assets as well as the changing composition of the types of stocks in which they invest. For example, the Institutional Study Report of the Security and Exchange Commission (1971) finds that institutional equity holdings "tend to be concentrated in the shares of the larger, publicly traded corporations." (vol 1, p. ix). The more recent analyses of Del Guercio (1996), using data from 1988 through 1991, and Falkenstein (1996), using data from 1991 through 1992, reach similar conclusions. In an often-cited paper, Gompers and Metrick (2001) conclude that institutions overweight their allocations in "larger, more liquid stocks" and have gradually increased this allocation over the years 1980 through 1996. Bennett, Sias and Starks (2003) also find that institutions overweighted large-cap stocks throughout the period 1983 to 1997, but unlike Gompers and Metrick (2001), they conclude that this overweighting decreased in the second half of their sample period. In conformity with these studies, the profession appears to have accepted as a stylized fact that institutions prefer larger, more liquid stocks, and that this preference has increased over time. (See, for example, Campbell, Ramadorai and Schwartz (2009), p. 67).

In the first half of this paper, we use the Thomson 13f institutional holdings file to analyze trends in institutional stock ownership over the period 1980-2008, thereby extending the evidence by eleven years. We examine institutional portfolio allocations across equal-value market-cap deciles[1] and find, contrary to the conventional wisdom, that institutional investors since 1980 have decreased, *not increased,* their holdings in larger stocks and have increased, *not decreased,* their holdings in smaller stocks. Specifically, over the last three decades institutions as a whole gradually increased their portfolio allocations to the stocks that make up the smallest ten percent of the value of the market – from 3.5 percent in 1980 to 10.4 percent in 2008 – and now overweight these smallest stocks relative to market weights. Further, institutions as a whole

[1] Each equal-value decile contains approximately ten percent of the total value of the stock market. In contrast, the market values in the equal-number deciles, which the academic literature typically uses, are skewed with about 80 percent of the market value of all stocks in the largest decile and the remaining 20 percent in the other nine deciles. It is important to note that our findings are not dependent on how the market-cap deciles are constructed – our results using equal-value deciles are consistent with those using equal-number deciles. However, the results using equal-value deciles reveal significant differences in changes in institutional holdings among the largest stocks, which make up the bulk of the market; these changes are not discernable with equal-number deciles, which group these largest stocks into one decile. We discuss these issues in more detail in sections 3.1 and 4.1.

have over time decreased their portfolio allocations to the largest stocks, and at the end of 2008 collectively underweighted those stocks that make up the largest 40 percent of the value of the market.

We also show that even though these trends apply to institutions of all sizes, they are more pronounced for smaller institutions. In addition, for the shorter eleven-year period from 1998 through 2008, we find that hedge funds exhibited a greater shift towards smaller-cap stocks than non-hedge institutions of comparable size.

In the second half of the paper we use the 13f data to explore the implications of these changes in the composition of institutional holdings for the performance of institutionally-managed portfolios. This is in the spirit of Grinblatt and Titman (1989), Daniel, Grinblatt, Titman and Wermers (1997), Wermers (2000) and others who exploit mutual fund portfolio weights to analyze investment performance. Our initial examination of the data finds two types of data errors in two quarters during 1999 and 2000 in the Thomson 13f database, which result in substantial upward biases in returns computed from the Thomson data for these quarters. These quarters coincide with the tech bubble and the high returns associated with hedge funds during that period (e.g., Brunnermeier and Nagel (2004)). After correcting for these inaccuracies, the extremely large returns in 1999 and 2000 vanish. All of the analyses in this paper correct for these data errors.

The first part of our analysis of investment performance examines whether institutions invest more heavily in stocks with the highest future returns and, as a mirror image, stocks with the lowest future returns. This analysis is similar to that of Cohen, Polk and Silli (2009), who show that the "best ideas" of mutual fund managers, defined as those stocks in the portfolio with the largest weights relative to market weights, generate statistically and economically significant positive risk-adjusted returns.[2] We find that hedge funds, and to a lesser extent smaller non-hedge funds, overweight relative to market weights those stocks with both extremely high and extremely low future returns.

Whether or not we control for firm characteristics such as market cap, book to market ratios and momentum, we find that the hedge fund overweight of stocks in the decile of highest

[2] See also Cremers and Petajisto (2009) who examine differences between portfolio and benchmark weights to compute a measure of "activeness" of a portfolio. Note that Cohen, Polk and Silli (2009) and Cremers and Petajisto (2009) use the Thomson mutual fund holdings data, whereas we use the aggregated institutional holdings data as reported on 13f filings. Recent studies that use the 13f data to examine institutional investment strategies and performance include Bennett, Sias and Starks (2003), Brunnermeier and Nagel (2004), Cohen, Gompers and Vuolteenaho (2002), DelGuercio (1996), Gompers and Metrick (2001), and Lewellen (2009).

returns in the following quarter is significantly larger than their overweight of stocks with the lowest returns. Consistent with these results, we find weak evidence that hedge funds exhibit positive risk-adjusted returns, where the risk-adjustment is a four-factor model. For other institutional investors, both large and small, we find no evidence of positive risk-adjusted returns, which is consistent with both prior literature and our analyses of overweighting of stocks in the deciles of both highest and lowest future returns.

In the second part of our analysis of investment performance we find that some individual institutions, primarily the smallest institutions and hedge funds, engage in style timing. We reach this conclusion through a test of the stationarity over time of the coefficients on size, value, and momentum factors in a four-factor model for individual institutions. For smaller institutions, we present weak evidence that for some time periods these style shifts added more value than chance would suggest.

The paper is organized as follows. In Section 2, we describe our data. In Section 3, we document trends in institutional ownership of common stocks over the period 1980 to 2008, and show that institutional stock allocations have shifted toward smaller-cap stocks. In Section 4 we reconcile our results with results from previous research, and also highlight the differences between our definition of equal-capitalization deciles and other decile definitions, including that used by CRSP. In Section 5, we use the 13f data to explore the implications of our documented changes in the composition of institutional holdings for institutional investment performance – aggregated over all institutions, disaggregated by size of institution, and also separately for hedge funds. In Section 6, we conclude the paper.

2. Data

Any financial institution exercising discretionary management of investment portfolios over $100 million in qualified securities is required to report those holdings quarterly to the SEC using Form 13f. Qualified securities include stocks listed for trading in the US, among other securities. These filings, compiled quarterly by Thomson/CDA and available through Wharton Research Data Services (WRDS), are the source of the stock holdings used in this study for the period 1980 to 2008. To examine the holdings and investment performance of hedge funds separately, we used several sources to compile a list of hedge funds, as described in detail in Section 3.3. It should be noted that the use of holdings data avoids the selection and survivor biases that occur in hedge fund return databases (see Griffin and Xu (2009) for a discussion of these issues, and for a list of references.)

We merge the holdings data with accounting and market data from Compustat and the CRSP monthly file, both available through WRDS, using the concurrent CUSIP number. Our analysis includes all common stocks and Real Estate Investment Trusts (REITs) listed on US markets, as determined by the CRSP share codes 10, 11, 12, 18, 48, and 72. We exclude American Depository Receipts (ADRs), Exchange Traded Funds (ETFs), and closed-end investment companies. ETFs and closed-end investment companies can be viewed as pass-through vehicles of liquid assets including common stock and are similar to mutual funds; including these companies would distort our analysis of institutional ownership. Because the focus of this study is investments in US stocks by institutional investors, we exclude ADRs as they represent investments in foreign companies.

3. Trends in Institutional Stock Ownership

This section updates previous research on the types of stocks owned by institutions, extending the evidence by eleven years to the end of 2008, a period of considerable change in equity markets. We begin with an analysis of the aggregate holdings of all institutions by market value and, like other studies, find an increase in institutional stock ownership. In contrast to most previous research, however, we find that institutions have gradually increased their holdings of smaller stocks and decreased their holdings of larger stocks relative to market weights (Section 3.1). In addition, we find that the ownership shift toward smaller-cap stocks is evident for all institutions regardless of size, although the pattern is more pronounced for smaller than for larger institutions (Section 3.2). The hedge funds in our sample, which fall almost exclusively in the smallest quartile of institutional size, exhibited the greatest shift toward smaller-cap stocks during the last twelve years (Section 3.3).

3.1. The Distribution of Stock Ownership: All Institutions

We begin by partitioning US equities into ten equal-capitalization deciles (hereafter, equal-cap deciles). Specifically, for each quarter during the period 1980 to 2008, we rank all US equities in our sample by their quarter-end market values and assign to the first decile the largest stocks whose combined market value is less than or equal to ten percent of the total market value of all stocks. Because of the granularity of market values, the combined market value of the stocks in our top decile is very likely to be less than ten percent of the total market value of all equities. To adjust for this possibility, we assign to the second decile the next largest equities whose total market value combined with those in the first decile is less than or equal to twenty percent of the total market value. We then repeat this process for the remaining eight deciles. This approach differs substantially from that used by most researchers when constructing market-cap deciles and by CRSP when constructing its US Market Cap-Based Portfolios. Those alternative approaches focus on the number of securities in each decile, rather than the market value of the stocks in each decile. As shown below, the stratification we use highlights more clearly deviations from market portfolio weights, especially for larger stocks.

To analyze the distribution of stocks by equal-cap deciles, we calculate summary statistics at yearend 1980 and yearend 2008 for all stocks and for all institutional holdings, and report these in Table 1. We first turn to the total value of the entire stock market and the total value of stocks held by all institutions, reported in the rightmost column. The total market value of all stocks as of 1980 was $1.4 trillion, of which institutions held $493 billion, or 36 percent. By 2008, the total market value of all stocks had increased to $11.4 trillion, of which institutions held $7.8 trillion, or 68 percent. Over these years, the percentage ownership by institutions almost doubled. Previous studies documented gradual growth in institutional ownership of common stocks following World War II, and this trend continues during our sample period.

We find that much of the value of the stock market is highly concentrated in a limited number of stocks. In 1980, the equal-cap decile with the largest stocks contained just four stocks out of the 4844 stocks in our sample, and the four largest equal-cap deciles contain only 68 stocks (Table 1, Panel A). At the other extreme, the equal-cap decile with the smallest stocks contained 3,753 stocks, or 77.5 percent of all stocks. The results for 2008 in Panel B are similar, with a high concentration of market value in a limited number of stocks.

Institutional allocations across the equal-cap deciles, relative to market weights, have changed over time, as illustrated in Table 1. In 1980, institutions underweighted the smallest three equal-cap deciles, while overweighting the seven larger equal-cap deciles, particularly the third and fourth largest equal-cap deciles. Their underweight of the smallest equal-cap decile was extreme: the stocks in this decile constituted just 3.5 percent of the value of institutional holdings in comparison to the ten percent representation in the entire market—an underweight of

65 percent.[3] Although institutions overweighted all of the seven larger equal-cap deciles in 1980, they particularly overweighted the third and fourth deciles—an overweight of 36.2 percent and 21.9 percent, respectively. By the end of 2008, however, institutions were underweighting the stocks in the largest three deciles and overweighting the stocks in the smallest five deciles.[4] Indeed, the percentage of individual stocks in the smallest equal-cap decile that were *not* held in institutional portfolios declined from 37 percent in 1980 to less than one percent at the end of 2008 (Figure 1).

In Figure 2, we illustrate the time trend in institutional allocations with a plot of the annual under- and overweights for all institutions by aggregating the ten equal-cap deciles into four groupings for 1980 through 2008. While there is little time trend in institutional allocations to stocks in the fifth through the eighth deciles, there is a steady increase in allocation to the two smallest deciles and a steady decrease in the allocation to the four largest deciles. As a result, institutions which had overweighted the largest four deciles in 1980 began to underweight these deciles by the third quarter of 1990.[5] And in contrast, institutions, which had a substantial underweight (-66 percent) in the smallest decile in 1980, gradually increased their allocation to the smallest stocks and by the first quarter of 2006 they were overweighting this decile. Similarly, institutions began to overweight the stocks in the second smallest decile by the second quarter of 1996.[6]

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[3] We compute over- and under-weights as the ratio of institutional ownership percentages to the total market percentages less one and expressed as a percent.

[4] We broke up the smallest equal-cap decile into five groups of successively smaller market proportions (largest 8% of the decile value, the next 1%, next 0.5%, next 0.25%, and smallest 0.25%) to see whether institutions were uniformly overweighting the entire smallest decile at the end of 2008. We found that only the smallest 2% of the stocks was underweighted by institutions relative to market weights. The largest 8% of the smallest decile was overweighted by institutions (8.5%).

[5] For clarity of presentation in Figure 2, the four largest deciles have been combined into one group. The results by individual decile: institutions began to consistently underweight the largest decile in first quarter of 1981, the second largest decile in the fourth quarter of 1988, the third largest deciles in the fourth quarter of 1996, and the fourth largest decile in first quarter of 2007. Also, for clarity of presentation, the fifth through eighth deciles have been combined. Institutions overweighted these deciles for most quarters from 1980 through 2008, but the ownership patterns differed across the deciles reflecting the wide range of market caps for of the securities in this group – the overweights for deciles 5 and 6 exhibited a declining trend, for decile 7 exhibited no trend, and for decile 8 exhibited an increasing trend.

[6] Another way to illustrate the shift in institutional ownership is to compute the percentage of the value of a decile owned by institutions. Although the institutional ownership share grew across all the equal-cap deciles, the growth in the institutional ownership share of the larger-cap deciles is much smaller than the growth in their shares of the smaller cap deciles over our sample period. For example, the percentage of the largest cap decile owned by institutions grew from 35.3% in 1980 to 57.3% in 2008. In contrast, the percentage of the smallest cap decile owned by institutions grew from 11.9% in 1980 to 68.2% in 2006. And even though institutions underweighted the smallest 2% of stocks in 2008 relative to market weights (see footnote 4), the institutional ownership percentage of this tail of the distribution increased dramatically between 1980 and 2008 (from 3.75% to 44.9%). Thus, although

In sum, institutions that file 13f reports have gradually shifted their holdings from larger to smaller stocks over the years 1980 through 2008. They now underweight the largest stocks and overweight the smaller stocks relative to market weights. The reader is reminded that the results reported here are based on deciles having equal total market values. Results using the more traditional equal-number deciles formed from market value rankings convey a similar message. In terms of equal-number deciles, institutional ownership in the largest decile declined from a 12.3 percent overweight in 1980 to a 2.1 percent underweight in 2008, while institutional allocations to stocks in each of the nine other deciles increased over the same years. As shown below in Section 4.1, these differences can be reconciled by comparing the composition of our equal-cap deciles with the composition of the equal-number deciles. The equal-number deciles assign a substantial portion of the value of the entire market to the top decile – ranging from 75 percent to 87 percent during our sample period – so that this decile spans the largest seven or eight equal-cap deciles. Including such a large percentage of market value in one decile obscures the differing trends in institutional holdings among large, midcap, and even some small stocks.

3.1.1. Some Issues Regarding SEC Reporting Requirements

It is possible that unique characteristics of the 13f data may in part be responsible for the relative increase in institutional small-cap stock ownership. As mentioned above, only institutions with more than \$100 million of qualified securities are required to file Form 13f. This cutoff has not changed during our sample period even though the annual return on the equity market, as measured by the value-weighted CRSP index, averaged 12.2 percent from 1980 through 2008. This increase in market value could result in a relatively greater number of smaller institutions in the sample over time. If smaller institutions invest more heavily in smaller-cap stocks, as the next section shows, an increase in the number of smaller institutions might over time artificially increase the ownership percentage in small stocks. To examine this possibility, we adjust the 1980 cutoff of \$100 million dollars annually by the return on the CRSP value-weighted market index, and identify institutions that were required to file but would have fallen below this adjusted cutoff. The number of institutions falling below the adjusted cutoff increases to a high of 2618 in 2008, while the number above the cutoff shows only a small increase from

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institutions were steadily displacing individual investors across *all* strata of the market-cap spectrum, the displacement was largest for the smallest market-cap stocks.

511 in 1980 to 522 in 2008. Over most of our sample period, the institutions that fall below the adjusted cutoff underweighted the stocks in the largest seven equal-cap deciles and overweighted the stocks in the smallest three deciles. Even though the number of institutions falling below the cutoff is large, their market value in total is small due to the small size of each institution: for example, in 2008 these institutions represented only 7.6 percent of total institutional holdings. Eliminating them from the sample changes neither the trends we observe in Figure 2 nor the conclusions drawn.[7]

Another issue arises from the way in which institutions report their holdings when they have lent these holdings to other investors. When an institution lends a security, it technically no longer owns the security and carries it in a security receivable account. Yet, the SEC requires that such an institution report the security as if it owned it on the rationale that the institution is still exposed to the risk of that security even if it does not have legal title. This is a reasonable rationale for the purpose of analyzing individual portfolios. For the purpose of analyzing trends in aggregate holdings, though, this SEC reporting requirement can result in a double-counting of the same security, which will occur if both the institution that lent the security and the one that ultimately holds the security are required to file a form 13f. Indeed, we find that the ratio of institutional ownership to the total market value of an individual security sometimes exceeds one, and a likely explanation of this observation is the double-counting associated with lending for 13f filers.[8]

There are numerous reasons to borrow and lend securities (e.g., short selling, dividend-recapture programs, and corporate voting schemes.) Aside from proprietary sources, the only data available on security lending at the security level are short sales data. If the lender in a short sale transaction and the ultimate holder are both 13f filers, analysis of the 13f data overstates institutional ownership. If most lending of securities involves short sales and involves 13f filers, we can make a rough adjustment to institutional holdings by reducing the total 13f holdings in each security by the short interest in that security.

To adjust for this double-counting, from 2007 to 2008 we use the short interest at the end of each quarter from Compustat Xpressfeed. Prior to 2007 and going to back to 2003, only mid-

[7] Gompers and Metrick (2001) also examined this bias and found that during their sample period (1980–1996) institutions were sufficiently concentrated above this breakpoint that any resulting bias is minimal.

[8] We find numerous instances where the market value of the holdings for a stock from the Thomson data exceeds the outstanding market value of the stock as reported in CRSP. (Most of these violations were concentrated in the smallest three equal-cap deciles, with no violations in the largest four deciles.) We eliminate these observations from our sample.

month short interest is available and we approximate the short interest at the end of the quarter by the mid-month short interest of the last month in each quarter. We find that this adjustment reduces the percentage of stock held by institutions in the four largest and two smallest deciles, but has a negligible effect on their allocations to stocks in deciles five through eight. Even with this adjustment, it is still the case that institutions decreased allocations to the largest stocks during the period and underweighted them by the end of 2008, and increased their allocations to the two smallest deciles during the period. Unlike our earlier conclusions, though, the adjusted holdings indicate that institutions slightly underweighted the stocks in the smallest decile relative to market weights at the end of 2008. As short interest data are available only after 2002 and the adjustment for short interest does not materially affect our findings, the analysis in the rest of the paper relies on the unadjusted holdings data.

3.2. The Distribution of Stock Ownership: Large versus Small Institutions

In actively managing a portfolio, the strategy used by an investment manager might limit the number of securities the portfolio can contain. As one example, some managers will only invest in companies whose headquarters they have personally visited, and clearly time considerations will limit such visits. Similarly, some managers review in detail companies' filings with the SEC, and again there is a limit to how many companies can be followed. And some institutional investors are legally limited with regard to the percentage of an individual company's stock they can own, and others may perceive that federal and state diversification requirements require similar limitations.[9] One might expect that larger active institutions which face practical limits on the number of securities they can hold will on average tilt their portfolios to larger companies. If they were to invest in smaller companies, they would necessarily have to take large positions that likely would entail large transactions costs,[10] SEC reporting requirements for holdings in excess of five percent, and possibly violations of statutory limits on investment in individual companies. Such constraints, however, are not as binding on smaller institutions, enabling them to tilt their portfolios towards smaller-cap stocks.

[9]On the other hand, some managers use quantitative screens and presumably even the largest quantitative manager faces few limitations on the number of securities in which they invest, provided the allocations are approximately proportional to the market value of each stock (e.g., an enhanced index fund.)

[10] See, e.g., Chan and Lakonishok (1995) and Keim and Madhavan (1997) for evidence on the magnitudes of price impacts and trading costs associated with common stock trades.

To explore these conjectures, each year we break our sample into four quartiles of institution size from the largest to the smallest, where each quartile has approximately the same total market value. Thus, the largest quartile contains many fewer institutions than the smallest quartile. As an example, in 2008 the largest quartile contained seven institutions and the smallest contained 3015 institutions. We then cross-classify the holdings of the institutions by these quartiles and the equal-cap deciles described earlier. To conserve space, we limit our discussion to the quartile of largest institutions and the quartile of smallest institutions.

As conjectured, the largest institutions overweight larger stocks (equal-cap deciles one to eight) relative to market weights, and underweight the smallest stocks (equal-cap deciles nine and ten) for most of the sample from 1980 through 2007 (Figure 3, Panel A). However, over time, the largest institutions gradually shifted some of their holdings into the smallest two deciles. By 2008, the average institution in the largest quartile virtually eliminated its overweight of the largest eight equal-cap deciles, and dramatically reduced its underweight of the two smallest equal-cap deciles (in fact, the largest institutions overweighted the ninth decile in 2008). This shift towards smaller stocks is consistent with a growth in quantitative portfolio strategies among these large institutions.

Although we have no specific conjecture as to the market-cap tilt of smaller institutions, we note that these institutions are less constrained than larger institutions and have greater flexibility to invest in smaller stocks. As it turns out, the smaller institutions do tilt their portfolios towards smaller stocks (Figure 3, Panel B). The smaller institutions overweighted the small stocks in decile 9 for the entire period, increasing their overweight from five percent in 1980 to 54 percent in 2008. The allocations to the smallest decile exhibited the most dramatic increase over the period, beginning with a 39 percent underweight in 1980 and ending with a 59 percent overweight in 2008. In contrast, their underweight in the stocks in the largest four deciles increased throughout most of the period, ending 2008 with an underweight of about 30 percent relative to market weights. And they had a slight overweight in the stocks in deciles 5-8 for the first part of the period, but ended 2008 with approximately market weights in these stocks. In the next section we explore the extent to which the increase of hedge funds in recent years contributed to these portfolio allocation patterns for the smallest institutions.

3.3. The Distribution of Stock Ownership: Hedge Funds versus Non-Hedge Funds

The first step in comparing the holdings and performance of hedge funds to non-hedge institutions was to develop a list of hedge funds. Our starting point is the annual list of the largest 100 hedge funds from *Institutional Investor Magazine* for each year end from 1997 to 2008.[11] To these we add funds from a list of the 100 largest hedge funds in the Goldman Sachs database (Kostin, et.al (2009)). Finally, following Brunnermeier and Nagel (2004) and Griffin and Xu (2009), we consult *Nelson's Directory* and the ADV forms on the SEC Website and identify additional hedge funds (ranging from 27 in 1998 to 48 in 2006), requiring each fund to have over half of its assets listed as "other pooled investment vehicles (e.g., hedge funds)" or over half of its clients to be "high net worth individuals." We manually match our list of hedge fund names with the parent institution names in the 13f file and identify the Thompson "mgrno" codes, thereby allowing us to obtain holdings data for them. The hedge funds in our sample fall in the fourth (173 funds in 2008) and third (5 funds in 2008) quartiles of institution size as defined in the previous section.

As shown in Table 2, our hedge fund sample at year end 2008 consisted of 178 funds with equity holdings of $318 billion, or 2.8 percent of all stocks outstanding.[12] How does our hedge fund sample compare to samples used by other researchers? In their Table 1, for example, Griffin and Xu (2009) report that their sample covering the years 2000 through 2004 contained approximately 200 funds with average equity holdings of $2.105 billion, or a total of $421 billion in equity holdings. From our Table 2, the average values for the same period are 126 funds with total equity holdings of approximately $224 billion, a little more than half the size of theirs. On the other hand, our sample contains more funds with a larger total market value than the sample in Brunnermeier and Nagel (2004), which includes about 40-45 hedge funds in the period 1998 to 2000 with an aggregate value of about $45 billion. The corresponding averages for our sample are 82 funds with total holdings of just under $130 billion.

As the hedge funds in our sample in most years fall in the fourth quartile of institutions, we restrict our comparisons to just those institutions in the fourth quartile. In Figure 4, we plot the annual under- and overweights for hedge funds in Panel A and for the non-hedge institutions

[11] Thanks to Chris Geczy for providing this list for the earlier years in our sample.
[12] This is down from 180 funds with equity holdings of $650 billion at year end 2007, or 3.4 percent of stock outstanding. This decline is largely due to the decline in the stock market in 2008.

from quartile 4 in Panel B for each year end from 1998 to 2008.[13] Hedge fund allocations to the stocks in the largest eight deciles are fairly constant over the time period, but compared to the non-hedge institutions they significantly underweight the stocks in the largest four deciles (e.g., 45 percent in 2008), and slightly overweight the stocks in deciles five to eight (e.g., 5 percent in 2008) relative to the non-hedge institutions. And hedge funds had a much greater overweight in stocks in the smallest two deciles (e.g., 90 percent in the smallest decile in 2008) than did the non-hedge institutions (58 percent in 2008). Taken together, as we will see below, these differences in weightings may have contributed to the better performance of hedge funds over these years.

4. Comparison with Previous Literature

As discussed in Section 1, previous researchers, with the notable exception of Bennett, et al. (2003), conclude that institutions increased their allocations to large-cap stocks and decreased their allocations to small-cap stocks in recent years. Our conclusions from the results in Section 3 are just the opposite in that institutions decreased their allocations to large-cap stocks and increased their allocations to small-cap stocks. These differences in conclusions are economically important, as Gompers and Metrick (2001) (hereafter GM) argue that their finding of increased demand for large stocks "can explain part of the disappearance of the historical small stock premium." In an attempt to reconcile the differences, we take a closer look at the results in GM. They base their conclusion on two observations: First, the institutional ownership percentage of common stocks has increased over time; second, institutions tilt their portfolios towards larger stocks. These two observations together imply that institutions have increasingly overweighted larger stocks over time. The first observation is consistent with our results. The second observation, based on regression analyses, differs from our results. Specifically, GM find a positive correlation between institutional ownership (measured by the ratio of shares owned by institutions to shares outstanding) and the logarithm of the market value of the shares outstanding.[14] From the first quarter of 1980 through the last quarter of 1996, they

[13] Because there are many more non-hedge funds than hedge funds in quartile 4 (2842 and 173, respectively), the plot of all funds in this quartile is almost identical to the plot for all quartile 4 institutions in Figure 3B.

[14] Bennett, Sias and Starks (2003) report a regression result similar to Gompers and Metrick using the same institutional ownership ratio. Campbell, Ramadorai and Schwartz (2009) also reach the same conclusion as Gompers and Metrick – institutions decreased their allocations to small-cap and increased their allocation to large-cap stocks. CRS compute the ratio of the quarterly change in number of shares held by institutions to total shares outstanding for each stock, and find that the average of the ratio is negative in the smallest equal-number size

report an average cross-sectional correlation of 0.625 (computed every quarter, across individual securities). We replicated their analysis for the 115 quarters from the first quarter of 1980 through 2008 and find that the correlations varied from a low of 0.60 to a high of 0.72. These correlations are consistent with theirs.

To help resolve this paradox, we focus first on 1980 and plot in Figure 5A the linear regression of the percent of institutional ownership in each stock on the logarithm of its market value, treating the market value variable as an exogenous variable as they do. We also plot the unweighted means of these two variables for each market-cap decile and center upon each point a disk whose area is proportional to the number of stocks in the decile used in the regression. As a measure of specification, we also indicate the average residual for each decile. The regression overestimates institutional holdings in the two largest market-cap deciles by large amounts, slightly overestimates institutional holdings in the smallest decile, and underestimates institutional holdings in the middle deciles. This pattern of over and underestimates suggests that the linear specification might not be appropriate – the expected residuals conditional on the independent variable are not zero – and that a non-linear function would better fit the data. Further, the large number of observations in the two smallest market-cap deciles relative to the small number in the larger market-cap deciles, coupled with the differences in institutional holding in the smaller market-cap deciles, may be driving the positive slope. As a rough test of this conjecture, we set the ratio of institutional holdings to zero for each stock in the four largest market-cap deciles. The re-estimated correlation coefficient (0.23) is a still positive.

These diagnostics suggest that the data better conform to a non-linear specification, consistent with the results in Section 3. As reported in Table 1, institutions in 1980 underweighted the largest market-cap decile and the three smallest market-cap deciles, with substantial underweights in the smallest decile. They overweighted the middle market-cap deciles. Over time, we find that institutions gradually reduced their relative holdings in the four largest market-cap deciles while increasing their relative holdings in the smaller market-cap deciles. To analyze the effects of these changes on the linear regression specification, we produced a plot like Figure 5A for 1996, the last year of the GM study, and report it in Figure 5B. Like the 1980 analysis, the large number of stocks in the smallest market-cap deciles appears to be driving a positive relation between institutional holdings and log of market

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quintile and positive in the four largest quintiles (see their Table 1). However, their ratio measures the change in the number of shares held and not the change in value of shares held, and thus does not tell us much about changes in institutional portfolio allocations.

capitalization – the estimated linear model for 1996 overestimates institutional holdings for the seven largest market-cap deciles. The diagnostics again suggest a non-linear relationship.

In sum, GM's conclusion that institutions have increased their relative investments in large-cap stocks rests on a model specification that is inconsistent with the data. As shown in Section 3, institutions over time actually have reduced their relative allocations to large-cap stocks and increased their relative allocations to small-cap stocks.

4.1. Comparison with other Weighting Schemes

In this section we highlight the implications of different decile weighting schemes. As described in Section 3, we form deciles of equal market value so that each decile contains approximately ten percent of the market value of all stocks. As a result, the number of stocks per decile varies dramatically. These characteristics are evident under the columns labeled "Equal Cap" in Table 3 where we report the market value and number of securities in each decile at yearend 1980 and 2008. For example, at yearend 2008, our smallest decile contains 82.1 percent of all the securities in our sample while the largest decile contains only 0.1 percent of the number of names.

An alternative is equal-number deciles in which each decile contains an equal number of stocks. As a result, the market values of the deciles vary dramatically. The characteristics of the deciles in this scheme are reported under the columns "Equal Number" in Table 3. Looking again at December 2008, the stocks comprising the largest equal-number decile have a market value that represents almost 81.9 percent of the entire market, while the smallest equal-number decile has a market value less than 0.1 percent of the total market.

The composition of our deciles is also very different from that of the U.S. market-cap-based portfolios published by CRSP. To illustrate, CRSP first ranks NYSE-listed US stocks by market value and assigns an *equal number* of stocks to each decile. It then uses the resulting market-value breakpoints to assign NASDAQ and AMEX stocks to the deciles. Although this approach falls between the equal market value and the equal number approaches, it is closer to the equal number method. For example, by applying the CRSP algorithm to the stocks used in this study for yearend 2008, we find that the market value of the stocks in the largest decile makes up 65.4 percent of the market value of all stocks and the stocks in the smallest decile makes up 0.7 percent.[15]

The stratification we use better highlights deviations from market portfolio weights, especially for larger stocks, than other commonly used stratification methods. If the objective is to understand market-wide relations, such as the investment performance of institutions relative to the market, the equal-number scheme has less power than the equal-cap scheme because cross-sectional variation in relative weights for up to 82 percent of the market is obscured by combining all this value into one decile. On the other hand, if one is testing hypotheses about individual securities independent of their market value, equal-number (or CRSP) deciles will have more power than our equal-cap deciles.

5. Institutional Holdings and Institutional Returns

In this section we use the 13f data to analyze how the documented changes in the composition of institutional holdings have impacted the investment performance of institutionally managed portfolios. We find that at the end of each quarter hedge funds overweighted those stocks that realized the highest returns in the subsequent quarter (hereafter, 'future returns').[16] Although hedge funds also overweighted stocks with the lowest future returns, their overweight in the highest future-return stocks is significantly larger than their overweight in the lowest future-return stocks. Using a four-factor model, we find weak evidence that hedge funds delivered positive alphas, i.e., the performance on their investments in the highest future-return stocks more than offsets the performance on their investments in the lowest future-return stocks. For all other institutions, we find little or no evidence of significant performance using the standard four-factor model. However, we do find evidence of some style timing ability, particularly for the small institutions (both hedge funds and non-hedge funds.) Before we turn to our performance results, we discuss data errors occurring in two quarters of the Thomson/CDA database which result in substantial upward biases in returns calculated from the holdings data for these quarters.

[15] Note that CRSP uses all stocks in its indexes, whereas we exclude ADRs, ETFs, and closed-end investment companies. If we use all stocks as CRSP does, the corresponding percentages are 65.2 percent 0.6 percent.
[16] As in previous sections, we define over- and underweight relative to market weights.

5.1. Measuring institutional performance with the Thomson/CDA database: a word of caution

For an initial look at institutional performance, we compute a simple time series of excess returns for all institutions. To this end, we aggregate the dollar value of the holdings of all institutions at the end of each quarter for each individual stock. We then compute a buy-and-hold return for the aggregated balance sheet of all institutions by averaging the quarterly return for each stock weighted by the dollar value of the holdings of each stock at the end of the prior quarter. To measure the market return, we compute an average return of the equities used in this study, weighted by the market value of each stock at the end of the prior quarter.

A plot of the differences between the quarterly institution and market returns reveals two outliers: a return in excess of the market of 9.76 percent in the fourth quarter of 1999 and 7.51 percent in the third quarter of 2000 (Figure 6). Both outliers occurred during the internet bubble during which Brunnermeier and Nagel (2004) report that hedge funds significantly outperformed the market due to their investments in technology stocks. Thus, it is possible that these outliers might be correct if technology stocks had larger weights in the aggregate institutional portfolio than in the market portfolio.

In analyzing the data used to calculate these returns, we found two types of errors in the prices and shares in the Thompson data for September 30, 1999 and June 30, 2000. These errors are related to the incorrect substitution of the prices in these two months with prices from the subsequent end of quarter, and incorrect adjustments for stock splits and dividends. The appendix contains a detailed description of the errors and the adjustments we make to correct them. Once these corrections are made, the excess return of 9.76 percent for the fourth quarter 1999 decreases by 10.04 percent to −0.28 percent, and the excess return of 7.51 percent for the third quarter 2000 decreases by 6.39 percent to 1.12 percent. The returns used in the remainder of this section, as well as our earlier results, are based upon these corrected prices and shares.

5.2. Performance Analysis based on over- (under-) weights in high-future-return stocks

In this section we exploit the richness of the disaggregated holdings data to examine the extent to which institutions overweight those stocks with highest future returns and underweight those with the lowest future returns – investment positions that are likely to have a large influence on portfolio performance. Our main focus is on the differences between hedge funds and non-hedge institutions. The use of the 13f data to analyze institutional performance has two benefits for this study. First, it eliminates the selection and survivor biases that occur in hedge fund return databases.[17] Second, it allows us to measure institutional portfolio weights, relative to market weights, for individual stocks in the extreme tails of the distribution of future returns. In this regard, our analysis is similar to Cohen, Polk and Silli (2009) who examine the contribution of extremely large holdings ("best ideas") to mutual fund investment performance.

Similar to the market-cap deciles described in Section 3, we create equal-cap future-return deciles for the period 1980 through 2008. Specifically, at the end of each quarter we rank all US equities in our sample by their return over the following quarter, and assign to the first decile the stocks with the highest returns during the following quarter whose combined market value is less than or equal to ten percent of the total market value of all stocks. We repeat this process for successively lower quarterly returns to determine the remaining nine deciles. Decile one contains those stocks with the highest future three-month returns, and decile ten the lowest future three-month returns. We then cross-classify stocks by future-return deciles and the manager size quartiles discussed in Section 3.2. Within each cell, we compute institutional over- and under-weightings as before.

As a visual overview, we plot the average under- and overweights for each future-return decile for each quarter from April 1998 to December 2008 for hedge funds in the smallest institutional-size quartile. As shown in Figure 7, the hedge funds significantly overweighted stocks in the largest future-return decile – the weighted average overweight is 42.07 percent with a t-value of 10.22.[18] To a lesser degree, the hedge funds also overweighted the stocks in next two largest future-return deciles, but these average overweights are not significant at usual levels. Importantly, hedge funds also significantly overweighted stocks in the lowest future-return decile—the weighted average overweight is 28.23 with a t-value of 7.18. This pattern is suggestive of an investment strategy that focuses on high-volatility stocks, which we discuss further below. Offsetting these overweights, the hedge funds consistently underweighted stocks in the intermediate future-return deciles – the weighted average underweight in deciles two through nine is -8.52 percent with a t-value of -5.50.

The non-hedge institutions in the smallest quartile display a similar pattern of overweights, although it is not as pronounced as for the hedge funds. They overweight stocks in the highest (mean of 10.27 with a t-value is 7.20) and lowest (mean of 7.69 with a t-value of 5.09) future-return deciles, and underweight stocks in deciles two through nine (mean of −2.18

[17] See Griffin and Xu (2009) for a discussion of these issues, and for a list of references.
[18] All t-values in the section are computed with heteroscedasticity-consistent standard errors.

with a t-value of −3.19). In contrast, the overweights for the institutions in the three largest size quartiles do not display any obvious patterns. If there is any pattern at all, these institutions slightly overweight stocks in the future-return deciles two through nine (mean is 0.24, t-value is 0.46) and underweight stocks in the highest (mean is −1.19, t-value is 1.24) and lowest (mean is −0.80, t-value is −0.81) future-return deciles.

It is possible in the univariate analysis above that the observed relation between over- and underweights and subsequent returns is due to other variables such as market capitalization, the book-to-market ratio and prior returns, and it is only through correlation with these variables that there is any variation in over- and underweights of future-return deciles. To examine this possibility, at the end of each quarter we cross-classify stocks by: future return (return over the subsequent three months); end-of-quarter market value; the ratio of book value to market value, both measured at the end of the quarter; and return over the prior three months. For each variable, we assign a stock to one of three categories—the top equal-cap decile, the middle eight equal-cap deciles, and the bottom equal-cap decile. As there are four variables, the cross-classification results in 81 cells. For each cell, we calculate for each quarter *t* the percentage institutional over- and underweight, as defined in footnote 2, using the market value of total institutional ownership in that cell and the total market value of all the stocks in that cell. We then regress this percent, labeled $RelAlloc_t$, on dummy variables that describe the characteristics of each cell. As the total market value of the stocks in each cell is different, we weight the regression by the market value in each cell. The regression takes the form:

$$RelAlloc_t = a_0 + a_1 RET1_t + a_2 RET10_t + a_3 MV1_t + a_4 MV10_t + a_5 BM1_t + a_6 BM10_t + a_7 MO1_t + a_8 MO10_t + e_t$$

The independent variables are dummy variables defined as:

$RET1_t$ = 1 for highest future-return decile in quarter t, = 0 otherwise
$RET10_t$ = 1 for lowest future-return decile in quarter t, = 0 otherwise
$MV1_t$ = 1 for largest equal-cap decile in quarter t, = 0 otherwise
$MV10_t$ = 1 for smallest equal-cap decile in quarter t, = 0 otherwise
$BM1_t$ = 1 for largest book/market decile in quarter t, = 0 otherwise
$BM10_t$ = 1 for smallest book/market decile in quarter t, = 0 otherwise
$MO1_t$ = 1 for highest prior 3-mo return decile in quarter t, = 0 otherwise
$MO10_t$ = 1 for lowest prior 3-mo return decile in quarter t, = 0 otherwise

For comparison purposes, we also estimate an unconditional version of the model that includes only a constant and the future-return dummy variables.

As we are interested in the difference between the over- and underweights in the extreme deciles, we report the differences in the estimated coefficients on the corresponding dummy variables. Although our main focus is on the difference in the coefficients between the two future-return variables, the difference between the coefficients on the equal-cap decile variables should validate our previous findings in Section 3 as to the ownership distribution as a function market value of individual stocks. Further, the differences in the coefficients on the dummy variables for the book-to-market ratio and prior-returns deciles measure how institutions tilt their portfolios.

In Table 4, we report these differences for the institutions in the largest three quartiles (Panel A) and for the institutions in the smallest quartile (Panel B) for three subperiods: 1980-1987; 1988-1997; and 1998-2008. Differences reported in bold are significant at the one percent level using heteroscedasticity-consistent standard errors. We also report results separately for non-hedge and hedge institutions in the smallest quartile for the last subperiod only, as this is the only subperiod in which we can distinguish between these two types of institutions (Panels C and D respectively).

For the largest institutions, the difference in the overweights between the highest and lowest future-return stocks (a_1-a_2) is insignificant in each of the three subperiods, for both the univariate and multivariate regressions (Table 4, Panel A). Confirming the results in Section 3, the largest institutions significantly tilted their portfolios to large-cap stocks, but this tilt declined through time. The largest institutions also had a significant growth stock tilt during all three subperiods and a significant momentum tilt in the 1988-1997 subperiod.

For the institutions in the smallest quartile, including both hedge and non-hedge institutions, the difference in the overweights between the highest and lowest future-return stocks is also insignificant in each of the three subperiods, for both the univariate and multivariate regressions (Panel B). Confirming the results in Section 3, the smallest institutions significantly tilted their portfolios to small-cap stocks, and this tilt increased substantially over the sample period. The results also show that the investment strategies of the smallest institutions relied on growth and momentum, but at different times: They had a significant growth tilt in the first subperiod (but neither a value nor growth tilt in the last two subperiods), and they had a significant momentum tilt during the last two subperiods.

Among the smallest institutions, the hedge funds exhibited the most extreme overweights. The difference in the hedge fund overweights between the highest and lowest future-return stocks is 13.8 percent unconditionally and 12.31 percent conditional on the stocks' other characteristics. That these two numbers are virtually the same indicates that the future returns are a distinct variable in explaining the investments of hedge funds. The same statistics for non-hedge funds in the smallest quartile of institutions are not significant at the one percent level. Further, the small-cap and momentum tilts of the hedge funds are of a much larger magnitude than exhibited by the non-hedge funds – the differences in the coefficients on each of these style variables as between hedge funds and non-hedge funds are statistically significant at the one percent level. The large difference in hedge fund overweights between the highest and lowest future-return deciles, whether or not one controls for tilts in size, book-to-market and prior returns, is suggestive of positive alpha in a more traditional performance analysis. We turn to such an analysis in the next section.

5.3. Investment Performance Using Factor Models

In this section we analyze institutional performance using factor models with *monthly* returns computed from the quarterly holdings. Although these within-quarter monthly returns provide no additional information about the effect of changes in holdings during the quarter on returns, their higher frequency provides information about the within-quarter price variability and increases the degrees of freedom in our tests. As in Section 5.1 we aggregate institutional holdings at the end of each quarter, but then calculate monthly returns for each of the three months in the next quarter such that these monthly returns cumulate to the same quarterly return described in Section 5.1. For the first month, the weights are proportional to the market value of the holdings at the end of the prior quarter. For the second month, the weights are proportional to the market value of the holdings at the end of the prior quarter increased by the monthly return of each holding in the first month. The weights for the third month are similar, except increased by the cumulative returns in the first and second month.[19]

These calculations assume managers make no trades within the quarter. If their trading within a quarter adds value, the returns used here will understate performance. As a rough check on this possibility, we also compute performance using only the returns for the first month following the end of the quarter, a calculation that makes a less restrictive assumption. The results replicated with this monthly return are similar, and thus we report only results using the three monthly returns for each quarter.

[19] The value of any holding in a stock that ceases to exist is set to zero.

We estimate alphas from a four-factor model (Fama and French (1993), Carhart (1995).) Three of the monthly factors are from Ken French's Webpage: size (SMB), value (HML), and momentum (UMD) factors. Our market factor is the market return, calculated from the returns of the stocks used in this study (see section 2), minus the one-month T-bill returns from CRSP. Similarly, the excess institutional return is the institutional return less the one-month T-bill return.

5.3.1 Largest Institutions vs. Smallest Institutions

As shown in Section 3, the holdings of institutional managers differ according to their size, with smaller institutions more concentrated in smaller stocks than the larger institutions. Because of these differences in portfolio allocations, we first examine the relative performance of institutions in the smallest and in the largest quartiles by estimating alphas from the four-factor model in three subperiods of approximately equal length – 1980-1987, 1988-1997, and 1998-2008.[20] According to results not shown, the four-factor alphas for neither the smallest nor the largest institutions are significant at usual levels in any of the three subperiods. Although the alphas for the smallest institutions are generally larger than the alphas for the large institutions (e.g., 4.9 basis points per month difference in the first subperiod, 1.3 basis points in the second subperiod), the differences are not significant at usual levels. The estimated coefficients on the factors do, however, provide some useful confirmation of the investment allocations of the different-size institutions. Echoing the results in Sections 3 and 5.2, the smallest institutions have significant small-cap tilts and the largest institutions have significant large-cap tilts, controlling for the other factors. Additionally, both the small and large institutions exhibit growth tilts in the first two subperiods and value tilts in the third subperiod, but the coefficients on the momentum factor are insignificant for both large and small institutions for all three subperiods. In summary, consistent with previous literature, the four-factor tests detect little or no superior investment performance.

5.3.2. Hedge Funds vs. Smallest Non-Hedge Institutions

As noted above, hedge funds in our sample are concentrated in the smallest quartile of investment managers and thus we compare these funds to the non-hedge funds in the smallest

[20] We also examined aggregate performance across all the institutions in our sample using the four-factor model. We found that the estimated alphas were not significantly different from zero, either in the overall period or in the three subperiods.

quartile. The four-factor alphas for hedge funds are positive and often economically large in each of five approximately two-year subperiods from 1998 through 2008: for instance, 41 basis points per month from 1998 through 2000; and 24 basis points from 2005 to 2006. Although none of the hedge fund alphas is significant at the five-percent level, the probability of obtaining five positive alphas from a binomial distribution where a positive or negative drawing is equally likely is just three percent. We find that hedge fund alphas are economically larger than the alphas for the non-hedge institutions in most subperiods (e.g., 30 basis points larger in 1998-2000 and 20 basis points larger in 2005-2006), but the differences are not statistically significant at usual levels. However, under a binomial distribution the probability of five hedge fund alphas exceeding the alphas for non-hedge funds is also approximately three percent and, thus, quite unlikely.

To summarize, the traditional investment performance tests yield only weak evidence of hedge fund performance, both in an absolute sense and also relative to other comparable institutions. However these results appear to reinforce the notion of superior hedge fund stock picking ability raised in Section 5.2, where we showed that hedge funds had significantly greater overweights in high future-return stocks than do other institutions, both before and after controlling for other characteristics. In the next section, we try to determine whether part of the superior investment performance of hedge funds is due to tactical shifts in style tilts.

5.4 Style Timing

In the four-factor regressions described above, there is substantial variation in the estimated coefficients on the four factors across subperiods, particularly those coefficients on the value and momentum factors in the hedge-fund sample. For example, the estimated hedge fund HML coefficient is a significant 0.128 in 2001-2002 and a marginally significant -0.155 in 2007-2008. Such variation could be suggestive of an aggregate shift by hedge funds from a value to a growth tilt, or simply random noise. In this section, we take a closer look at whether individual institutions shift their style tilts over time, and whether such style timing is associated with positive performance.

5.4.1 Do institutions engage in style timing?

To assess style timing ability, we estimate a style-timing model similar to the market timing model of Henriksson and Merton (1981). Specifically, for each institution we regress excess monthly returns on the excess market return plus the returns on the three factors discussed above, as well as three modified factor variables designed to capture style timing. These additional variables, termed style factors, are equal to the original factor returns except that if the factor return in a particular month is negative, that factor return is set to zero. In this specification we interpret the coefficients as follows. The coefficient on a factor's return is an estimate of the factor "beta" when the returns on that factor are negative, and the sum of this coefficient and the coefficient on the style factor is the factor "beta" when the returns on the that factor are non-negative. The coefficient on the style factor is the difference between these two factor "betas." We compute for each regression the F-statistic associated with the hypothesis that the coefficients on the three additional style timing variables are jointly zero. If the institutions in our sample are not engaged in style timing, the probabilities of these F-statistics should be uniformly distributed. We assume that an institution is actively engaging in style timing if the p-value associated with this F-test is less than 10 percent, and compute the expected and actual number of such style timers. We then estimate a chi-squared test of whether the expected number equals the actual number. The results are summarized in the left half of Table 5.[21]

We turn first to institutions in the smallest institution size quartile and find that both non-hedge funds (Panel A) and to a lesser extent hedge funds (Panel B) displayed significant style shifts. For example, for the 679 non-hedge funds with complete data from 1998 through 2008, one would expect 67.9 to have an F-statistic with a p-value of 10 percent or less. In fact, 237 managers had F-statistics of 10 percent or less, which according to a chi-squared test is significantly different from the number expected at usual levels. The corresponding numbers for hedge funds are 3 and 14.

Thus, in the overall period, a larger number of both hedge and non-hedge funds in the smallest institution size quartile exhibit style shifts than would be expected by chance. This statement is also true for the first and second halves of the overall period. In all cases, the hypothesis that such results could be observed by chance is rejected at the one percent level. The numbers of institutions exhibiting style shifts is not only statistically significant but also economically important. For example, nearly half of the hedge funds appear to engage in style timing.

[21] Because the regressions in this section require institutions to have survived for the entire estimation period, the number of institutions reported in Table 5 will be less than the numbers reported in section 3.

For the institutions in the largest three quartiles, the results are mixed. For the overall period, seven of 18 institutions engaged in style shifts, a significantly larger number than the expected value of 1.8 (Panel C). However, the results are sensitive to the subperiod. What might be happening is that over the longer period of time, the style timing variables are picking up the gradual change in larger institutions' investment allocations from larger to smaller stocks; and for the shorter periods of time, these changes in ownership are not sufficiently pronounced to be detected by the statistical analysis.

5.4.2 Does style timing add value?

To determine whether a manager added value via style timing, we compare (a) the alpha from a standard four-factor model, to (b) the alpha from a regression with the same independent variables in (a) plus the additional style-timing variables. If the alpha from (a) is greater than the alpha from (b), style timing adds value as model (b) conditions on this timing ability. Under the assumption that adding or subtracting value via style timing is equally likely, we compute the expected and actual number of institutions that added value and, as above, estimate a chi-squared test of the difference. We report these results in the right half of Table 5.

For the overall period, there is evidence that style timing added value for the non-hedge institutions in the smallest quartile. As discussed above, there were 237 non-hedge firms in the smallest quartile that engaged in style timing for the overall period 1998-2008. If adding or subtracting value was equally likely, one would expect 118.5 of these funds to have added value. In fact, 188 added value—a statistically significant result based on a chi-squared test. An examination of the two subperiods for these institutions suggests that the first subperiod is driving the results for the overall period: style timing added value in the first subperiod, but subtracted value in the second.

In contrast, the style timing behavior of hedge funds did not add value, neither in the overall period nor in either subperiod. And the results for the larger institutions are unclear as to whether these attempts at style timing added or subtracted from investment performance.

6. Conclusion

The conventional wisdom is that over time institutional investors have increased the tilt of their equity portfolios towards larger and more liquid stocks. And as the institutional share in the U.S. equity market has grown since World War II (to 68 percent at the end of 2008), institutional concentration in these larger stocks has increased. We show that this conventional wisdom is not accurate. Since 1980 institutional investors have shifted their portfolio allocations from larger stocks to smaller stocks and as of 2008 underweight the larger stocks in comparison to market weights. As a mirror image, non-institutional investors – defined as those who do not file form 13f with the SEC, and consisting primarily of retail investors – now overweight larger stocks and have reduced their ownership of smaller stocks.

The changes over time in the composition of institutional portfolios, both the long-term trends documented in Section 3 and the significant short-term tactical changes we document in our style timing tests in Section 5.4, suggest the traditional multi-factor performance measures that assume factor coefficients are stationary over time might produce misleading results. As an illustration of this, we use the 13f data to analyze institutional investment performance. We find that small institutions, and particularly hedge funds, overweight at the end of each quarter those stocks that realized the highest returns in the subsequent quarter; but these institutions also overweight those stocks with the lowest subsequent returns. On net, the hedge fund overweight in the highest future-return stocks is significantly larger than their overweight in the lowest future-return stocks, and this difference is economically large enough to be consistent with a positive alpha. However, using a four-factor model we find only weak evidence that hedge funds delivered positive alphas. The question naturally arises as to whether these overweights are due to security selection or the presence of systematic factors, priced or not, in addition to the standard factors of traditional models. The economic effect of such misspecification requires further work.

The shift in institutional ownership from larger to smaller stocks, along with the corresponding shift in trading volume, has important implications for the U.S. equity markets, including, among other issues: liquidity; informational efficiency of stock prices; volatility; corporate control; and the ability of firms to raise capital. As one example, consider the liquidity of U.S. equity markets. Chordia, Roll and Subramanyan (2008) show that liquidity, as measured by bid-ask spreads, has increased over time. In view of the changing ownership patterns of institutions documented in this study, a reasonable conjecture is the increase in liquidity should be greater for small stocks than large stocks. This conjecture is based upon two assumptions: (1) As institutions increase their overall ownership of stocks, overall equity market liquidity will increase, holding constant other influences on liquidity; and (2) as institutions increase their relative holdings of smaller stocks, the relative liquidity of smaller stocks will increase. In

Figure 8 we plot the median month-end closing bid-ask spread, computed as a percent of the mid-spread price, for four groupings of our equal-cap deciles (as described in Section 3.1) from 1993 to 2004. Consistent with our conjecture, small stocks have seen a greater increase in liquidity that large stocks.[22]

Finally, the shift in stock ownership from individuals to institutions also has important policy implications. For example, the intended effects of tax incentives, such as reduced capital gains rates, will be blunted because such incentives have a limited effect on the investment decisions of institutional investors whose clients are non-profit entities, such as pension funds or endowments. Even institutional investors with taxable clients may be less sensitive to taxes than their clients as they attempt to optimize portfolios in seeking greater pre-tax returns. Over time the effects of these changes in institutional ownership will weigh disproportionately on the smaller-cap end of the equity spectrum as institutions increase their ownership share of small stocks.

[22] Note that several structural changes during the time period likely affected the level of spreads: Changes brought about by SEC and Justice Department actions regarding brokers who were avoiding quotes at the odd eighths, and changes in the minimum tick size from eighths to sixteenths in 1997 and then to decimals at the end of 2000 (phased in over the period August 2000 to February 2001). Visually, it is possible to split the plot in Figure 8 into three segments according to these three regimes. But it is apparent that within each of the regimes there is also a downward trend in spreads across all the quintiles.

Appendix

To analyze the outliers in the Thomson/CDA data in the fourth quarter of 1999 and the third quarter of 2000 (Figure 6), we compare the share and price data from Thomson/CDA with those in CRSP for the two quarters. This analysis reveals two types of errors in the Thomson/CDA data that account for the two outliers. The first error occurs in the closing stock prices and shares outstanding recorded by Thomson for September 30, 1999, and June 30, 2000. Consider the error for the stock of Toll Brothers on June 30, 2000. On this date, Thomson/CDA recorded a price of $34.38, while CRSP recorded a price of $20.50. It appears that Thomson/CDA replaced the price for June 30, 2000 with the price for September 30, 2000. Indeed for all stocks in our sample, the price recorded by Thomson/CDA for June 30, 2000 is the same as the price for September 30, 2000. Similarly, Thomson/CDA replaced the prices for September 30, 1999 with December 31, 1999 prices.

Replacing an earlier price with a later price creates a look-ahead bias. In the absence of stock splits, stocks whose later prices are greater (less) than their earlier prices will receive a larger (smaller) weight in any portfolio than they would with correct prices. Such over- and under-weightings result in an upward bias in institutional returns calculated from the Thomson/CDA data for the third quarter of 2000 and the fourth quarter of 1999.

The effect of this pricing error is more complicated when there is a stock split within the quarter. For example, Merrill Lynch declared a two-for-one stock split on July 18, 2000, with a record date of August 24. Thomson/CDA reports the June price as $66, which is actually the September price. CRSP reports the correct June price of $115. How this split-related error affects the weight given in a portfolio depends also on how Thomson adjusts the number of shares held by institutions. As an illustration, the firm McGahan Greene McHugh Capital Management in its 13f filing (retrieved from Edgar) reports that it held 96,000 shares of Merrill Lynch on June 30, 2000 and 192,000 shares on September of that year. The change in shares is consistent with no transactions during the quarter and a two-for-one split. However, Thomson/CDA reports that McHugh owned 192,000 on June 30. This example leads to the conjecture that Thomson/CDA retroactively and incorrectly adjusted the June shares for the split that occurred in August. To verify this conjecture, WRDS at our request compared a sample of the holdings reported in Thomson/CDA to those reported in the contemporaneously filed Form 13f (retrieved from Edgar) for the twelve managers that had the largest number of holdings in the

Thomson/CDA data.[23] With a few exceptions, the comparisons are consistent with our conjecture.

The effects of these errors on portfolio weights can be substantial. Consider a portfolio containing Merrill Lynch from the example above. The weight using the Thomson/CDA data is $12,672,000, the product of the 192,000 shares held and the price of $66.00. The correct weight is $11,040,000, the product of the 96,000 shares held (from the actual filing) and $115 (from CRSP). In this case, the Thomson data overweight Merrill Lynch. The key to the over- or under-weighting for June 30, 2000 is the relation of the CRSP price on June 30 adjusted forward for the split and the Thomson/CDA price on September 30. The CRSP price of $115 adjusted forward for the split is $57.50, which being less than the Thomson/CDA September 30 price of $66.00 results in an overweight. If the Thomson/CDA September 30 price were less than $57.50, the stock would be underweighted. Thus, stocks with positive returns will be overweighted and stocks with negative returns underweighted—a look-ahead bias.

Researchers who use stock prices from CRSP in place of the Thomson/CDA price may face an even greater bias. For Merrill Lynch for June 30, the number of shares held according to Thomson in this example is 192,000 and the CRSP price is $115, resulting in a dollar holding of $22,080,000—twice the correct number. If above-average returns are associated with stock splits, the over-weighting could result in a substantial upward bias in calculating overall institutional returns. It is difficult to assess the impact of this bias on the results of prior studies of institutional performance that include Thomson holdings for these two quarters because the source of the price data used in those studies is often unclear.[24]

To remove these two biases, we replaced Thomson prices with CRSP prices for September 30, 1999 and June 30, 2000, and also reversed the incorrect Thomson adjustment of holdings for those two dates. Once we make these corrections, the fourth quarter 1999 outlier of

[23] Many thanks to Luis Palacios at WRDS for his help on this analysis. To illustrate, WRDS selected the 12 managers with the largest number of holdings as of June 2000, according to Thomson. These twelve include, for example, AXA Financial, Vanguard, and Nomura Securities. WRDS was able to match eleven of these managers to the 13f reports to the SEC. For the sake of this exercise, WRDS included all holdings—not the restricted list used in this study. Among the eleven managers there were 41,580 holdings that could be matched to CRSP using the common CUSIP numbers. These 41,580 holding represented 7,104 issues, of which there were 914 with stock splits or dividends of 50 percent of more. For 897 of these 914 issues, the ratios of the Thomson holdings to the holdings in the SEC filings were equal to the split factor available in CRSP. The corresponding numbers for September 1999 are: 37,879; 6,865; 759; and 744.

[24] An exception is Binay (2005), who uses only Thomson/CDA data. Possibly as a result of this bias, he finds abnormally good returns for institutional investors in 1999 and 2000.

9.76 percent decreases by 10.04 percent to − 0.28 percent, and the third quarter 2000 outlier of 7.51 percent decreases by 6.39 percent to 1.12 percent.

A natural question is which of the two Thomson errors is the most important. To answer this question, we apply the corrections sequentially. If we make only the price adjustment, the 1999 outlier declines from 9.76 percent to 1.30 percent, and the 2000 outlier declines from 10.04 percent to 0.84 percent. If we only make the share adjustment, the 1999 outlier declines to 6.66 percent and the 2000 outlier declines to 7.45 percent. Thus, the price adjustment appears to be more important.

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Table 1
Percentage Distribution of Stock Ownership by Market Cap Deciles: All Stocks, Institutions, and Mutual Funds
Year End 1980 and 2008

This table presents the percentage distribution of stock analyzed in this study by market cap-deciles, where the largest decile contains the largest stocks whose total market value equal to or less than 10 percent of the total market value of all stocks. The second decile contains the next largest stocks whose total market value combined with the stocks in the largest cap-decile is less than 20 percent of the total market value of all stocks, and so on for the remaining deciles. Also presented are the upper bound values for each decile, and total numbers of stocks in each decile along with the corresponding cumulative number. Market values are in billions of dollars.

	Market Cap Decile										
	Largest	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**Smallest**	**Total Value**
A. 1980											
All Stocks	9.74	10.25	9.92	9.91	10.10	10.07	9.96	10.04	10.01	10.01	1,375.93
All Institutions	9.93	10.97	13.49	12.07	11.05	11.67	10.50	9.75	7.11	3.46	493.35
Memo: All Stocks											
Number	4	9	20	35	59	87	133	230	514	3,753	
Cumulative	4	13	33	68	127	214	347	577	1,091	4,844	
Upper Bound of Decile	39.63	22.35	9.83	5.03	2.87	1.95	1.29	0.81	0.43	0.17	
B. 2008											
All Stocks	8.65	10.72	10.49	9.84	10.12	10.09	10.10	9.97	10.02	10.01	11,375.94
All Institutions	6.32	10.02	9.60	9.90	9.52	10.59	10.51	11.51	11.60	10.43	7,781.05
Memo: All Stocks											
Number	4	9	14	24	39	60	94	191	448	4,060	
Cumulative	4	13	27	51	90	150	244	435	883	4,943	
Upper Bound of Decile	406.07	170.46	102.49	69.31	36.59	23.00	16.18	9.32	4.11	1.59	

Table 2

Total Hedge Fund Assets and Number of Funds for Hedge Funds in Institution Size Quartiles 3&4

year	Total Value of HF Holdings ($ millions)	% of Total Mkt	# Funds
1997	46,454	0.44%	36
1998	99,714	0.76%	76
1999	148,995	0.88%	79
2000	138,643	0.90%	91
2001	211,568	1.55%	121
2002	193,962	1.80%	130
2003	249,717	1.76%	140
2004	327,670	2.05%	148
2005	402,415	2.40%	139
2006	611,636	3.25%	174
2007	650,309	3.38%	180
2008	318,636	2.80%	178

Table 3

This table reports the market value of, and the number of securities in, each decile under three alternative methods for creating deciles: (1) the equal-cap approach used in this paper; (2) the equal-number approach commonly used in much academic research; and (3) the CRSP approach (CRSP first ranks NYSE-listed US stocks by market value and assigns an equal number of stocks to each decile. It then uses the resulting market-value breakpoints to assign NASDAQ and AMEX stocks to the deciles.) Year-end results are reported for 1980 and 2008

	Basic Data						Percentage by Decile					
	Market Value of Decile ($ Billion)			Number of Securities in Decile			Market Value of Decile			Number of Securities in Decile		
Equal Cap Decile	Equal Cap	CRSP Approach	Equal Number	Equal Cap	CRSP Approach	Equal Number	Equal Cap	CRSP Approach	Equal Number	Equal Cap	CRSP Approach	Equal Number
A. December 1980												
Largest	133,952	743,327	1,055,611	4	158	484	9.7	54.0	76.7	0.1	3.3	10.0
2	141,085	189,805	160,178	9	155	484	10.3	13.8	11.6	0.2	3.2	10.0
3	136,457	122,479	69,227	20	171	485	9.9	8.9	5.0	0.4	3.5	10.0
4	136,286	80,740	36,898	35	185	484	9.9	5.9	2.7	0.7	3.8	10.0
5	138,971	60,975	22,000	59	214	484	10.1	4.4	1.6	1.2	4.4	10.0
6	138,536	46,056	13,797	87	240	485	10.1	3.3	1.0	1.8	5.0	10.0
7	137,076	44,307	8,741	133	357	484	10.0	3.2	0.6	2.7	7.4	10.0
8	138,156	30,218	5,290	230	390	485	10.0	2.2	0.4	4.7	8.1	10.0
9	137,710	28,505	3,026	514	625	484	10.0	2.1	0.2	10.6	12.9	10.0
Smallest	137,695	29,512	1,155	3753	2349	485	10.0	2.1	0.1	77.5	48.5	10.0
Sum	1,375,925	1,375,925	1,375,925	4,844	4,844	4,844	100.0	100.0	100.0	100.0	100.0	100.0
B. December 2008												
Largest	983,472	7,441,525	9,321,834	4	195	494	8.6	65.4	81.9	0.1	3.9	10.0
2	1,219,525	1,487,077	1,066,792	9	201	494	10.7	13.1	9.4	0.2	4.1	10.0
3	1,193,465	742,352	467,804	14	213	494	10.5	6.5	4.1	0.3	4.3	10.0
4	1,119,029	473,288	239,690	24	218	495	9.8	4.2	2.1	0.5	4.4	10.0
5	1,150,840	360,891	134,773	39	255	494	10.1	3.2	1.2	0.8	5.2	10.0
6	1,147,648	261,572	73,381	60	275	494	10.1	2.3	0.6	1.2	5.6	10.0
7	1,148,517	237,842	38,571	94	396	495	10.1	2.1	0.3	1.9	8.0	10.0
8	1,134,626	163,603	20,260	191	452	494	10.0	1.4	0.2	3.9	9.1	10.0
9	1,140,013	128,244	9,801	448	689	494	10.0	1.1	0.1	9.1	13.9	10.0
Smallest	1,138,808	79,549	3,036	4060	2049	495	10.0	0.7	0.0	82.1	41.5	10.0
Sum	11,375,942	11,375,942	11,375,942	4,943	4,943	4,943	100.0	100.0	100.0	100.0	100.0	100.0

Table 4

Hedge and non-hedge institutional investment performance
Measured as over- (under-) weights, relative to market weights, in high vs. low future return stocks

To assess institutional ability to discriminate between high- and low-return stocks, controlling for stock characteristics, we estimate the following model of institutional holdings using weighted least squares (where the weight is total market value of the stocks for that decile category):

$$RelAlloc_t = a_0 + a_1 RET1_t + a_2 RET10_t + a_3 MV1_t + a_4 MV10_t + a_5 BM1_t + a_6 BM10_t + a_7 MO1_t + a_8 MO10_t + e_t$$

where *RelAlloct* is the percentage institutional over- and under-weights (relative to market weights) in a specific stock characteristic decile, defined as the ratio of institutional ownership percentage to the total market percentage in the respective deciles in quarter t, less one. We identify the stock characteristic deciles with the following indicator variables:

RET1t = 1 for Highest Future 3-mo Return decile in quarter *t* , = 0 otherwise
RET10t = 1 for Lowest Future 3-mo Return decile in quarter *t* , = 0 otherwise
MV1t = 1 for largest market cap decile in quarter *t* , = 0 otherwise
MV10t = 1 for smallest market cap decile in quarter *t* , = 0 otherwise
BM1t = 1 for largest Book/Market decile in quarter *t* , = 0 otherwise
BM10t = 1 for smallest Book/Market decile in quarter *t* , = 0 otherwise
MO1t = 1 for Highest Prior 3-mo Return decile in quarter *t* , = 0 otherwise
MO10t = 1 for Lowest Prior 3-mo Return decile in quarter *t* , = 0 otherwise

We report below the differences in estimated coefficients between the extreme deciles of a particular characteristic. The difference in the extreme future 3-mo return coefficients (i.e., $a_1 - a_2$) measures instititutional ability to discriminate between good and poor future performers. The second regression in each subperiod measures this ability while controlling for their investment behavior along the investment styles of size, value-growth, and momentum. Bold indicates significance at 1% level. (heteroscadisticity consistent standard errors)

	Difference in Over- (Under-) Weights Relative to Market Weights				
	High - Low FutRet ($a_1 - a_2$)	**Large - Small ($a_3 - a_4$)**	**Value - Growth ($a_5 - a_6$)**	**Winners - Losers ($a_7 - a_8$)**	**Adj R^2**
A. Institutions in Three Largest Manager Size Quartiles					
1980-1987	2.64	—	—	—	0.040
	1.74	**39.17**	**-11.47**	0.47	0.481
1988-1997	3.01	—	—	—	0.017
	1.44	**30.61**	**-5.52**	**5.78**	0.691
1998-2008	-0.38	—	—	—	0.001
	-0.85	**12.32**	**-5.46**	-1.02	0.541
B. All Institutions in Smallest Manager Size Quartile					
1980-1987	4.10	—	—	—	0.018
	4.58	-3.10	**-18.48**	4.32	0.387
1988-1997	2.37	—	—	—	0.045
	2.73	**-35.65**	2.31	**17.01**	0.447
1998-2008	3.72	—	—	—	0.056
	2.60	**-89.09**	0.96	**15.07**	0.756
C. Non-Hedge Institutions in Smallest Manager Size Quartile					
1998-2008	2.58	—	—	—	0.038
	1.52	**-83.93**	0.46	**11.21**	0.740
D. Hedge Funds in Smallest Manager Size Quartile					
1998-2008	**13.84**	—	—	—	0.103
	12.31	**-135.15**	-0.53	**48.52**	0.574

Table 5

Analysis of the Existence and Value of Style Timing, 1998-2008

This table reports statistics by type of advisor for the overall period and two subperiods. The left side gives information about the total number of advisors and data on those exhibiting significant style timing. Whether an advisor exhibits significant style timing is determined from a regression of monthly excess returns on the market excess return, size, value and momentum factors plus three additional style timing variables--one for each type of style. To illustrate for the size factor, the additional factor has the same returns as the original size factor except that all negative returns are set to zero. An advisor was determined to engage in style timing if the p-value of the F-statistic that tests the hypothesis that the coefficients on the style timing variables are jointly zero was less than 10 percent, and the number of these is reported as the actual. The expected number is 10 percent of the total. The excess is the difference between the actual and the expected. The chi-squared statistic that tests whether the actual equals the expected was calculated and p-values reported. The right hand side of the table breaks the actual style timers into those who added value. The expected number is half of the actual style times on the null assumption that adding or subtracting value is equally likely. An advisor was determined to have added value if the alpha coefficient for the regression with the style timing variables was less than the alpha coefficient for the regression without the style timin variables. The excess is the difference between the actual and the expected. The p-value for the chi-squared statistic that tests the hypothesis the the actual is equal to the expected is shown.

	Number of Advisors					Significant Style Timing			
	Total	Signif. Style Timing (p-val of F<0.10)				broken down by those that added value			
		Expected	Actual	Excess	χ^2 p-Value	Expected	Actual	Excess	χ^2 p-Value
A. Non-Hedge Funds from the Fourth Quartile									
1998-2008	679	67.9	237	169.1	0.00	118.5	188	69.5	0.00
1998-2002	945	94.5	139	44.5	0.00	69.5	106	36.5	0.00
2003-2008	1242	124.2	433	308.8	0.00	216.5	198	-18.5	0.08
B. Hedge Funds from the Fourth Quartile									
1998-2008	30	3.0	14	11.0	0.00	7.0	8	1.0	0.59
1998-2002	33	3.3	7	3.7	0.00	3.5	5	1.5	0.26
2003-2008	96	9.6	34	24.4	0.00	17.0	10	-7.0	0.02
C. Investment Managers from Three Largest Quartiles									
1998-2008	18	1.8	7	5.2	0.00	3.5	6	2.5	0.06
1998-2002	27	2.7	1	-1.7	0.28	0.5	0	-0.5	0.32
2003-2008	24	2.4	5	2.6	0.08	2.5	1	-1.5	0.18

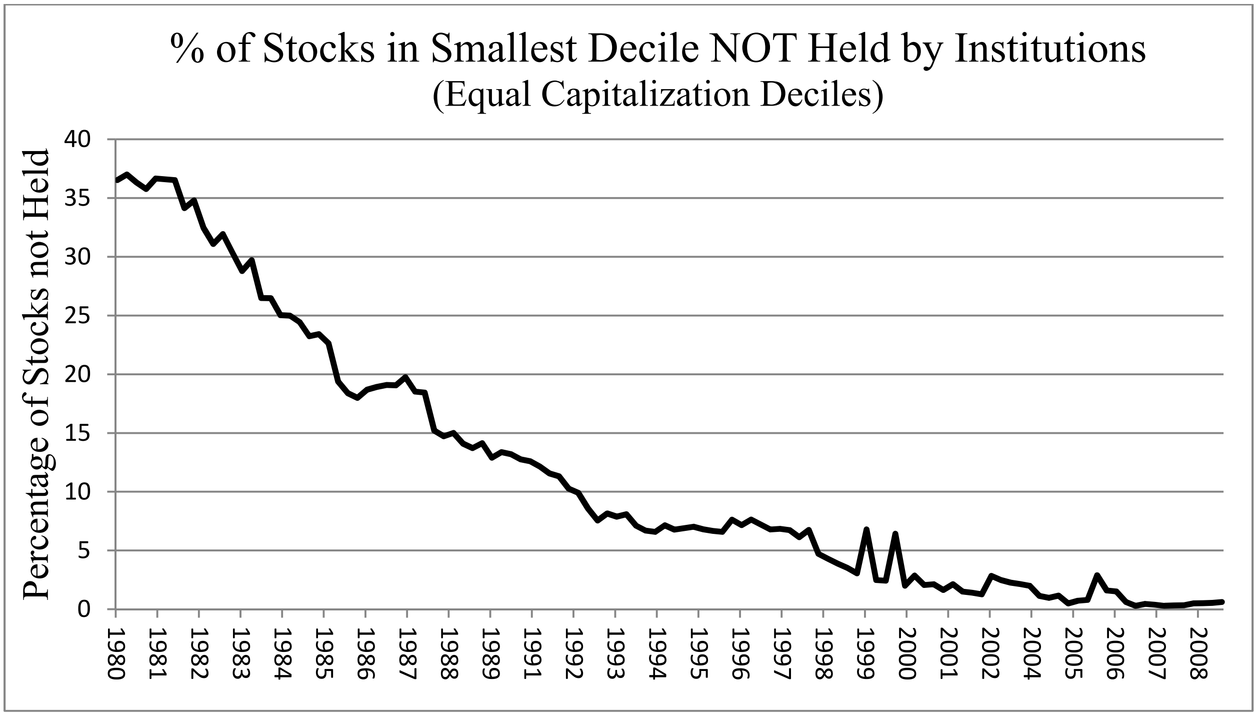


Fig. 1. The percentage of stocks in the smallest equal-cap decile that were *not* held in institutional portfolios, 1980 to 2008. Holdings data are for all institutions in the Thomson/IDC 13f database.

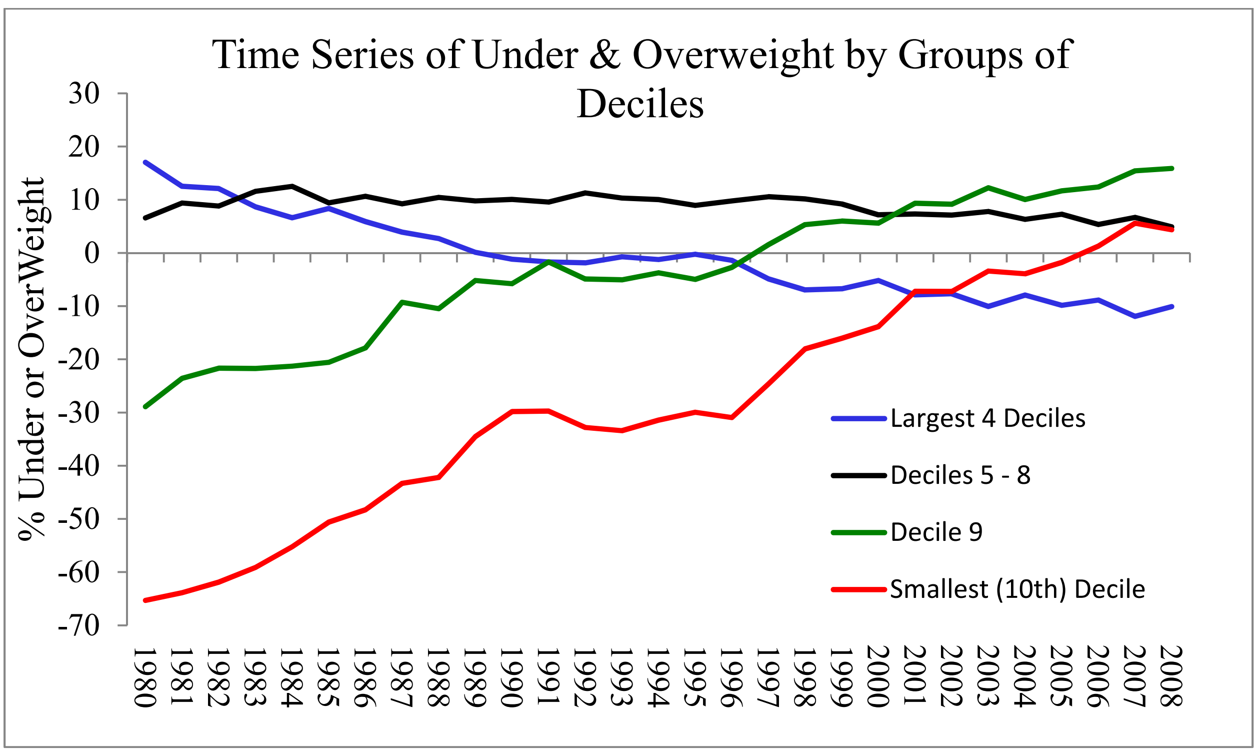
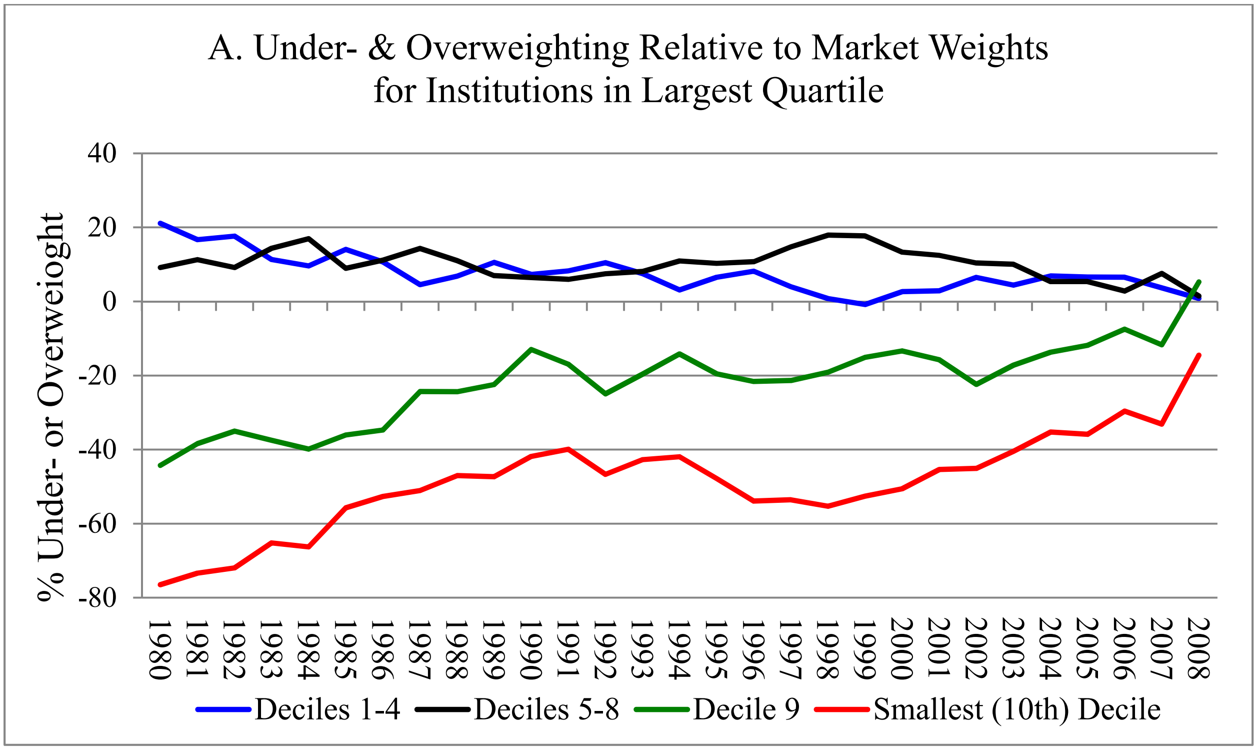


Fig. 2. Under- and over-weights relative to market weights for four equal-cap-based groupings of stocks across all institutions, reported for yearend 1980 to yearend 2008. Holdings data are for all institutions in the Thomson/IDC 13f database.



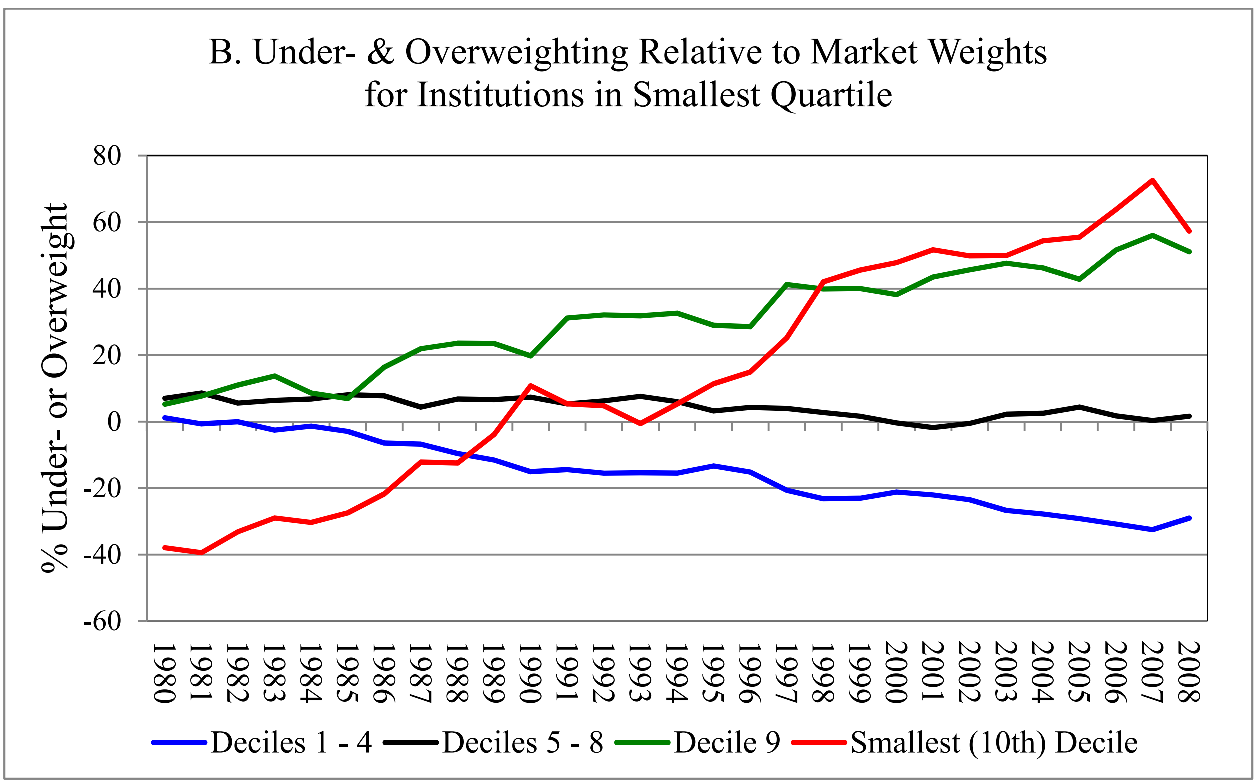
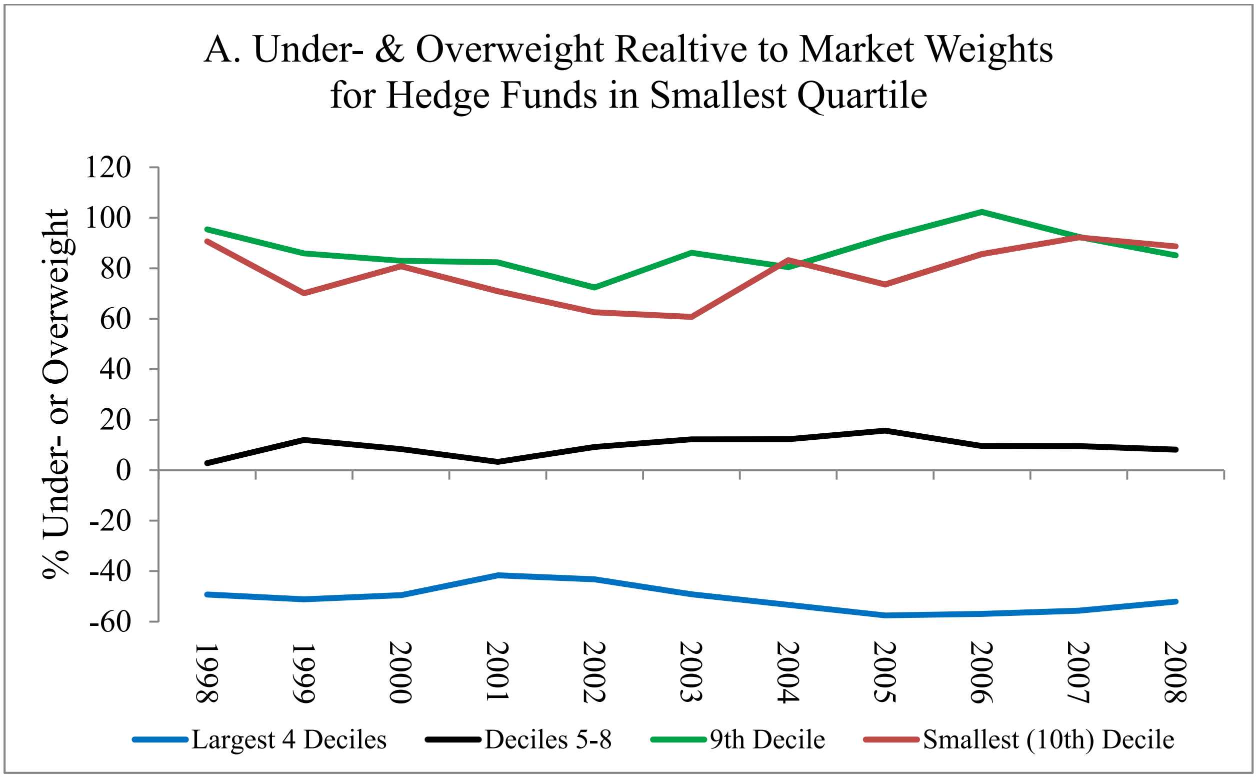


Fig. 3. Under- and overweights relative to market weights for the quartile of largest institutions and the quartile of smallest institutions. The quartiles are constructed each year by breaking our 13f sample into four equal-market-value quartiles of institutions. Thus, the largest quartile contains many fewer institutions (e.g., seven in 2008) than the smallest quartile (e.g. 3015 in 2008). Results are reported for yearend 1980 to yearend 2008.



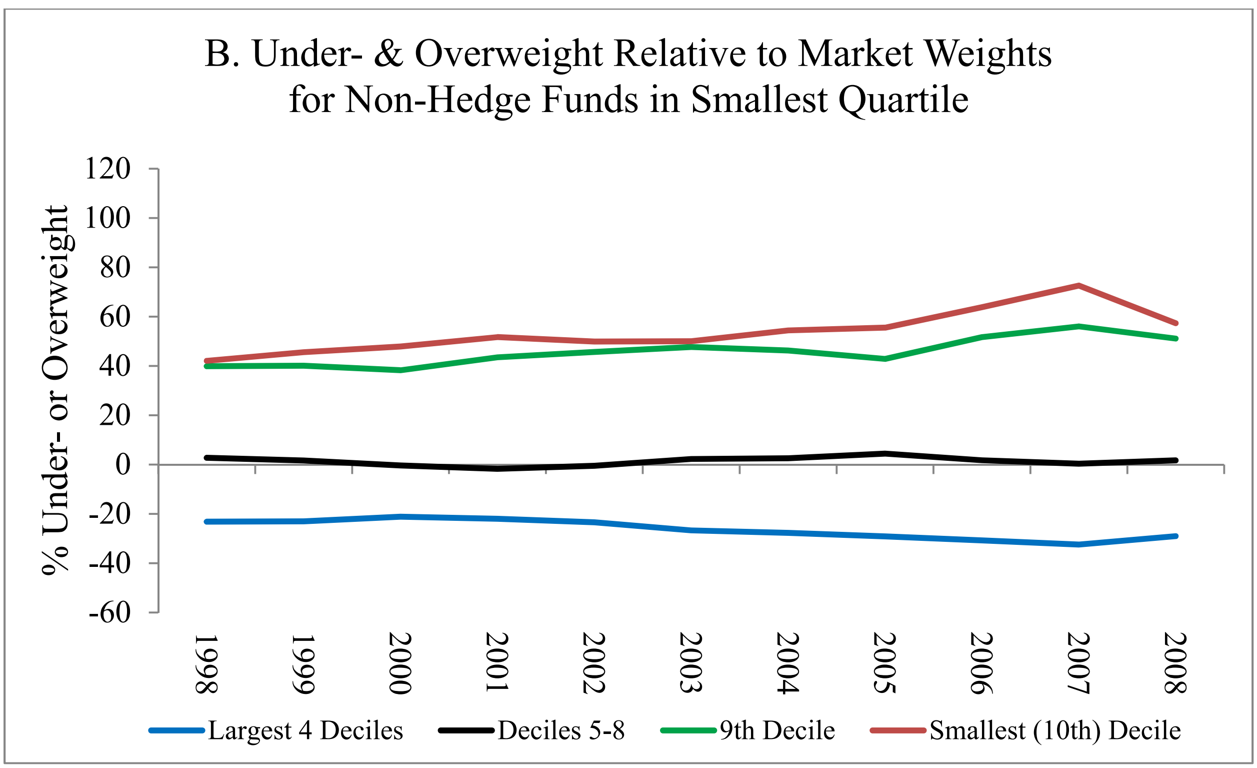
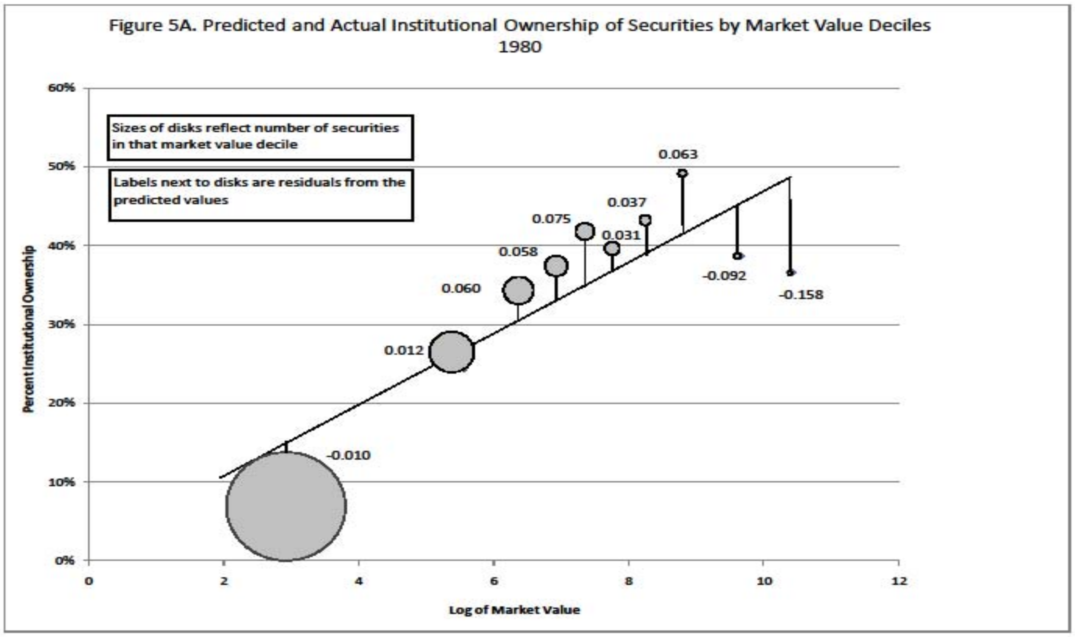


Fig. 4. Under- and overweights relative to market weights for hedge funds and non-hedge institutions in the quartile of smallest institutions. Results are reported for yearend 1980 to yearend 2008.



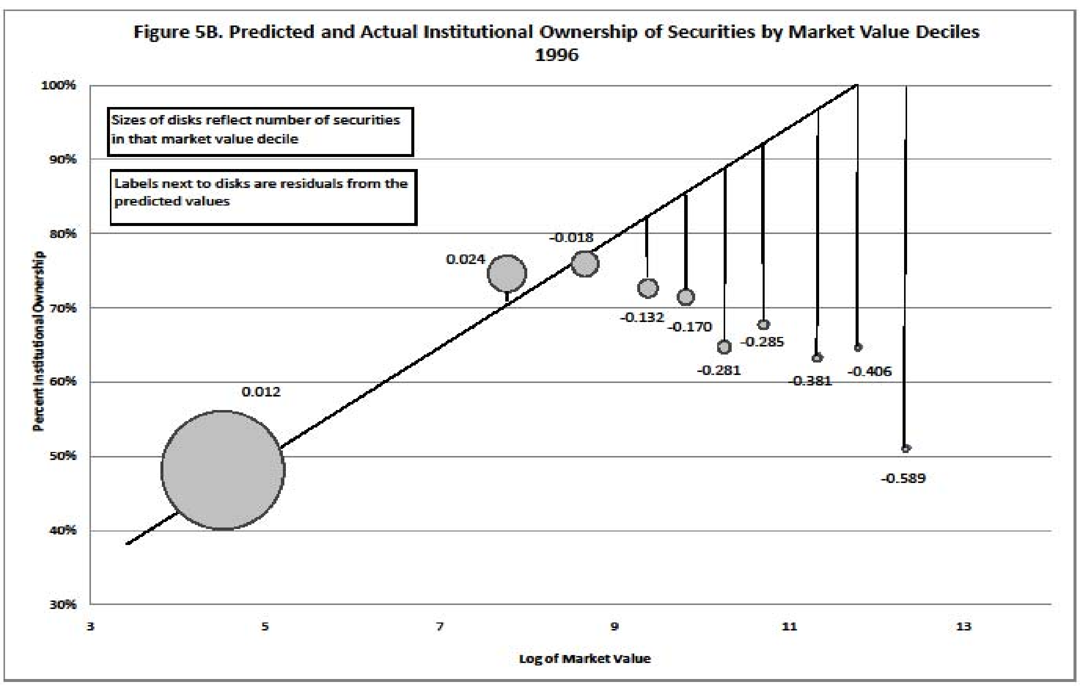


Fig. 5. These figures plot the linear regression of the percent of institutional ownership in each stock on the logarithm of its market value. We also plot the unweighted means of these two variables for each market-cap decile and center upon each point a disk whose area is proportional to the number of stocks in the decile used in the regression. As a measure of specification, we also indicate the average residual for each decile.

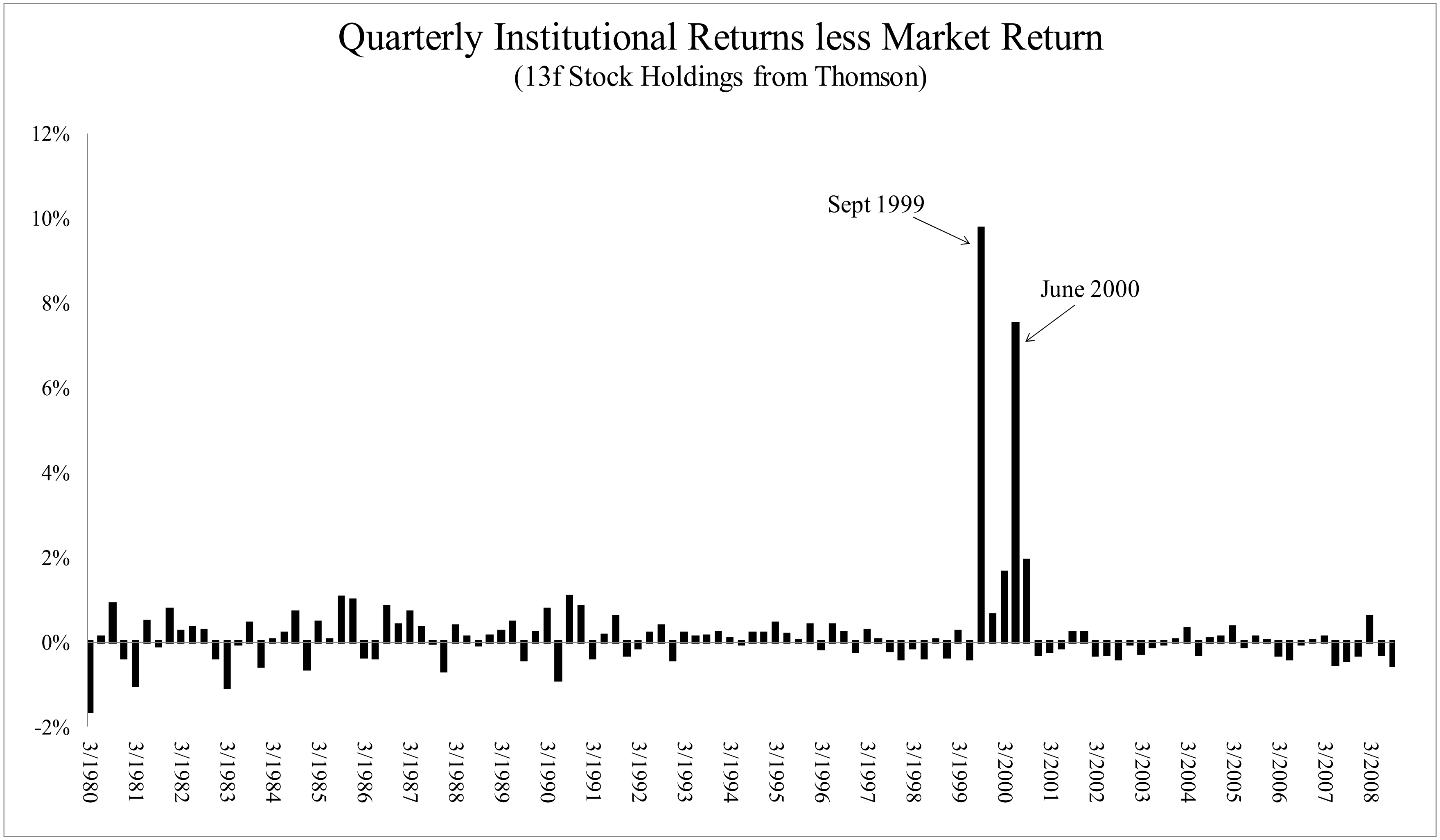


Fig. 6. This figure plots the differences between quarterly institution returns and quarterly market returns. To compute the institution returns, we aggregate the dollar value of the holdings of all institutions at the end of each quarter for each individual stock. We then compute a buy-and-hold return for the aggregated balance sheet of all institutions by averaging the quarterly return for each stock weighted by the dollar value of the holdings of each stock at the end of the prior quarter. To measure the market return, we compute an average return of the equities used in this study, weighted by the market value of each stock at the end of the prior quarter.

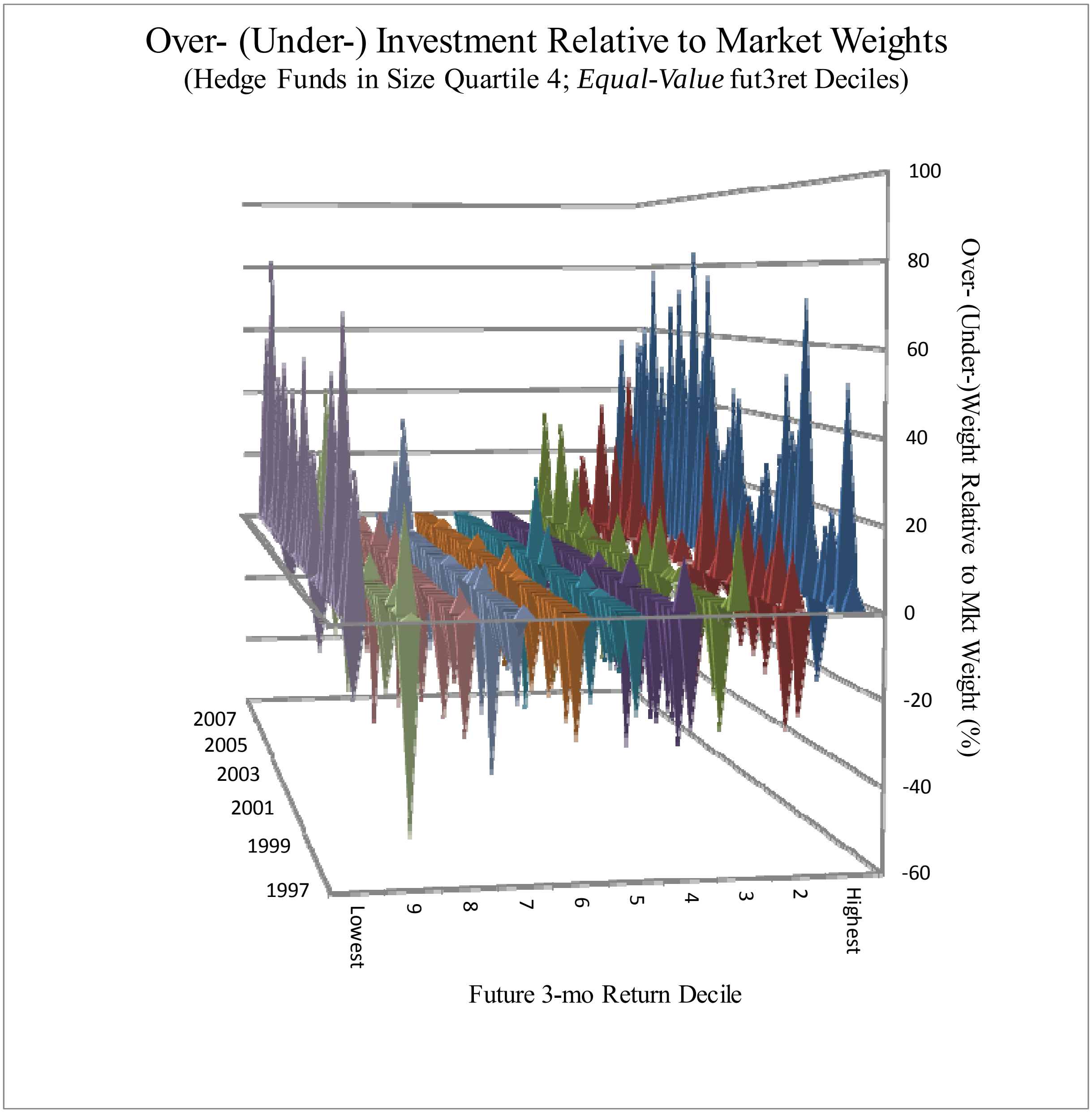


Fig. 7. End-of-quarter under- and overweights relative to market weights for equal-cap future-return deciles for the hedge funds in our decile of smallest institutional size, 1980 to 2008. At the end of each quarter we rank all US equities in our sample by their total return over the following quarter, and assign to the first decile the stocks with the largest returns during the following quarter whose combined market value is less than or equal to ten percent of the total market value of all stocks. We repeat this process for successively lower quarterly returns to determine the remaining nine deciles. We compute weighted average under- and overweights using decile total market value as the weight.

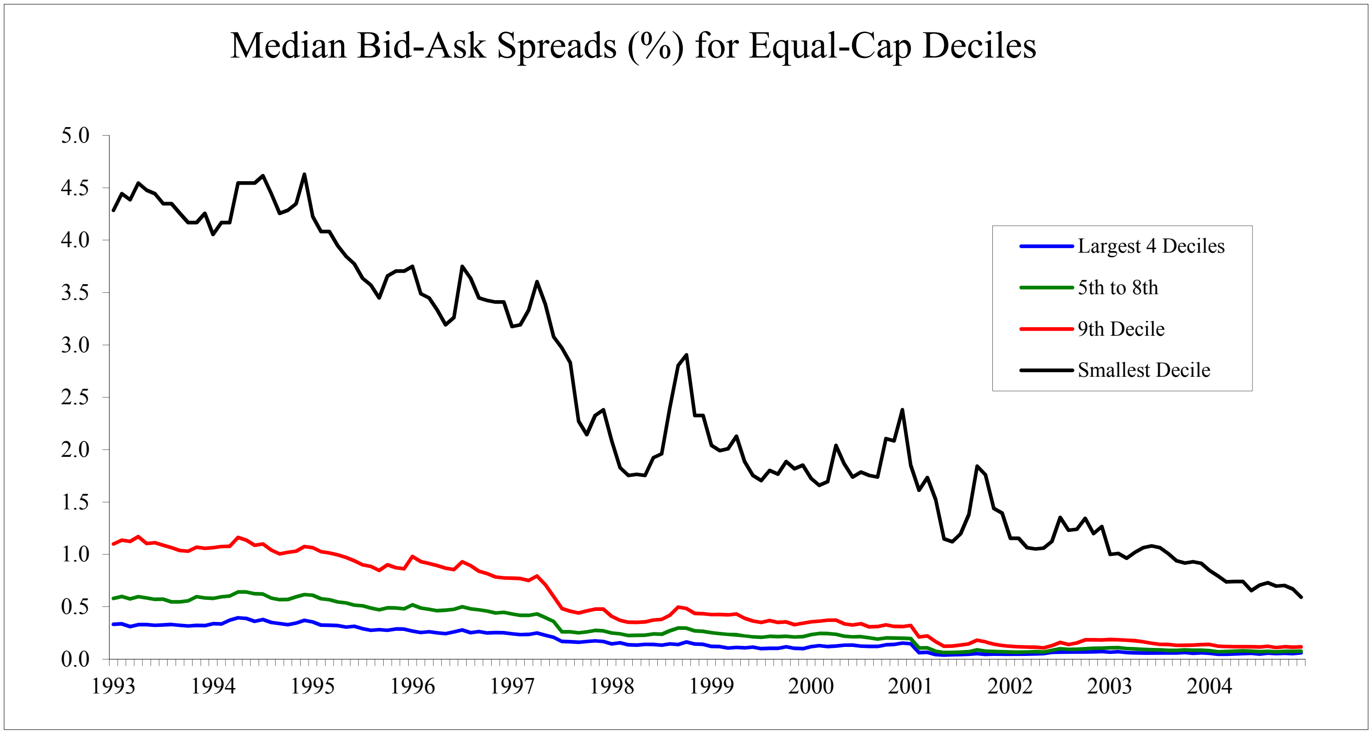


Fig. 8. This figure plots for four groupings of equal-cap deciles (as described in Section 3.1) the median month-end closing bid-ask spread (in percent) from 1993 to 2004. The decile cutoffs are based on all NYSE, AMEX and Nasdaq stocks.

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