Institutional Investors and Stock Market Liquidity: Trends and Relationships

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Abstract

In this paper we show that institutional participation in the U.S. stock market in recent decades has played an ever increasing role in explaining cross-sectional variation in stock market illiquidity. We first document trends in the growth of institutional stock ownership using the 13F holdings, extending the evidence by thirteen years to the end of 2010. 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 currently underweight the largest stocks and overweight the smallest stocks relative to market weights. We then examine the relation between illiquidity and two measures of institutional stock ownership – the percentage of a stock owned by institutions and the number of institutions that own the stock – both in the cross section and through time. We find that: (1) the number of institutions that own and trade a stock is more important than the percentage of institutional ownership in explaining the cross-sectional variability of illiquidity; and (2) the power of the number of institutional owners in explaining illiquidity is significantly stronger in the second half of our sample period.

Keywords: Institutional investors, Institutional stock ownership, SEC 13F filings, Hedge funds, Market liquidity

JEL Classification: G11, G12, G23

1. Introduction

Since the Congressional repeal of fixed non-competitive commission rates in 1975, there have been numerous, and sometimes important, regulatory changes in the equity market. To name two: the gradual reduction in the tick size, which allowed tighter spreads as between the quoted bid and ask prices; and Regulation National Market System (NMS) in 2005, which mandated the electronic integration of trading in all listed equities and allowed high-frequency trading. Concurrent with these changes was the growth of investing through institutions and an increase in stock market liquidity, or equivalently a decrease illiquidity. In this paper, we examine the role of institutions in explaining illiquidity across stocks and over time.

We first address recent changes in institutional preferences for common stocks. An extensive academic literature documents the overall growth in institutional equity ownership as well as the changing composition of the types of stocks in which they invest. We use the Thomson 13F institutional holdings file to analyze trends in institutional stock ownership over the period 1980-2010, thereby extending the evidence by thirteen years. We examine institutional portfolio allocations across deciles of equal market value (equal-cap deciles)[1] and find, in contrast to previous evidence, that institutional investors since 1980 have decreased their holdings in larger stocks and have increased 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 10.2 percent in 2010 – and now overweight these smallest stocks relative to market weights. Further, institutions as a whole have over time decreased their portfolio allocations to the largest stocks, and as of the end of 2010 underweight, relative to market weights, 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 most pronounced for smaller institutions. In addition, for the shorter thirteen-year period from 1998 through 2010, we find that hedge funds exhibited a greater shift towards smaller-cap stocks

[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 equal-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 discernible 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.

than non-hedge institutions of comparable size. We find evidence that the returns of the hedge funds in our sample were greater than the returns of comparable non-hedge funds.

The trends in institutional stock ownership that we document, along with the growth in institutional trading volume that has occurred over recent decades, has implications for the liquidity of U.S. equity markets. Most previous research analyzing institutional ownership and liquidity has focused on the relation between institutional ownership and share turnover (e.g., Bennet, Sias and Starks (2003)). Share turnover, however, is an imprecise and indirect measure of liquidity. Rubin (2007) examines the relation between institutional ownership and several liquidity measures and finds a negative relation for both bid-ask spreads and price impact measures. But because of the specialized data he uses, Rubin is limited to a short sample period from 1999 to 2003.

Like Rubin, we examine the relation between the Amihud (2002) illiquidity measure and the percentage of a stock owned by institutions. We also include in our tests a second measure of institutional ownership – the number of institutions that own the stock – which we argue below should be an important variable in explaining difference in illiquidity across stocks. We find that (1) the number of institutions that own and trade a stock is more important than the percentage of institutional ownership in explaining the cross section of liquidity; and (2) the power of the number of institutional owners in explaining illiquidity across stocks is significantly greater in the second half of our sample period.

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 2010. We analyze cross-sectional differences in ownership patterns across deciles of equal market capitalization and across exchanges, and show that institutional stock allocations have shifted toward smaller-cap and NASDAQ stocks. In Section 4 we examine ownership patterns across institutions of different size, and also for hedge funds compared to non-hedge institutions of the same size. In Section 5 we reconcile our stock ownership 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 6 we examine the implications of these changing institutional ownership patterns for changes in market liquidity. In Section 7, 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 2010. It is important to note that the holdings reported in Forms 13F are not the holdings of an individual portfolio but are the aggregate of the holdings in what could be a large number of portfolio, each managed in different styles. Further, some small institutions may engage a larger institution to report its holdings as part of those of the larger institution. One might expect that the number of aggregated portfolios will be greater for large institutions. The reports of smaller institutions are more likely to contain a limited number of separately managed portfolios—perhaps following the same style. Thus, the holdings for large institutions obtained as reported in Form 13F may not be as useful in understanding the investment behavior of a single portfolio manager as those for smaller institutions. As documented below, Thomson/CDA made two errors in transcribing the original 13F filings to its files—errors that cause a substantial upward bias in the calculation of institutional returns for two months. The analysis in this paper uses corrected data.

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 3.4. A major advantage of using holdings data is that it avoids the self-reporting biases that occur in hedge fund return databases when a fund chooses not to report poor returns (see Griffin and Xu (2009) for a discussion of these issues, and for a list of references.) In anticipation of the results presented below, the identified hedge funds are almost always associated with smaller institutions, as it is not possible to separate the hedge fund of, say, Goldman Sachs from their other non-hedge fund portfolios as reported to the SEC.

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

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 67 percent by the end of 2010. An extensive literature documents this 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) also find that, relative to individuals, institutions prefer "larger, more liquid stocks," and these preferences have remained stable over the years 1980 through 1996. Based on this finding, combined with the increasing institutional share of stock ownership mentioned above, Gompers and Metrick conclude there was increasing demand for large stocks during their sample period and argue that this contributed to the demise of the small-stock premium. Bennett, Sias and Starks (2003) also find that institutions overweighted large-cap stocks throughout the period 1983 to 1997, but 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 resulted in an increased demand for large stocks over time. (See, for example, Campbell, Ramadorai and Schwartz (2009), p. 67).

This section updates previous research on institutional preferences for common stocks, extending the evidence by thirteen years to the end of 2010, 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. As of 2010, institutions now underweight the largest stocks relative to market weights

and overweight the remainder. We also find that, over time, changes in both aggregate and institutional holdings were more pronounced for NASDAQ stocks than for NYSE stocks.

3.1. Trends in Stock Ownership: All Stocks

We begin by partitioning US equities into ten equal-capitalization deciles (hereafter, equal-cap deciles). Specifically, for each quarter during the period 1980 to 2010, 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 compensate 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 for the larger stocks, which of course account for a substantial portion of the total market value of all stocks.

In Table 1, we present summary statistics for the distribution of stocks by equal-cap deciles at yearend 1980 and yearend 2010 for all stocks and for all institutional holdings. Of the total market value of US common stocks of $1.4 trillion in 1980, institutions held $473 billion, or 34 percent. By 2010, the total market value of common stocks had increased to $17.1 trillion, and institutions had increased their holdings to $11.5 trillion, or 67 percent of all stocks. This increase in institutional ownership of common stocks continues the trend following World War II that prior studies have documented.

The market value of stocks is highly concentrated.. In 1980, there were 4844 stocks in our sample (Table 1, Panel A). The largest four accounted for 10 percent of the total market value of these stocks, and the largest 68 accounted for 40 percent of the total market value. The smallest 3,753 stocks accounted for just 10 percent of the total market value. The results for 2010 are similar (Table 1, Panel B).

Institutional allocations across the equal-cap deciles, relative to market weights, have changed over time, as illustrated in Table 1. In 1980, institutions underweighted each of the smallest three equal-cap deciles, while they overweighted each of the seven larger 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.[2] 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 2010, however, institutions were underweighting the stocks in each of the largest five deciles, and overweighting the stocks in the smallest five deciles.[3] 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 three percent at the end of 2010 (Figure 1).

The time trend in institutional allocations provides further insights. In Figure 2, we plot the annual under- and overweights for all institutions for four market-cap groups: large-cap stocks (equal-cap deciles 1 to 4), mid-cap (deciles 5 to 8), small-cap (decile 9), and micro-cap (decile 10). We picked these groupings to correspond roughly to the broad trends discussed in the last paragraph and at the same time to simplify the figure. There is little change in institutional allocations to mid-cap stocks during our sample period, but there is a steady increase in allocation to small-cap and micro-cap stocks and a steady decrease in the allocation to large-cap stocks. On the basis of more detailed data than shown in Figure 2, institutions that had overweighted large-cap stocks in 1980 began to underweight these stocks by the third quarter of 1990. In contrast, institutions, which underweighted the micro-cap stocks by 66 percent in 1980, gradually increased their allocation to these stocks and by the first quarter of 2006 were overweighting them. Similarly, institutions began to overweight the small-cap stock by the second quarter of 1996.[4] In sum, institutions have gradually shifted their holdings from larger to

[2] 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.

[3] 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 2010. 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 by 8.9%.

[4] 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

smaller stocks over the years 1980 through 2010 and now underweight large-cap stocks and overweight small-cap and micro-cap stocks relative to market weights.[5]

3.2 Trends in Stock Ownership: NYSE versus NASDAQ stocks

In this section we compare institutional ownership trends between NYSE and NASDAQ stocks and find substantial differences. To compare the distributions of market value and institutional holdings of NYSE and NASDAQ stocks, we use the same decile cutoffs that we used in Section 3.1.

In 1980, the bulk of the $125 billion market value of NASDAQ stocks was tilted towards smaller stocks: 82 percent of this value was in the two smallest equal-cap deciles and none in the four largest equal-cap deciles (Table 2, Panel A). In contrast, at yearend 1980 NYSE stocks were underweighted in the two smallest deciles and overweighted in the largest seven deciles. By 2010, the distribution of NASDAQ stocks was bimodal with close to market weights in the largest three deciles, substantial underweight in the fourth and fifth decile, close to market weights in the sixth through ninth deciles, and substantial overweight in the smallest decile (although considerably less overweight than in 1980 (Table 2, Panel B)). The changes in the distribution of NYSE stocks were less dramatic between 1980 and 2010 with the most noticeable changes being a reduction in NYSE market value in the largest three deciles and an increase in the two smallest deciles.

Substantial differences in institutional holdings exist between NYSE and NASDAQ stocks. In 1980 institutions held a greater proportion of the market value of NYSE stocks in comparison to NASDAQ stocks (37.5 percent for NYSE and 17.2 percent for NASDAQ), but by 2010, this relationship had reversed (66.2 percent for NYSE and 71.6 percent for NASDAQ)

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in the institutional ownership share of the large-cap stocks is much smaller than the growth in their shares of the small-cap and micro-cap stocks over our sample period. For example, the percentage of the large-cap stocks owned by institutions grew from 40.3% in 1980 to 60.0% in 2010. In contrast, the percentage of the micro-cap stocks owned by institutions grew from 11.9% in 1980 to 68.2% in 2010. And even though institutions underweighted the smallest 2% of stocks in 2010 relative to market weights (see footnote 3), the institutional ownership percentage of this tail of the distribution increased dramatically between 1980 and 2010 (from 3.75% to 45.7%). Thus, although institutions were steadily displacing individual investors across *all* strata of the market-cap spectrum, the displacement was largest for the micro-cap stocks.

[5] These results 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 12.8 percent overweight in Dec 1980 to a 2.5 percent underweight in 2010, while institutional allocations to stocks in each of the nine other deciles increased over the same years. As shown below in Section 5.1, these differences can be reconciled by comparing the composition of our equal-cap deciles with the composition of the equal-number deciles

(derived from Table 2). Consistent with overall trends, institutions increased their ownership of micro-cap stocks and decreased their ownership of large-cap stocks for both NYSE and NASDAQ stocks (Figure 3). For mid-cap stocks, institutions reduced their overweighting of NASDAQ stocks over the sample period, while institutions maintained a small, and mostly unchanged, overweight of NYSE stocks.

Thus, there are significant and important differences in the patterns of institutional allocations to NYSE and NASDAQ stocks over time. There are other differences as well: As mentioned before, the two exchanges record trade volume in different ways. Further, each exchange has different trading systems—a specialist system for the NYSE and a competitive dealer system for NASDAQ, although NMS in 2005 has introduced competition between these two systems and perhaps reduced their differences. For these reasons, our analysis of the relation between institutional holdings and illiquidity in section 6 will examine NYSE and NASDAQ holdings separately.

3.3 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 holdings in small-cap and micro-cap stocks. 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 12.9 percent from 1980 through 2010. 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 small- and micro-cap stocks, as the next section shows, an increase in the number of smaller institutions might over time increase the ownership percentage in small stocks from those reported above. 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 2567 in 2010, while the number above the cutoff shows only a small increase from 511 in 1980 to 580 in 2010. 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 2010 these institutions represented only 6.1 percent of total institutional holdings. Eliminating them from the sample does not change our conclusions as to the trends in institutional ownership.[6]

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 as a security receivable. 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.[7]

There are numerous reasons to borrow and lend securities (e.g., short selling, dividend-recapture programs, and corporate voting schemes.) Although it would be desirable to adjust for all of these types of lending, the only publicly available data 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, we use the short interest at the end of each quarter from Compustat Xpressfeed from 2007 to 2008. Prior to 2007 and going to back to 2003, we approximate the short interest at the end of the quarter by the mid-month short interest of the last month in each quarter by mid-month short interest, as month-end data are not available. We find

[6] 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.

[7] 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.) For these observations, we reduced the institutional holdings to the outstanding market value.

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.

4. 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 that a 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.[8] One might expect that those larger active institutions that 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, there may not be enough stock outstanding to satisfy their investment needs and even if there were, they would necessarily have to take large positions that likely would entail large transactions costs.[9] SEC reporting requirements for holdings in excess of five percent, and possibly violations of statutory limits on investment in individual companies are further constraints. Such constraints, however, are not as binding on smaller institutions, enabling them to tilt their portfolios towards smaller stocks.

[8]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.)

[9] 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, we break our sample each year into four quartiles of institution size from the largest to the smallest, where each quartile has approximately the same total market value in the same manner as the equal-cap deciles. Thus, the largest quartile contains many fewer institutions than the smallest quartile. As an example, in 2010 the largest quartile contained six institutions and the smallest contained 2991 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 large- and mid-cap stocks relative to market weights, and underweight the small- and micro-cap stocks for most of the sample from 1980 through 2007 (Figure 4, Panel A). However, over time, the largest institutions gradually shifted their holdings of large-cap stocks into small- and micro-cap stocks. By 2010, these largest institutions had virtually eliminated their overweight of the large- and mid-cap stocks, and dramatically reduced their underweight of small- and micro-cap stocks; in fact, the largest institutions had a slight overweight in small-cap stocks after 2007. This shift towards smaller stocks is consistent with a growth in quantitative portfolio strategies among these large institutions, where portfolio weights are close to market weights.

Although we have no specific conjecture as to the market-cap tilt of smaller institutions, we have noted 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 indeed tilt their portfolios towards smaller stocks (Figure 4, Panel B). The smaller institutions overweighted the small-cap stocks for the entire period, increasing their overweight from five percent in 1980 to 52 percent in 2010. Their allocations to micro-cap stocks exhibited the most dramatic increase over the period, beginning with a 39 percent underweight in 1980 and ending with a 51 percent overweight in 2010. In contrast, their underweight of large-cap stock became more pronounced throughout most of the period, ending 2010 with an underweight of about 29 percent relative to market weights.

4.1 Stock Ownership by the Smallest Institutions: Hedge Funds versus Non-Hedge Funds

In this section we explore the extent to which the increase of hedge funds in recent years contributed to the increased holdings of small-cap and micro-cap stocks. Our first task is to develop a list of hedge funds (HFs), and we begin with the annual list of the largest 100 HFs

from *Institutional Investor Magazine* for each year end from 1997 to 2010.[10] To these we add funds from a list of the 100 largest HFs 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 HFs (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 HF 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 HFs in our sample fall in the fourth (208 funds in Dec 2010) and third (8 funds in Dec 2010) quartiles of institution size as defined in the previous section.

Our resulting HF sample at yearend 2010 consisted of 208 funds with equity holdings of $689 billion, or 4.03 percent of all stocks outstanding (Table 3)[11]. Since most of the HFs in our sample fall in the smallest (fourth) quartile of institutions in most years, we restrict our comparisons to just those institutions in the fourth quartile. In Table 4, we report the percentage distribution of ownership by equal-cap decile, as well as the corresponding percentage over- and under-weighting, separately for hedge funds and non-hedge funds for yearend 1997 (Panel A) and yearend 2010 (Panel B). In 1997, HFs underweighted the stocks in the seven largest equal-cap deciles, relative to market weights, and this underweight (on average −40.5%) is substantially greater than the underweight for non-HFs (−11.6%). Further HFs substantially overweighted stocks in the three smallest deciles (on average 94.2%), in comparison to the average 27.0% overweight by the non-hedge institutions. These same patterns are also evident in the 2010 results in Panel B, but at a somewhat attenuated level. Indeed, this pattern is a consistent feature of the HF versus non-HF weights throughout our sample period. Taken together, these more extreme under- and over-weightings by the HFs may have contributed to the performance differential between HFs and non-HFs over these years, an issue we address in the next section.

[10] We thank Chris Geczy for providing this list for the earlier years in our sample.

[11] How does our HF 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 HFs with average equity holdings of $2.105 billion, or a total of $421 billion in equity holdings. From our Table 3, 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 HFs 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 HFs with total holdings of just under $130 billion.

4.2 The Effect of Holdings Differences on the Relative Performance of Hedge and non-Hedge Funds

There is not a consensus in the academic literature on the investment performance of HFs. For example, Ibbotson, Chen and Zhu (2011) document a 3.0% risk-adjusted return for a large sample of HFs over the period 1995-2009, while Griffin and Xu (2009) find little evidence of superior HF performance over the period 1980-2004. Such differences may be due to their use of substantially different data sources. We use the 13F data to ask whether these differences in holdings documented in the previous section resulted in differences in returns as between HFs and non-HFs. The benefit of using 13F holdings data to analyze hedge fund performance is that it eliminates the selection and survivor biases that occur in hedge fund return databases.[12]

For both HFs and non-HFs, we compute weighted average quarterly returns within each of the equal-cap deciles described above, where the weights are proportional to the market value of the holdings at the end of the prior quarter within each decile. Of particular interest to reseachers, we identified two types of data errors in the Thomson 13F database. These errors, which occurred in the quarters ending September 30, 1999, and June 30, 2000, result in substantial upward biases in returns computed from the Thomson data for these quarters. The appendix contains a detailed description of the errors and the adjustments we make to correct them. All of the analyses in this section correct for these data errors. [13]

Our focus is on relative performance, so we compute the differences in return between HFs and non-HFs for each quarter for each equal-cap decile and report the average return differences for three subperiods in panel C of table 4. In all three subperiods and in most of the equal-cap deciles, the returns of HFs are greater than those of non-HFs. The largest differences in returns are in the smaller-cap deciles, especially deciles 6 through 9, and many are significant in the first two subperiods.[14] This superior selection ability of HFs, coupled with their overweighting of smaller stocks relative to non-HFs, indicate that their outperformance is both statistically and economically significant. In a related paper, we find weak evidence that the

[12] See Griffin and Xu (2009) for a discussion of these issues, and for a list of references.

[13] Briefly, 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. These two 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.

[14] The level of significance was determined by the ratio of the simple average of the quarterly differences to the estimated standard deviation of that average.

performance differential remains when estimated using a four-factor model (Fama and French (1993), Carhart (1995).)[15]

5. Institutional Ownership Results: Comparison with Previous Literature

As discussed in Section 3, previous researchers, with the notable exception of Bennett, et al. (2003), conclude that the relative allocation of institutional portfolios as between large and small stocks in recent decades has remained largely unchanged. Our conclusions differ in that institutions over time decreased the relative allocation of their portfolios to large-cap stocks and increased their allocations to small stocks. Whether the relative institutional allocation to large stocks has been stable or not is economically important, as Gompers and Metrick (2001) (hereafter GM) argue that a stable institutional allocation contributed to increased aggregate demand for large-cap stocks and, thereby, "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 of an increasing demand for larger stocks over time on two observations. First, the institutional ownership percentage of common stocks has increased over time: this is consistent with our results. Second, there is an institutional preference for larger stocks that has been stable over recent decades; this observation 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.[16] From the first quarter of 1980 through the last quarter of 1996, they report an average cross-sectional correlation of 0.625 (computed every quarter, across individual securities), and assume this relation is stable over their sample period. We replicated their

[15] In Blume and Keim (2012) we find that hedge fund alphas, computed relative to a four-factor model, 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 where a positive or negative drawing is equally likely, the number of times the hedge fund alphas exceed the alphas for non-hedge funds is significant at the five percent level..

[16] GM also illustrate this result in a multiple regression in which the institutional ownership ratio is regressed on a number of stock characteristics, including log of market capitalization. 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) find that 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 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.

analysis for the 124 quarters from the first quarter of 1980 through 2010 and find that the correlations varied from a low of 0.58 to a high of 0.68. These correlations are consistent with theirs and on the surface suggest a stable relation.

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 equal-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 equal-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 is inappropriate – 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 equal-cap deciles relative to the small number in the larger equal-cap deciles, coupled with the differences in institutional holding in the smaller equal-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 equal-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, As reported in Table 1, institutions in 1980 underweighted the largest equal-cap decile and the three smallest equal-cap deciles, with substantial underweights in the smallest decile. They overweighted the middle equal-cap deciles. Over time, we find that institutions gradually reduced their relative holdings in the four largest equal-cap deciles while increasing their relative holdings in the smaller equal-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 equal-cap deciles appears to be driving a positive relation between institutional holdings and log of market capitalization – and now the estimated linear model for 1996 overestimates institutional holdings for the seven largest equal-cap deciles. The diagnostics again suggest a non-linear relationship, but one that has changed dramatically from that in 1980.

In sum, GM's conclusion of increased demand for large-cap stocks rests on a model specification that is inconsistent with the data and, while assumed to be stable, is not. As shown above in Section 3, institutions over time actually have reduced their relative allocations to large stocks and increased their relative allocations to small stocks.

5.1. Comparison with other Weighting Schemes

In this section we highlight the implications of different decile weighting schemes. As described in Section 3, each equal-cap 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 5 where we report the market value and number of securities in each decile at yearend 1980 and 2010. For example, at yearend 2010, the smallest decile contains 77.8 percent of all the securities in our sample while the largest decile contains only 0.2 percent.

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 5. Looking again at December 2010, the stocks comprising the largest equal-number decile have a market value that represents almost 77.3 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. In its procedure, 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 2010, we find that the market value of the stocks in the largest decile makes up 60.5 percent of the market value of all stocks and the stocks in the smallest decile makes up 1.1 percent.[17]

The stratification we use in this paper better highlights deviations from market portfolio weights, especially for larger stocks, than other commonly used stratification methods. If the

[17] Note that CRSP uses all stocks in its indexes, whereas we exclude ADRs, ETFs, and closed-end investment companies.

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 77 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.

6. Illiquidity and Institutional Ownership

The shift in U.S. institutional ownership from larger to smaller stocks, along with the growth in institutional trading volume over recent decades has potential implications for the liquidity of U.S. equity markets. In this section we examine the relation between U.S. stock market liquidity and measures of institutional ownership. Most of the previous research in this area has focused on the cross-sectional relation between institutional ownership and share turnover. For example, Bennet, Sias and Starks (2003) document a positive relation between the percentage of a stock owned by institutions and turnover. The motivation for such a test is twofold: More institutional ownership leads to greater volume; and greater volume is associated with lower trading costs and, thereby, decreased illiquidity (Demsetz (1968), Schwartz and Shapiro (1992)). A more direct test is that of Rubin (2007), who documents a negative relation between institutional ownership and liquidity using both bid-ask spreads and price impact measures. Rubin uses ownership data from Vickers' Stock Research and limits his study to just 1999 to 2003.

Like Rubin, we examine the cross-sectional relation between the Amihud (2002) illiquidity measure and the percentage of a stock owned by institutions. We also include a second measure of institutional ownership – the number of institutions that own the stock. The motivation is that an increase in the number of institutional holders of a stock decreases the average number of shares of the stock held by individual institutions and, thereby, reduces the potential size of a trade and its accompanying liquidity-induced impact (e.g., Merton (1987).)

6.1 Illiquidity and Institutional Ownership Variables—Definitions and Summary Statistics

We use the Amihud (2002) measure to measure illiquidity. Goyenko, Holden and Trzcinka (2009) show that illiquidity measures like Amihud's that rely on daily, or low-frequency, data accurately measure liquidity benchmarks based on transaction-level, or high-frequency, data. Indeed, they conclude the Amihud measure does a better job than most other

measures at capturing liquidity, and is robust to regime changes such as the change in minimum tick size to decimals. The Amihud measure for stock *i* in quarter *q* is defined as:

$$\text{Illiquid}_{iq} = \frac{1}{N_{iq}} \sum_{t}^{N_{iq}} \frac{|r_{it}|}{\text{dolvol}_{it}},$$

where r_{it} is the daily return for stock *i* on day *t*; $dolvol_{it}$ is dollar volume for stock *i* on day *t*; and N_{iq} is the number days on which stock *i* traded during quarter *q*. We require that a stock trade on 40 or more days per quarter to be included in our sample.

We use a variety of institutional ownership and control variables to model the cross-sectional and time series variation in illiquidity. As in previous research (e.g., Bennet, Sias and Starks (2003), Gompers and Metrick (2001)), we use the ratio of the market value of the stock owned by institutions to the total market value of that stock (IO_{iq}) to measure the concentration of institutional ownership in stock *i* in quarter *q*. As described above, we also utilize another measure of institutional activity – the number of institutions holding the stock (num_{iq}). Our primary control variable is the market capitalization of the stock ($mktval_{iq}$), an often-used proxy for illiquidity in models describing price impact (e.g., Keim and Madhavan (1997, 1996)). Following previous research (e.g., Bennet, Sias and Starks (2003)), we also use share price, standard deviation of returns, and the ratio of book value to market value as control variables. All of these explanatory variables are measured at the end of quarter $q-1$, except the standard deviation of returns which is measured using daily returns during quarter $q-1$.

In Table 6, we report value-weighted averages of num_{iq}, IO_{iq} and turnover, and the median value of $Illiquid_{iq}$ multiplied by 10^9, within each equal-cap decile at years end 1982 and 2010. We start with yearend 1982, rather than 1980, as it was not until the third quarter 1982 that CRSP began to report volume information for NASDAQ stocks. Turning first to 1982, there are substantial differences in the values of these variables between NYSE and NASDAQ stocks. For example, the relative concentration of institutional ownership (IO_{iq}) between NYSE and NASDAQ stocks varied considerably across deciles (Panel A). Institutions held a larger proportion of the value of NYSE stocks than NASDAQ stocks in the three largest and three smallest deciles, and a larger proportion of the value of NASDAQ stocks in deciles four through seven. In contrast, the number of institutions holding NASDAQ stocks is uniformly less than for NYSE stocks across all deciles, although the differences are not as great for those for deciles 4 through 6 (Panel B).

Of note, illiquidity in 1982 is uniformly greater for NYSE stocks with its specialist system than NASDAQ stocks with its competitive dealer system, with the exception of the smallest decile (Panel C). For stocks in decile four through seven, the turnover rate is greater for NASDAQ stocks than for NYSE stocks in 1982 (Panel D). This finding is consistent with the double-counting of volume for NASDAQ stocks as discussed in Anderson and Dyl (2007). However, that the turnover rate is about the same for both NYSE and NASDAQ stocks in the smallest three deciles and the third largest decile is not consistent with the double-counting argument unless there is substantially more institutional trading in NYSE stocks than in NASDAQ stocks in these deciles.

By 2010, some of differences between NYSE vs. NASDAQ stocks had disappeared. The percentage of stocks held by institutions and the number of institutional holders are very similar in 2010 for both NYSE and NASDAQ stocks across most of the deciles (Panels A and B). Illiquidity is about the same for both markets at the end of 2010, except for the smallest equal-cap decile where the NASDAQ value is twice the NYSE value (Panel C). This general similarity is consistent with the homogenization of the equity markets following NMS. As might be expected, turnover rates are much higher in 2010 for both NYSE and NASDAQ stocks than in 1982 (Panel D). And although NASDAQ turnover rates are generally higher than for NYSE stocks, the differences between NYSE and NASDAQ turnover rates are narrower for most deciles.

The evidence in Table 6 shows that there are clear time trends in the ownership and liquidity variables, consistent with the changes in institutional structure over these years. In addition, in cross-sectional analyses of the data not presented here, we identified skewness in the data. To reduce the level of skewness, we compute natural logarithms of all the variables. By using logs, we are forced to eliminate zero values of the institutional holdings variable. Because substantial skewness remained in the log values of the variables, we also eliminated those observations with institutional ownership of less than 0.1 percent. The number of observations in the original sample is 569,616 observations. Elimination of observations with zero institutional holdings reduced the sample by 27,634, and the elimination of stocks with very small institutional holdings by 6,904. With these reductions, the final sample size is 535,078 observations. To eliminate time trends, we then standardized each variable in a quarter for each exchange by subtracting its quarterly mean and then dividing by its quarterly standard deviation,

similar to the approach used by Bennett, Sias and Starks (2003). In the following tests, we use the same variable labels for the transformed variables that we used in the discussion above.

6.2 The Relation between Illiquidity and Institutional Ownership

For reasons mentioned above, we examine the relation between *Illiquidity* and ownership characteristics separately for NYSE and NASDAQ stocks.[18] To begin, we compute Spearman rank correlations, estimated over the entire sample period, between the *Illiquidity* and our main independent variables. We find a high degree of correlation.[19] For NYSE stocks, the rank correlation of *Illiquidity* with number of institutions is −0.93, with institutional ownership −0.45, and with market value is −0.93. The corresponding rank correlations for NASDAQ stocks are −0.81, −0.61, and −0.86 respectively. Of concern, however, when estimating our proposed model of illiquidity is the level of correlation between the independent variables. The correlation between number of institutions and institutional ownership is 0.53 for NYSE stocks and 0.82 for NASDAQ. The correlation between market value and number of institution is also high: 0.91 for the NYSE and 0.86 for NASDAQ. Even with such high multi-colinearity, however, it is still possible to distinguish the individual importance of these three variables given a sufficiently large number of observations.

To examine this relation, we estimated two versions of a regression of the transformed dependent variable *Illiquid* on subsets of the transformed independent variables: (1) with variables *mktval* and *IO* , similarly to models estimated in prior studies and (2) with variables *mktval*, *IO*, and *numinst*. Table 7 reports these results separately for NYSE and NASDAQ stocks for six subperiods during 1982 to 2010. The inferences from the NYSE and NASDAQ results are not qualitatively different, so the discussion below is in general terms and applies to results for both exchanges. We also note that the regressions appear to fit the data well, with adjusted R-squared values ranging between 0.67 and 0.91.

The results for model (1) show that *mktval* and *IO* are both significant at the .0001 level and are negatively related to *Illiquidity* in each subperiod – the illiquidity of a stock declines with increasing market capitalization and with increasing institutional ownership. This is consistent

[18] While we analyze both NYSE and NASDAQ stocks, most of the previous research using the Amihud measure to measure market liquidity excludes NASDAQ stocks (e.g., Amihud (2002), Acharya and Pedersen (2005), Rubin (2007)) . Goyenko, Holden and Trzcinka (2009) use a sample of both NYSE and NASDAQ stocks in their analysis, but do not report results separately for the two exchanges. Hasbrouck (2009) includes both NYSE and NASDAQ stocks and reports results separately for the two exchanges.

[19] We also find similarly high correlations in the six subperiods we analyze below.

with results in previous research. Because the variables in the regression are standardized, we can directly compare the size of the coefficients. As such, it is clear that market capitalization plays a larger role than *IO* in explaining cross-sectional differences in illiquidity because the absolute values of the coefficients on *mktval* are much larger, sometimes by an order of magnitude. The coefficient on *mktval* is remarkably stable over time; but it is interesting to note that the coefficient on *IO* tends to become more negative over time, indicating that institutional ownership becomes more important over time in explaining illiquidity.

Including the standardized value of the log of number of institutions in the regression (i.e., model (2)) reduces the absolute value of the coefficients on both *IO* and *mktval*. Although the coefficients on both *mtkval* and *IO* are still significant, the coefficient on *IO* drops dramatically in absolute value, sometimes changes sign, and no longer displays a clear pattern over the subperiods. On the other hand, the coefficient on *numinst* is negative, significant, and much larger (in absolute value) than the coefficient on *IO*, indicating that *numinst* has much greater power than *IO* in explaining cross-sectional differences in Illiquidity. Thus, the larger is the number of institutions that own and trade a stock, the lower is the illiquidity of the stock. We also observe a growing importance of *numinst* in explaining the cross-sectional variability in illiquidity: The absolute values of the coefficient on *numinst* are almost constant in the first three periods; they are also almost constant in the last three subperiods, but nearly twice as large as in the first three subperiods. It is also interesting to note that in the latter half of our sample period the magnitudes of the coefficients on *mktval* and *numinst* are very similar, indicating that in recent years market capitalization and number of institutional owners have nearly equivalent importance in explaining cross-sectional differences in illiquidity.

6.3 Some Additional Diagnostic and Robustness Checks

Following Bennett, Sias and Starks (2003), we reestimated model (2) with three additional control variables (price, standard deviation of returns, and ratio of book to market) but do not report the results as the coefficient estimates for *mktval*, *IO*, and *numinst* in these regressions are similar to those in model (2). Further, the coefficients on the three additional variables are much smaller in absolute value than the estimates for *mktval*, *IO*, and *numinst*, and are often insignificant.

An examination of the residuals for models (1) and (2) suggests the relation is non-linear, particularly with respect to *mktval*. To account for nonlinearity, therefore, we estimated a

variation of the model that includes the squared values of the independent variables. The results are similar. As way of illustration, the estimated coefficients on *numinst* for NYSE stocks in the first subperiod are $-0.352*numinst - 0.107*numinst^2$. We plotted this curve for the first subperiod from −3.0 to 3.0 standard deviations from the mean. The difference between the endpoint value of 0.095 at -3.0 and-2.018 at 3.0, or -2.11, can be interpreted as a measure of steepness. The corresponding difference for the last subperiod is -3.07, indicating greater steepness. Similar analyses for the nonlinear model coefficients on *mktval* and *IO* are consistent with the patterns of these coefficients for the linear models in Table 7.

Finally, we also estimated regressions using log-transformed variables, rather the standardized values of the log-transformed variables which remove time trends, and find that the coefficients on numinst display similar patterns over time—becoming more negative in the second half of the sample. Because the average number of institutions increased over the sample period, it is tempting to say that the increase in institutional ownership resulted in reduced illiquidity. However, this conclusion may be overstated because both variables display a time trend and there may well be important omitted variables that are correlated with the average number of institutions. Given our evidence, we can only conclude that the observed trends in institutional ownership and illiquidity are correlated. In a recent unpublished paper, however, Agarwal (2007) finds evidence that percentage institutional of ownership causes (in a Granger sense) liquidity as measured by intraday spread measures.

As a final check of the reasonableness of our results, we note that the pattern in our estimated coefficients also coincides with a structural change that occurred during the 1996-2000 subperiod: 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).

7. Conclusion

In recent decades, there has been rapid growth in institutional ownership of common stocks and an increasing presence of institutional traders in stock markets. In this paper we show that institutional participation in equities markets has played an increasingly important role in explaining cross-sectional variability in illiquidity.

In the first part of the paper we document trends in the growth of institutional stock ownership using the 13F holdings data. Since 1980 institutional investors have shifted their portfolio allocations from larger stocks to smaller stocks; as of 2010 institutions underweight

larger stocks, and overweight the smallest stocks, in comparison to market weights. We also show that although these trends apply to institutions of all sizes, they are most pronounced for smaller institutions. And for the shorter thirteen-year period from 1998 through 2010, we find that of these smallest institutions, hedge fund portfolios exhibited the greatest shift towards smaller stocks.

In the second part of the paper we examine the relation between institutional ownership and stock market illiquidity. Most previous research in this area has focused on the relation between institutional ownership and share turnover, but share turnover is an imprecise and indirect measure of liquidity. We examine the relation between the Amihud (2002) illiquidity measure and two measures of institutional stock ownership – the percentage of a stock owned by institutions and the number of institutions that own the stock – both in the cross section and through time. While controlling for several factors that are commonly used to explain cross-sectional differences in illiquidity, we find: (1) the number of institutions that own a stock is more important than the percentage of institutional ownership in explaining the cross section of liquidity; and (2) the power of the number of institutional owners in explaining illiquidity is significantly stronger in the second part of our sample period, 1996-2010, than the first part, 1982-1995.

Appendix

Measuring institutional returns with the Thomson/CDA database: a word of caution

The analysis in section 4 requires quarterly returns for the institutions in our sample. 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. This appendix contains a detailed description of the errors and the adjustments we make to correct them.

To demonstrate the problem, consider the value-weighted returns for a portfolio for all the institutions in our sample. To compute this, we first 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. However, once we make the corrections described below, 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.

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.[20] With a few exceptions, the comparisons are consistent with our conjecture.

[20] 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

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.[21]

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 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

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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.

[21] 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.

percent and the 2000 outlier declines to 7.45 percent. Thus, the price adjustment appears to be more important.

References

Acharya, V., Pedersen, L., 2005. Asset pricing with liquidity risk. Journal of Financial Economics 77, 375–410.

Anderson, A.M., and E.A. Dyl. 2007. Trading Volume: NASDAQ and the NYSE. Financial Analysts Journal 63, 79-86.

Bennett, J. A., R. W. Sias, and L. T. Starks, 2003. Greener pastures and the impact of dynamic institutional preferences. The Review of Financial Studies 16, 1203-1238

Binay, M., 2005. Performance attribution of US institutional investors. Financial Management. 127-152.

Blume, M., D. Keim, 2012. Institutional holdings and investment performance. Unpublished working paper.

Brunnermeier, M., S. Nagel, 2004. Hedge funds and the technology bubble. Journal of Finance 59, 2013-2040.

Carhart, M.M., 1997. On the persistence in mutual fund performance. Journal of Finance 52, 57-82.

Campbell, J. Y., T. Ramadorai, A. Schwartz, 2009. Caught on tape: institutional trading, stock returns, and earnings announcements. Journal of Financial Economics 92, 66-91.

Chan, L. K. C., J. Lakonishok, 1995. The behavior of stock prices around institutional trades. Journal of Finance 50, 1147-1174.

Del Guercia, D., 1996, The distorting effect of prudent-man laws on institutional equity investments. Journal of Financial Economics 40, 41-62.

Demsetz, H., 1968. The cost of transactions. Quarterly Journal of Economics 82, 33–53.

Gompers, P. A., A. Metrick, 2001. Institutional investors and equity prices. The Quarterly Journal of Economics, 229-359.

Griffin, J. M., J. Xu, 2009. How smart are the smart guys? a unique view from hedge fund stock holdings. Review of Financial Studies 22, 2531-2570.

Falkenstein, E., 1996. Preferences for stock characteristics as revealed by mutual fund portfolio holdings. Journal of Finance 52, 111-136

Fama, E. F., K. R. French, 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3-56.

Ibbotson, R. G., P. Chen and K. Zhu. 2011. The ABCs of Hedge Fund: Alphas, Betas, and Costs. Financial Analysts Journal 67, 15-25.

Hasbrouck, J., 2009. Trading costs and returns for US equities: estimating effective costs from daily data. Journal of Finance 64, 1445-1477.

Keim, D. B., A. Madhavan, 1996. The Upstairs Market for Large-Block Transactions: Analysis and Measurement of Price Effects, with A. Madhavan. Review of Financial Studies 9, 1-36.

Keim, D. B., A. Madhavan, 1997. Transaction costs and investment style: An interexchange analysis of institutional equity trades. Journal of Financial Economics 46, 265-292.

Kostin, D., N. Fox, C. Maasry and A. Sneider, 2009. Hedge Fund Trend Monitor. (various dates, The Goldman Sachs Group).

Merton, R., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483–551.

Rubin, A., 2007. Ownership Level, Ownership Concentration and Liquidity. Journal of Financial Markets 10, 219-248.

Securities and Exchange Commission, Institutional Investor Study Report. (Washington: U. S. Government Printing Office, 1971)

Table 1
Percentage Distribution of Stock Ownership by Market Cap Deciles: All Stocks, all Institutions
Year End 1980 and 2010

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	9.99	11.02	13.51	12.07	10.99	11.67	10.47	9.69	7.12	3.47	473.26
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. 2010											
All Stocks	9.68	10.07	10.02	10.17	9.93	10.09	10.04	9.98	10.02	10.01	17,084.33
All Institutions	7.75	9.50	9.38	9.06	9.77	10.82	10.74	11.39	11.42	10.18	11,471.06
Memo: All Stocks											
Number	7	11	18	32	48	74	123	214	483	3,545	
Cumulative	7	18	36	68	116	190	313	527	1,010	4,555	
Upper Bound of Decile	368.71	180.07	115.90	72.69	43.78	29.15	18.76	10.96	5.64	2.28	

Table 2

Distribution of Institutional Holdings, Separately for NYSE and Nasdaq Stocks (Year End 1980 and 2010)

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. Total market values are in billions of dollars.

		Market Cap Decile										Total Value
		Largest	2nd	3rd	4th	5th	6th	7th	8th	9th	Smallest	($ Billion)
A. 1980												
NYSE:	Market Weights	11.34	11.95	11.56	10.56	11.34	10.58	11.02	9.99	7.98	3.68	1180.9
	Institutional Weights	10.67	11.77	14.43	12.70	11.49	11.92	10.68	9.18	5.59	1.56	443.2
NASDAQ:	Market Weights	0.00	0.00	0.00	0.00	2.28	4.32	2.83	8.71	24.78	57.08	124.9
	Institutional Weights	0.00	0.00	0.00	0.00	4.93	5.57	6.79	18.45	29.54	34.72	21.4
B. 2010												
NYSE:	Market Weights	8.56	10.81	10.08	12.52	11.69	10.47	10.70	9.81	9.41	5.96	13109.1
	Institutional Weights	6.25	10.13	9.41	11.11	11.74	11.06	11.52	11.12	11.02	6.63	8673.1
NASDAQ:	Market Weights	13.78	7.85	10.11	2.51	3.37	9.10	8.09	10.87	12.02	22.29	3856.6
	Institutional Weights	12.54	7.61	9.41	2.75	3.51	10.21	8.43	12.39	12.51	20.65	2763.2

Table 3

Total Hedge Fund assets and # of Funds
for HFs in Asset Size Quartiles 3 & 4

	Tot Value of HF Stock Holdings		
year	**($ 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
2009	564,933	3.84%	199
2010	688,768	4.03%	208

Table 4

Distribution of Stock Ownership (Year End 1997 and 2010) and Quarterly Returns for the Smallest Quartile of Institutions

Panels A and B present information about the distribution of stock ownership at year ends 1997 and 2010. The first and second row in each panel presents the percentage distribution by market cap of stocks held by institutions in the smallest quartile of asset size, separately for hedge funds and for non-hedge institutions. The market Cap Deciles are equal value deciles as defined in section 3.1. The third and fourth rows in each panel contain the under- and over-weights relative to market weights for the respective type of institution. Panel C contains the average difference in value-weighted quarterly returns between hadge funds and non-hedge institutions in the smallest quartile of manager size, reported separately for each of three subperiods. Values in bold are significant at the 10% level; values in bold and italics are significant at the 5% level.

	Market Cap Decile										Total Value
	Largest	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**Smallest**	**of Holdings**
A. 1997											
Holdings Distribution:											
Q4 ex Hedge Funds	7.14	7.67	8.39	9.09	8.84	9.70	11.03	12.16	13.79	12.18	$1,351
Hedge Funds in Q4	3.02	4.02	5.19	7.74	5.50	7.00	9.24	15.19	21.94	21.16	$35
Under- or Overweight:											
Q4 ex Hedge Funds	-28.51	-21.20	-15.28	-10.92	-12.78	-2.99	10.27	21.41	37.87	21.77	
Hedge Funds in Q4	-69.77	-58.73	-47.64	-24.15	-45.77	-29.99	-7.61	51.70	119.46	111.52	
B. 2010											
Holdings Distribution:											
Q4 ex Hedge Funds	6.40	7.12	8.32	8.05	9.00	9.69	9.96	11.54	14.64	15.27	$2,373
Hedge Funds in Q4	3.82	7.51	4.67	5.63	7.21	11.50	10.44	16.62	18.47	14.13	$453
Under- or Overweight:											
Q4 ex Hedge Funds	-33.91	-29.23	-16.97	-20.86	-9.36	-3.90	-0.77	15.67	46.17	52.52	
Hedge Funds in Q4	-60.54	-25.44	-53.36	-44.65	-27.43	13.96	3.98	66.62	84.42	41.18	
C. Average Quarterly Return Difference (%): Hedge Funds minus non-Hedge Funds											
1997-2001	0.26	0.31	-0.42	0.69	-0.09	0.86	**0.99**	**1.31**	***1.22***	0.61	
2002-2006	-0.19	***0.47***	0.01	0.21	0.17	***1.30***	***0.64***	**0.56**	***1.31***	0.43	
2007-2010	0.56	-0.52	0.57	-0.15	-0.34	-0.24	-0.12	**1.15**	0.43	0.53	

Table 5

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 2010.

	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 2010												
Largest	1,653,265	10,334,799	13,206,528	7	195	455	9.7	60.5	77.3	0.2	4.3	10.0
2	1,719,803	2,459,517	1,921,056	11	206	455	10.1	14.4	11.2	0.2	4.5	10.0
3	1,711,935	1,389,530	887,913	18	231	456	10.0	8.1	5.2	0.4	5.1	10.0
4	1,737,578	782,715	469,565	32	220	455	10.2	4.6	2.7	0.7	4.8	10.0
5	1,697,281	559,528	271,807	48	228	456	9.9	3.3	1.6	1.1	5.0	10.0
6	1,723,359	477,137	156,041	74	277	455	10.1	2.8	0.9	1.6	6.1	10.0
7	1,715,088	390,352	91,718	123	353	456	10.0	2.3	0.5	2.7	7.7	10.0
8	1,704,620	284,453	49,021	214	407	455	10.0	1.7	0.3	4.7	8.9	10.0
9	1,711,049	217,478	23,007	483	551	456	10.0	1.3	0.1	10.6	12.1	10.0
Smallest	1,710,356	188,824	7,677	3545	1887	456	10.0	1.1	0.0	77.8	41.4	10.0
Sum	17,084,332	17,084,332	17,084,332	4,555	4,555	4,555	100.0	100.0	100.0	100.0	100.0	100.0

Table 6

Institutional Holdings and Liquidity Characteristics: NYSE vs. Nasdaq Stocks

(Year End 1982 and 2010)

This table reports value-weighted averages of num_{iq}, IO_{iq}, and turnover, and median of Amihud's $Illiquid_{iq}$, within each equal-cap decile at year end 1982 and 2010. Values are reported separately for NYSE and NASDAQ stocks. num_{iq} is the number of institutions holding stock i at the end of quarter q, io_{iq} is the ratio of the market value of the stock owned by institutions to the total market value of that stock, and turnover is the average of the daily ratio of number of shares traded to number of shares outstanding, annualized and expressed as a percent . We multiply the Amihud illiquidity measure by 10^9 and report the median value within each decile.

	Market Cap Decile									
	Largest	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**Smallest**
A. Percentage of Stocks Held by Institutions (*IO*)										
1982										
NYSE	34.3	39.4	47.0	44.7	45.0	42.0	38.8	35.8	30.0	18.9
Nasdaq	0.0	0.0	40.5	49.3	51.0	42.3	51.7	32.5	27.7	14.7
2010										
NYSE	48.4	62.0	61.7	60.4	66.4	72.2	74.7	77.1	78.2	74.7
Nasdaq	65.2	69.5	66.7	78.6	74.5	80.4	74.6	81.2	78.7	67.6
B. Number of Institutional Holders (*num*)										
1982										
NYSE	484.2	371.8	314.4	220.1	176.2	134.0	99.4	65.4	36.8	13.6
Nasdaq	—	—	173.0	190.0	162.0	102.9	88.3	48.8	28.0	8.8
2010										
NYSE	1493.3	1367.3	1071.1	717.7	652.3	550.3	439.6	345.8	232.9	135.9
Nasdaq	1596.9	1231.9	1202.3	789.1	591.1	573.4	439.7	336.4	226.2	110.2
C. Median Amihud Measure (*Illiquid*)										
1982										
NYSE	0.14	0.88	1.00	1.75	2.50	4.36	8.37	15.02	35.79	127.47
Nasdaq	—	—	1.74	0.66	1.75	0.95	3.38	12.95	24.67	105.66
2010										
NYSE	0.01	0.01	0.02	0.03	0.04	0.06	0.09	0.14	0.36	1.32
Nasdaq	0.00	0.01	0.01	0.02	0.04	0.05	0.08	0.13	0.31	2.87
D. Turnover										
1982										
NYSE	33.3	42.5	56.8	64.8	73.2	72.9	70.2	73.0	72.6	70.7
Nasdaq	—	—	56.6	197.8	136.6	231.2	126.5	84.3	86.8	85.0
2010										
NYSE	100.8	182.2	149.9	158.0	188.5	202.8	236.9	272.1	280.6	246.6
Nasdaq	335.0	233.8	275.7	271.9	247.2	285.1	319.4	448.1	313.8	247.1

Table 7

Estimated coefficients from illquidity regression where the dependent variable is the Amihud measure

All variables are standardized values of log transformations, computed every quarter. Bold indicates significance at the 0.0001 level. Significance levels are computed with heteroscedasticity-consistent standard errors.

	Intercept	Mktval	IO	num	# obs	R^2
NYSE						
1982-1985	0.000	**-0.873**	**-0.104**		19,788	0.86
	0.000	**-0.665**	**-0.018**	**-0.272**		0.87
1986-1990	0.000	**-0.871**	**-0.151**		27,567	0.90
	0.000	**-0.682**	**-0.079**	**-0.241**		0.91
1991-1995	0.000	**-0.860**	**-0.168**		33,132	0.89
	0.000	**-0.631**	**-0.092**	**-0.284**		0.90
1996-2000	0.000	**-0.862**	**-0.174**		40,395	0.88
	0.000	**-0.483**	**-0.040**	**-0.470**		0.90
2001-2005	0.000	**-0.847**	**-0.239**		35,352	0.86
	0.000	**-0.510**	**-0.074**	**-0.436**		0.89
2006-2010	0.000	**-0.873**	**-0.225**		33,032	0.88
	0.000	**-0.518**	**-0.081**	**-0.434**		0.90
NASDAQ						
1982-1985	0.002	**-0.750**	**-0.105**		29,449	0.66
	0.002	**-0.678**	**-0.046**	**-0.130**		0.66
1986-1990	0.001	**-0.806**	**-0.022**		53,316	0.67
	0.001	**-0.714**	**0.077**	**-0.181**		0.67
1991-1995	0.001	**-0.830**	**-0.020**		64,379	0.71
	0.001	**-0.770**	**0.037**	**-0.114**		0.71
1996-2000	0.000	**-0.844**	**-0.066**		83,440	0.78
	0.000	**-0.643**	**0.075**	**-0.327**		0.79
2001-2005	0.000	**-0.830**	**-0.136**		61,330	0.84
	0.000	**-0.599**	**0.023**	**-0.376**		0.86
2006-2010	0.000	**-0.794**	**-0.190**		53,777	0.84
	0.000	**-0.451**	**0.042**	**-0.545**		0.88

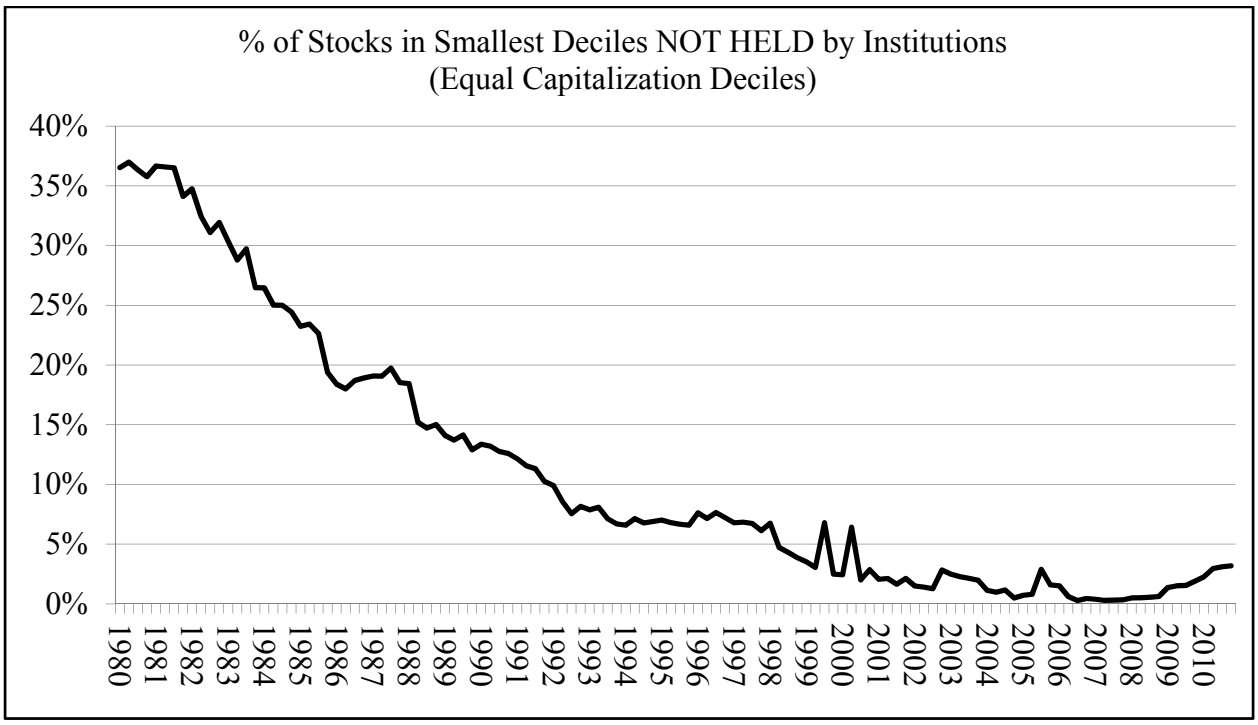


Fig. 1. The percentage of stocks in the smallest equal-cap decile that were *not* held in institutional portfolios, 1980 to 2010. Holdings data are for all institutions in the Thomson/IDC 13F database.

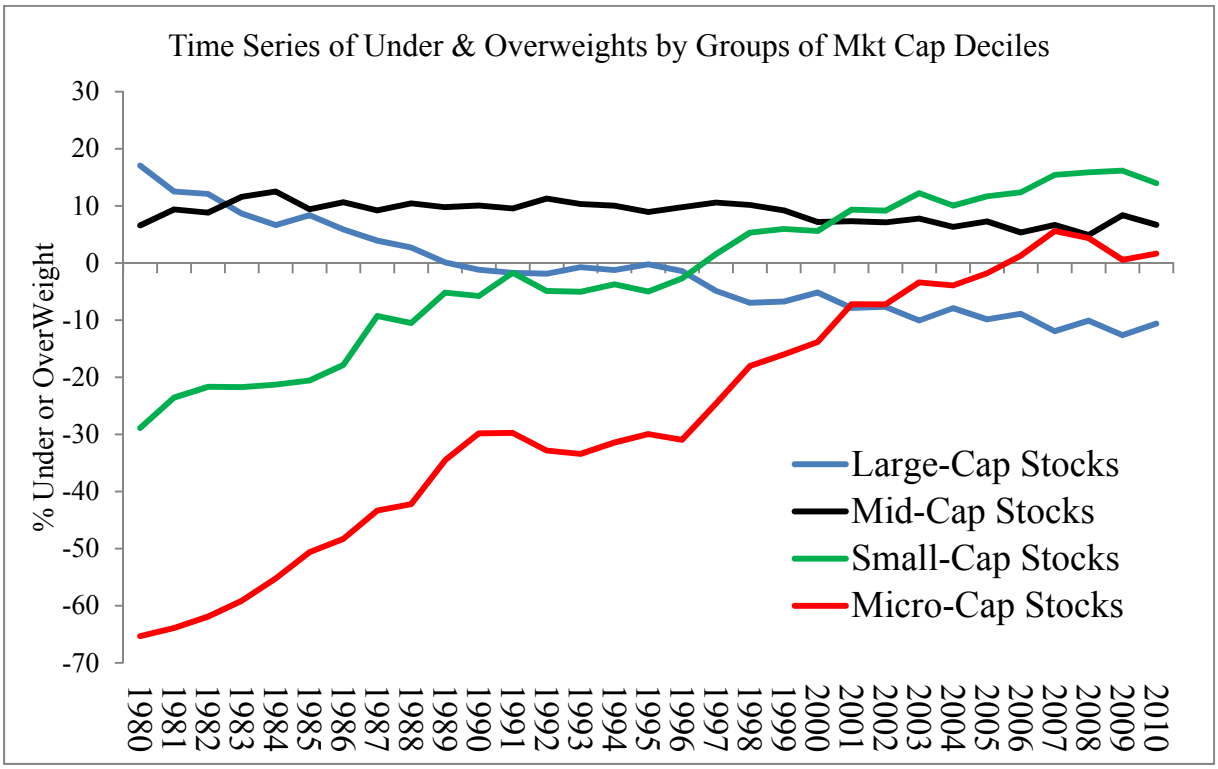


Fig. 2. Under- and over-weights relative to market weights for four equal-cap-based groupings of stocks across all institutions, reported for yearend 1980 to yearend 2010. Holdings data are for all institutions in the Thomson/IDC 13F database.

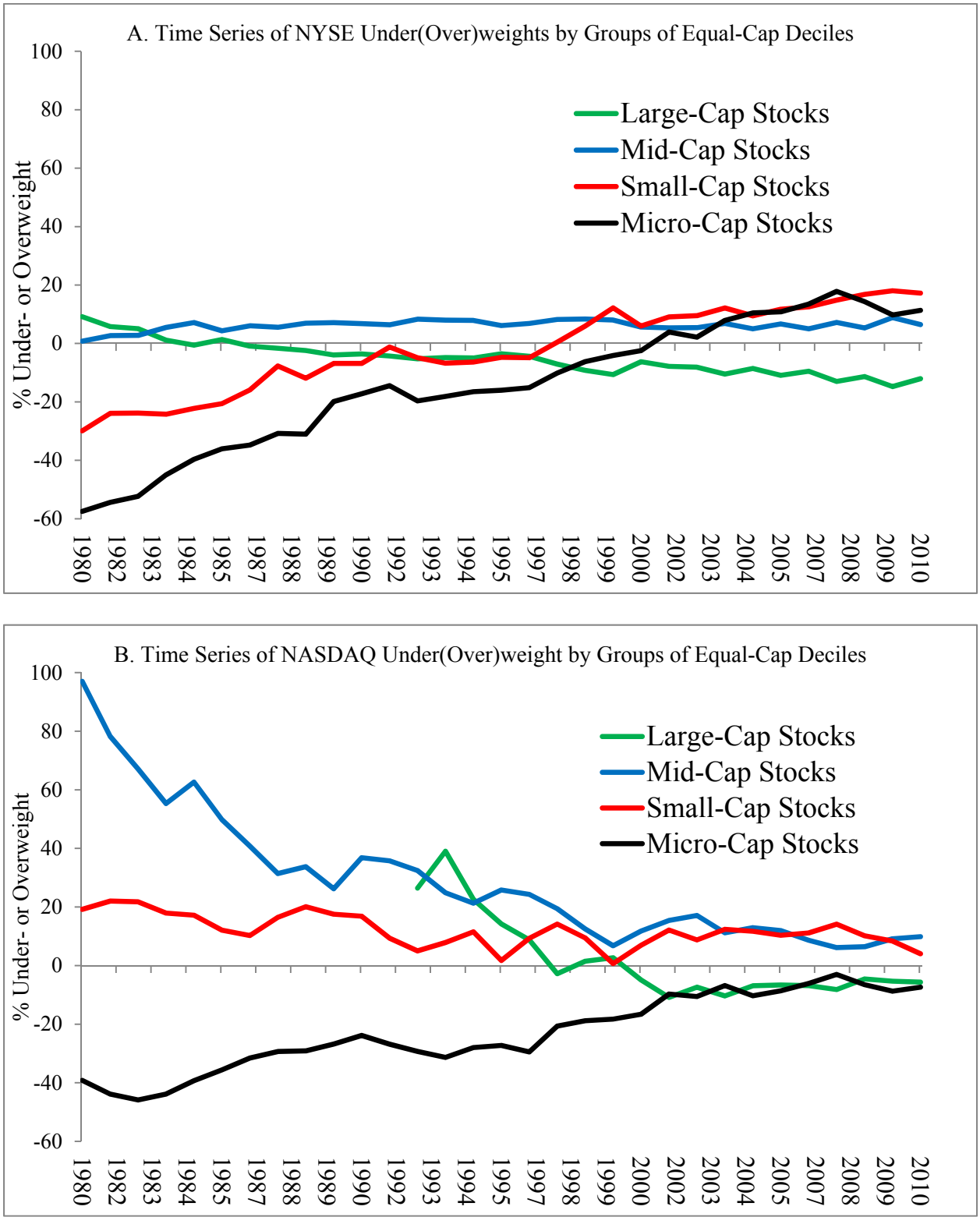


Fig. 3. Under- and over-weights relative to market weights for four equal-cap-based groupings of stocks, separately for NYSE and NASDAQ stocks and reported for yearend 1980 to yearend 2010. Holdings data are for all institutions in the Thomson/IDC 13F database.

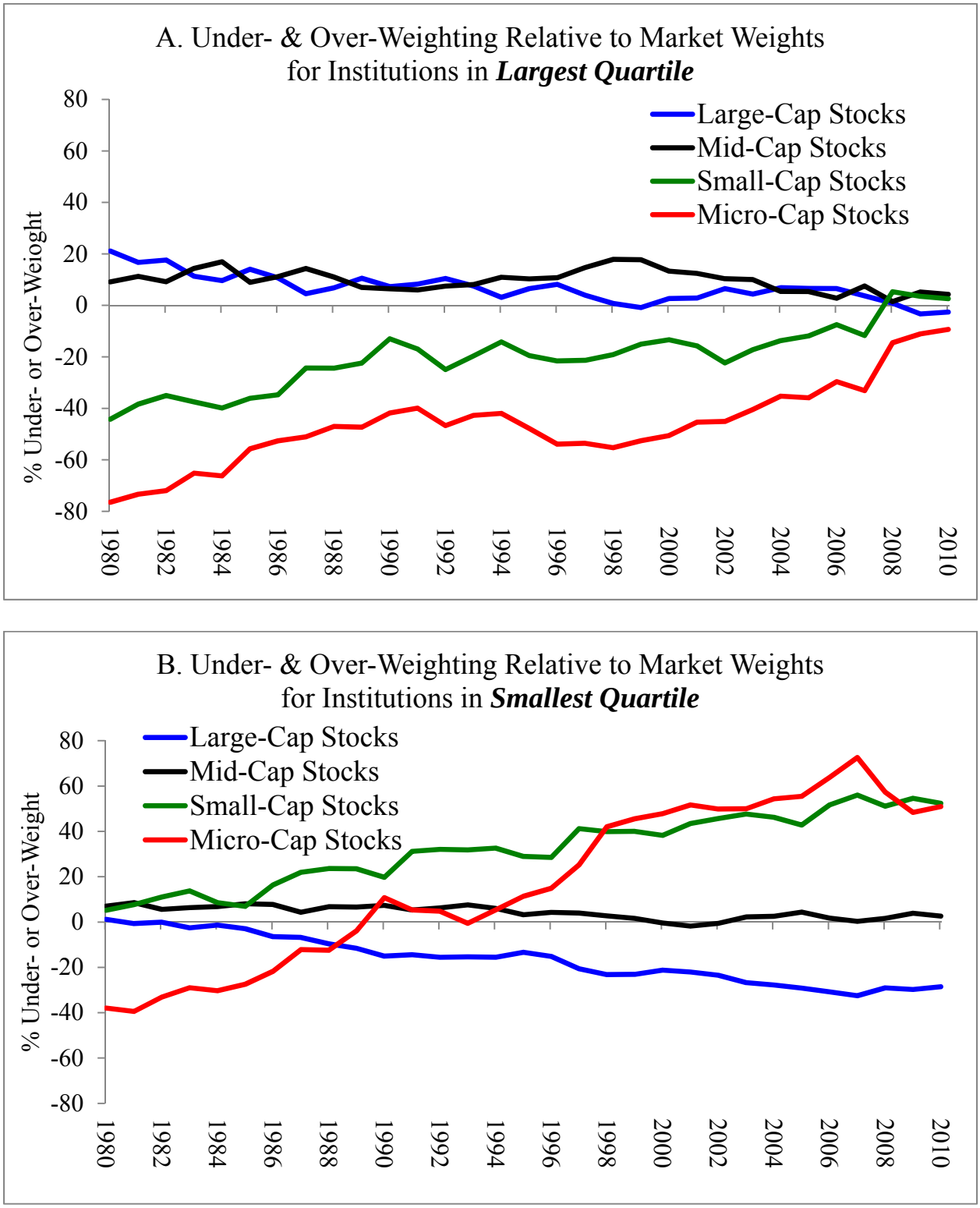
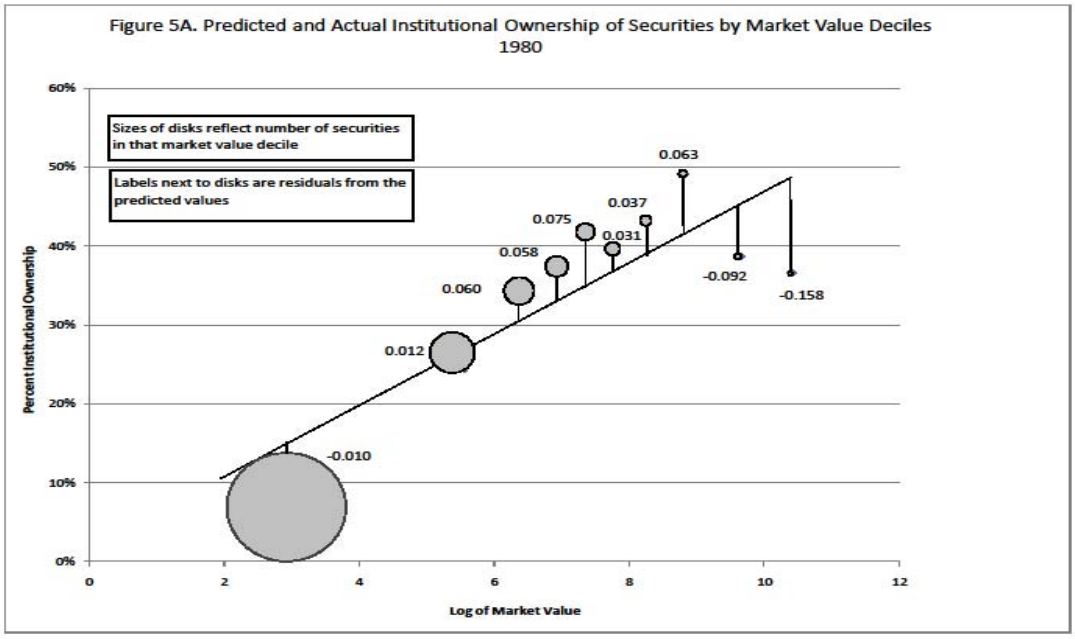


Fig. 4. Under- and overweights relative to market weights for the four quartiles of institutions. The quartiles are constructed each year by breaking our 13F sample into four equal-market-value quartiles of institutions. Thus, the largest quartile contains far fewer institutions (e.g., six in Dec 2010) than does the smallest quartile (e.g. 2991 in Dec 2010). Results are reported for yearend 1980 to yearend 2010.



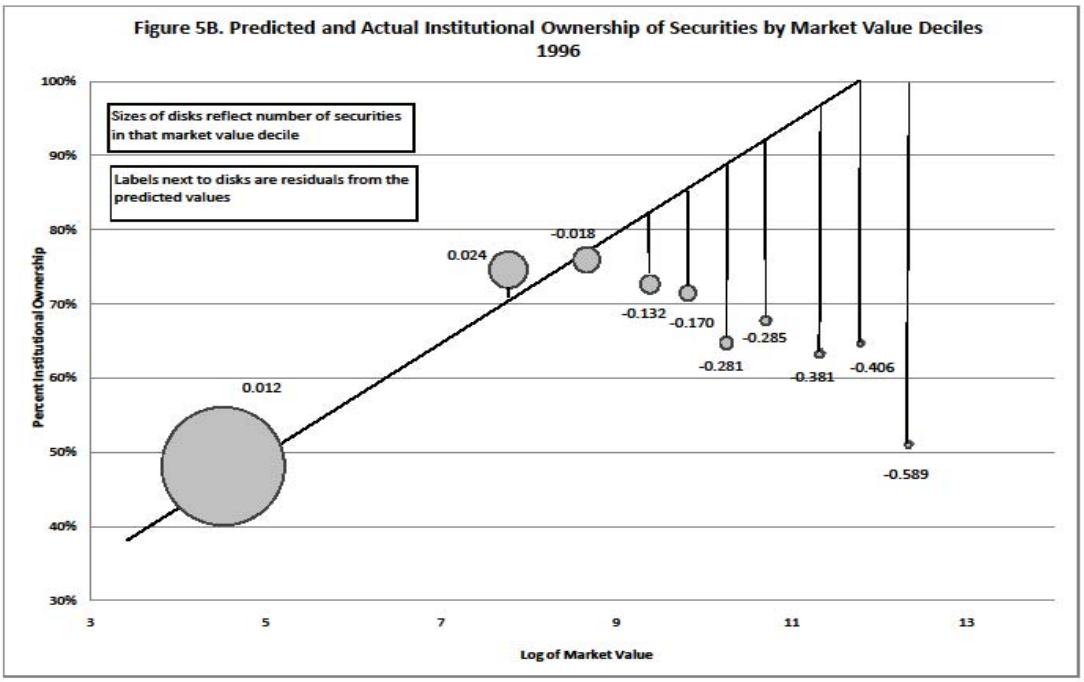


Fig. 5. These figures plot the linear regression of the percent of institutional ownership in each stock on the logarithm of its market value. We also plot the unweighted means of these two variables for each equal-cap decile and center upon each point a disk whose area is proportional to the number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

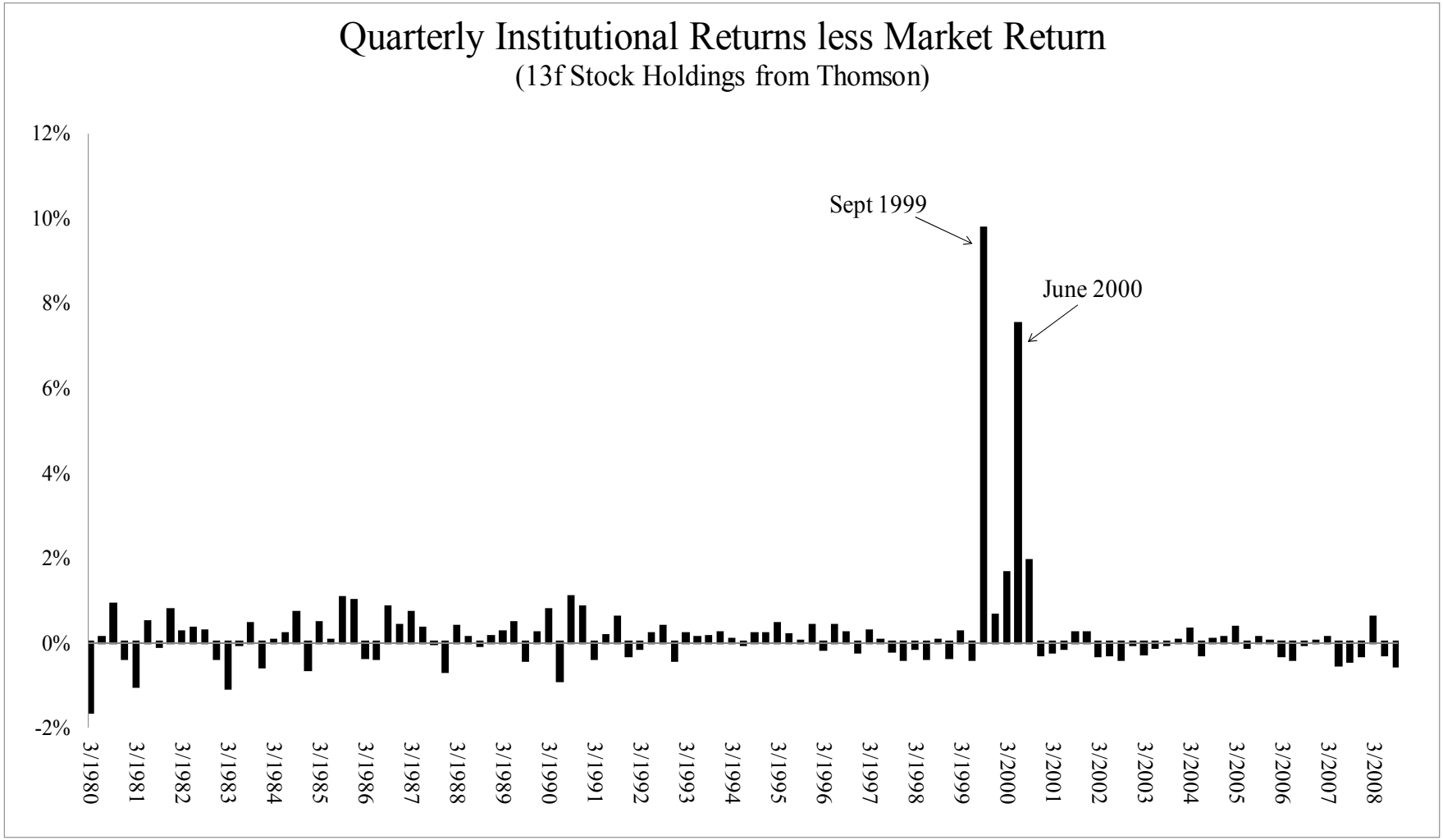


Fig. 6. This figure plots the differences between quarterly institution returns and quarterly market returns. To compute the institution returns, we aggregate the dollar value of the holdings of all institutions at the end of each quarter for each individual stock. We then compute a buy-and-hold return 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.