The Changing Nature of Institutional Stock Investing

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Abstract

We document that institutional investors, particularly hedge funds, decreased their holdings of larger stocks from 1980 to 2010 and increased their holdings of smaller stocks. Since 1990 institutions have underweighted, relative to market weights, those stocks that make up the largest 40 percent of the value of the market, and since 2006 have overweighted the stocks that make up the smallest 20 percent of the market. The contrary findings in the literature that institutions overweight larger stocks and underweight smaller stocks (e.g., Gompers and Metrick (2001) and Bennett, Sias and Starks (2003)) are due to the use of a linear relation between institutional ownership and the logarithm of market value. In fact, we show that this relation is nonlinear and resembles an inverted U. We discuss three factors that may have contributed to these changes in institutional holdings: better understanding of diversification; growing awareness of the small stock premium; and less efficient pricing of smaller stocks relative to larger stocks.

Keywords: Institutional investors; Institutional stock ownership; SEC 13F filings; Hedge funds; Efficient Pricing

JEL Classification: G11, G12, G23

1. Introduction

An extensive academic literature documents the overall growth in institutional equity ownership as well as the changing composition of the types of common stocks in which they invest. Because institutional investors differ in many ways from retail investors, knowledge of the differences in composition of portfolios held by these two types of investors has implication for corporate governance, informational efficiency of prices, stock market liquidity, public policy, and model development, to name a few. In this paper we study U.S. institutional stock ownership by comparing the composition of institutional portfolios to the composition of the market portfolio, and how this comparison differs between large and small stocks and also how it changes over the 1980 to 2010 period. We examine institutional portfolio allocations (based on 13F filings) across deciles of equal-market capitalization, a feature that distinguishes our paper from much of the other academic literature.

A number of papers have shown that institutions overweight stocks with large market capitalizations and, thereby, underweight smaller-cap stocks (e.g., Del Guercia (1996), Gompers and Metrick (2001), Bennett, Sias and Starks (2003), Lewellen (2011)). There is disagreement, though, whether this overweighting of large-cap stocks is stable over time or has decreased. Yet, the profession seems to have accepted the stylized fact that institutions overweight larger-cap stocks (See, for example, Campbell, Ramadorai and Schwartz (2009), p. 67).

Our analysis, however, comes to a different conclusion. Using the Thomson 13F institutional holdings data, we show that after 1990 institutions have underweighted the largest stocks that make up the top forty percent of the total market value of all U.S. stocks. In contrast, throughout our entire sample period from 1980 to 2010, institutions overweighted those large stocks that make up the next four deciles of stock market value. And from 1980 to 2010, institutions steadily increased their holdings of the smaller stocks that make up the bottom twenty percent of total market value, and since 2006 they have overweighted these stocks relative to market weights. 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 period 1997 - 2010, we find that hedge funds had larger allocations to smaller stocks than non-hedge institutions of comparable size and correspondingly smaller allocations to the larger stocks.

Our analysis clearly demonstrates a non-linear relation between institutional ownership and the logarithm of the market cap of a stock, specifically a cubic relation resembling an inverted U. We confirm this non-linear relation in several ways. In contrast, previous studies

that have estimated the relation between the proportion of stock owned by institutions and the stock's market cap have assumed a linear relation (e.g., Del Guercia (1996), Gompers and Metrick (2001), Bennett, Sias and Starks (2003). We show that this statistical misspecification is the reason for the differences in conclusions.

We argue that our findings are consistent with changes in the institutional investment environment over the last several decades that included a growing awareness of the small stock premium and a better understanding of portfolio risk that enabled investments in smaller stocks. Additionally, we present new evidence that institutions might find it easier to add alpha through investments in small stocks than in larger stocks.

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 for the entire market and then separately for their holdings in NYSE-listed stock and in NASDAQ-listed stocks. In Section 4, we reconcile our results with previous literature, particularly Gompers and Metrick (2001). In section 5, we compare our results using equal-cap deciles to results based on equal-number deciles that are commonly used in the literature. In Section 6, we examine ownership patterns across institutions of different sizes and types, as well as ownership differences between hedge funds and non-hedge institutions of the same size. In Section 7, we discuss three factors that may have played a role in these changes in institutional holdings. Section 8 concludes the paper. An Appendix contains a description of errors in the prices and shares in the Thompson 13F files in two separate quarters during our sample period, and the adjustments we make to correct them.

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 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.[1] 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

[1] On occasion, an institution will report its holding late, so that the report date and filing date in the Thomson data are not the same. As these holdings are not current, we delete them from our analysis.

number of portfolios, 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 as reported on Form 13F may not be as useful in understanding the investment behavior of a single portfolio manager as those for smaller institutions. As documented in the appendix, Thomson made two errors in transcribing the original 13F filings to its file. The analysis in this paper uses corrected data[2].

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 5.1. 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.[3] 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 funds 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) and the shares issued by 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 the stocks of these companies in our holdings data 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.

[2] The two errors occur in the data for September 30, 1999, and June 30, 2000. The errors were of two types: the incorrect substitution of the prices in these two months with prices from the end of the subsequent quarter and an incorrect adjustment of institutional holdings for stock splits and stock dividends. The effect was to substantially overstate the quarterly returns for the aggregate portfolio of all institutions for the fourth quarter of 1999 and the third quarter of 2000. For the fourth quarter of 1999, the quarterly return in excess of the market calculated using the uncorrected data is 9.76 percent, while the excess return using the corrected data is -0.28 percent. The corresponding excess returns for the third quarter of 2000 are 7.51 percent and 1.12 percent.

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

3. Trends in Institutional Stock Ownership

3.1. Related literature

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." (Appendix vol 1, p. ix).

The more recent studies, summarized in Table 1, all reach similar conclusions that institutions overweight larger stocks, and as a consequence underweight smaller stocks. Del Guercia (1996), using data from 1988 to 1991, concludes that many institutional investors, and particularly banks, have a preference for higher quality stocks, which are generally stocks of greater market value. In an often-cited paper, Gompers and Metrick (2001) also find that institutions overweight "larger, more liquid" stocks, and that this preference has remained stable over the years 1980 through 1996. Based on this finding, combined with the increasing institutional share of ownership mentioned above, they conclude that there was an increasing demand for large stocks during their sample period and argue that this increasing demand contributed to the demise of the small-stock premium. In contrast to Gompers and Metrick, Bennett, Sias and Starks (2003), using a similar sample period (1983 -1997), conclude that institutions have reduced their overweighting of larger stocks over time; importantly, they conclude that institutions still overweight larger stocks as of 1997. Lewellen (2011), using data from 1980 to 2007 and tabulation by quintiles with equal numbers of securities based on NYSE breakpoints, concludes that institutions overweight the larger stocks in 1980 but reduced this overweight over time and as of 2007 hold these larger stocks in roughly market proportions. As we discuss below, his definition of larger stocks is broad and includes stocks that make up nearly seventy-five percent of the value of the market. Most readers would not define larger stocks so broadly; moreover, defining larger stocks so broadly will hide any differential changes in institutional ownership throughout most of the market portfolio.[4]

[4] Two other papers have studied subsets of institutions and should be mentioned. Falkenstein (1996), using data from 1991 and 1992, found that mutual funds, other than funds with a small-cap objective, overweight larger stocks. Griffin and Xu (2009), using mutual fund data from 1980 through 2004, find that hedge funds prefer smaller stocks in comparison to mutual funds. Although comparisons to mutual funds is interesting, it should be noted that as of

These studies generally agree that institutions overweight larger stocks and thus underweight smaller stocks, which the profession appears to have accepted as a stylized fact. There is disagreement among these studies as to whether or not the institutional preference for larger stocks is stable over time. As detailed below, our evidence indicates that the relation between institutional holdings and the market value of a stock and the changes in this relation is more complex than prior studies suggest.

3.2. Trends in Stock Ownership: All Stocks

We begin by partitioning US equities into deciles of equal-market capitalization (hereafter equal-cap deciles) where the first decile contains the largest stocks. 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. In Section 5 we examine the differences between analyses of institutional ownership based on equal-cap and equal-number partitions. (Recall that Lewellen (2011) uses equal-number quintiles.) An examination of these differences is interesting in itself as many studies in finance use equal-number partitions.

In Table 2, we present summary statistics for the distribution of stocks by equal-cap deciles at year-end 1980 and year-end 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.

2007, the equity holdings of mutual funds represented only 21.4 percent of all equity outstanding, according the Financial Accounts of the United States. As we will see below, hedge funds tend to be smaller institutional investors, while mutual funds can be much larger. If, as it turns out, larger institutions hold smaller proportions of small stock than smaller institutions, the findings of Griffin and Xu are not surprising. Below we compare the holdings of hedge funds to other institutions of comparable size and do conclude that hedge funds are more likely to hold smaller stocks.

The market value of stocks is highly concentrated. In 1980, there were 4844 stocks in our sample (Table 2, 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 2, Panel B).

Institutional allocations across the equal-cap deciles, relative to market weights, have changed over time, as illustrated in Table 2. In 1980, institutions overweighted each of the seven larger equal-cap deciles and underweighted each of the smallest three 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 that these represent in the entire market—an underweight of 65 percent, which along with the other percentages in this paragraph are derived from Table 2.[5] 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, overweighting the stocks in the next four deciles, and holding stocks in the smallest decile roughly in market proportions.[6] 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).[7]

The trend in institutional allocations provides further insights. In Figure 2, we plot the annual under- and over-weights for all institutions for four market-cap groups: mega-cap stocks (deciles 1 to 4), large-cap (deciles 5 to 8), mid-cap (decile 9), and small-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. During our sample period, there is a steady decrease in the institutional allocation to mega-cap stocks, little change in allocations to large-cap stocks,

[5] 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.

[6] 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%.

[7] In the extreme, if institutions owned all stock outstanding, their aggregated portfolio would be the same as the market. However, until they own all stock, their ownership percentages by deciles can differ from market percentages. But as their ownership share increases, the differences between these two percentages will necessarily diminish.

and a steady increase in allocation to mid-cap and small-cap stocks. On the basis of more detailed data than shown in Figure 2, institutions that had overweighted mega-cap stocks in 1980 began to underweight these stocks by the third quarter of 1990.[8] In contrast, institutions, which underweighted the small-cap stocks by 66 percent in 1980, gradually increased their allocation to these stocks and after the first quarter of 2006 were holding them roughly in market proportions. Similarly, institutions began to overweight the mid-cap stock by the second quarter of 1996.[9] In sum, institutions have gradually shifted their holdings from larger to smaller stocks over the years 1980 through 2010 and now, relative to market weights, underweight mega-cap stocks, overweight mid-cap stocks, and hold small-cap stocks roughly in market proportions. Throughout these years, they have maintained a consistent overweight of large-cap stocks.

3.2 Trends in Stock Ownership: NYSE versus NASDAQ stocks

As many studies of institutional ownership have confined their analyses to NYSE stocks, it is possible that our conclusions in Section 3.2 about the trends in stockownership as a function of market capitalization are due to our inclusion of NASDAQ stocks. To examine this possibility, we now analyze the trends in institutional ownership separately for NYSE and NASDAQ stocks. Although we find substantial differences in the distribution of institutional ownership across equal-cap deciles between NYSE and NASDAQ stocks, the analysis of only NYSE stocks leads to the same conclusion as in Section 3.2. Note that in the following analysis we use the same equal-cap decile cutoffs used in Section 3.2, with the result that market weights for an exchange within the cap-weighted deciles no longer approximate ten percent.

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 3, Panel A). In contrast, at year-end 1980 NYSE stocks

[8] Institutions began underweighting the very largest stocks much earlier: they underweighted the stocks in the largest equal-cap decile after the fourth quarter of 1980 (with the exception of three quarters in 1984.)

[9] Another way to illustrate the shift in institutional ownership is to compute the percentage of the value of a decile owned by institutions. Although the institutional ownership share grew across all the equal-cap deciles, the growth in the institutional ownership share of the mega-cap stocks is much smaller than the growth in their shares of the mid-cap and small-cap stocks over our sample period. For example, the percentage of the mega-cap stocks owned by institutions grew from 40.3% in 1980 to 60.0% in 2010. In contrast, the percentage of the small-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 6), 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 small-cap 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 3, 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) (derived from Table 3). Consistent with overall trends, institutions increased their ownership of small-cap stocks and decreased their ownership of mega-cap stocks for both NYSE and NASDAQ stocks (Figure 3). For large-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. But the conclusion that institutions now and in recent years underweight the large stocks and overweight the smaller stocks holds for stocks overall and for NYSE stocks alone.

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 mid-cap and small-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 mid- and small-cap stocks, as shown in Section 6, an increase in the number of smaller institutions might over time increase the ownership percentage in smaller 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.[10]

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 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.[11]

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 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. It should be noted that this reduction is the maximum adjustment; if both sides of a short sale are not 13F filers, this adjustment should be zero. In making this adjustment, we use the short interest at the end of

[10] 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.

[11] 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.

each quarter from Compustat Xpressfeed from 2007 to 2010. Prior to 2007 and going 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 that this adjustment increases the percentage of stock held by institutions in the mega-cap deciles, has a negligible effect on their holdings in stocks in the large-cap decile, and decreased their holdings in the mid- and small-cap deciles. Even with this adjustment, it is still the case that institutions decreased allocations to mega-cap stocks and underweighted them relative to market weights by the end of 2010, and increased allocations to the mid- and small-cap stocks during this period.[12] Unlike our earlier conclusions, though, the adjusted holdings indicate that institutions slightly underweighted the stocks in the smallest equal-cap decile relative to market weights at the end of 2010. 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. Additionally, using unadjusted data allows our results to be compared to the results of most other research on institutional holdings which likewise uses unadjusted data.

4. Institutional Ownership Results: Comparison with Previous Literature

As discussed in Section 3, previous researchers have concluded that institutions overweight larger stocks and underweight smaller stocks. Most find that this relative allocation of institutional portfolios as between larger and smaller stocks in recent decades has remained largely unchanged; but, as already mentioned, Bennett, Sias, and Starks (2003) and Lewellen (2011) both find that this over- and underweighting has declined over time. In contrast, our evidence shows that institutions have gradually reduced their holdings of mega-cap stocks, made little change in their weightings of large-cap stocks, and increased their weightings of mid- and small-cap stocks. Institutions now underweight mega-cap stocks, relative to market proportions, overweight large-cap stocks, overweight mid-cap stocks, and hold small-cap stocks roughly in market proportions. In reconciling these differences, we take a closer look at the results in

[12] Institutions underweighted mega-cap stocks by 7.7 percent in March 2003 and by -10.6 percent in December 2010. Using the mid-month adjustment, the corresponding percentages are 6.8 percent and 8.9.percent. Institutions overweighted mid-cap stocks by 10.7 percent in March 2003 and by 14.0 percent in December 2010. Using the mid-month adjustments, the corresponding figures are 9.2 percent and 11.5 percent. Institutions underweighted small-cap stocks by 8.2 percent in March 2003 and overweighted them by 1.6 percent in 2008. Using the mid-month adjustments, the underweight in March 2003 is 8.8 percent, while in December 2010 the adjusted figures show an underweight of 2.9 percent, rather than an overweight. The adjusted percentages using end-of-month short sale figures for 2010 are approximately the same as the adjusted percentages reported here.

Gompers and Metrick (2001) (hereafter GM), who argue that a stable institutional allocation contributed to increased aggregate demand for larger stocks and, thereby, "can explain part of the disappearance of the historical small stock premium." 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. 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 they assume this relation is stable over their sample period.[13] We replicated their analysis for the 124 quarters in their sample and find that the correlations varied from a low of 0.58 to a high of 0.68. These correlations are consistent with their numbers and on the surface suggest a stable relation.

To help resolve this paradox, we focus on 1996 and plot in Figure 4A 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. Note that the estimated regression and the corresponding inferences are in no way related to our equal-cap deciles – the aggregation of the data points into deciles is simply a graphical device to help visualize what is going on. The regression overestimates institutional holdings in the largest seven equal-cap deciles and particularly institutional holdings in the largest three deciles. It is apparent that the large number of observations in the three smallest equal-cap deciles is the driver of the linear regression. This pattern of over and underestimates shows that the linear specification is inappropriate, and specifically that the expected residual conditional on the independent variable is not zero—a condition of a well-specified regression.

[13]Bennett, Sias, and Starks (2003) report a similar coefficient of 0.653 over the years 1983 through 1997. Both GM and Bennett et al 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. In both papers, the coefficients on log of market capitalization are positive. Campbell, Ramadorai and Schwartz (2009) find that institutions decreased their allocations to mid-cap and increased their allocation to mega-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.

These diagnostics indicate that a regression of institutional stock ownership on the logarithm of market value is non-linear. We first tried a quadratic regression, but the regression still overestimated institutional ownership for the larger cap stocks.[14] A cubic regression did fit the 1996 data points reasonably well, as shown in Figure 4b, where we plot the actual data points. An examination of similar plots from 1980 through 2010 confirms the adequacy of the cubic specification.

Although a cubic specification is adequate each year, the regressions do change over time. To demonstrate these changes, we plotted the cubic regression for year-end values at ten-year intervals—1980 through 2010 and show these plots in Figure 5. Because the distribution of the logarithm of market value changes over time, we standardized the logarithm of the market value of each stock in each year end by subtracting the mean of all stocks in the cross section of that year and then dividing by the cross-sectional standard deviation, producing (0,1) variables. As expected, the curves generally shift upwards with time, as the share of stock owned by institutions increase. The maximum point of each graph shifts upwards and to the left, which is consistent with the institutional overweight of large-cap stocks and the decreasing weight to mega-cap stocks. At the far left of the graph the curves tends to flatten out due to institutional underweighting of these smallest of the small-cap stocks (see footnote 6). And the increasing slopes over time in the mid-cap range reflect the increasing institutional allocations to, and eventual overweighting of, these stocks.

In some ways, these graphs are less informative than the tabular results in the prior sections, as they do not compare directly the institutional holdings to market weights. However, the graphs do clearly demonstrate the non-linear relations between institutional holdings and the logarithm of market value and explain why the linear specification leads to incorrect inferences.

5. Comparing Equal-Cap Deciles to Other Decile Formulations

The analysis in section 4 shows that our conclusions as to overweighting and underweighting of stocks of varying market value, as well as the trends over time, do not depend upon our use of equal-cap deciles. Still, a reader might ask exactly what the differences in results would be if we

[14] Griffin and Xu (2009) estimate a cross-sectional model for *mutual fund* holdings with twelve independent variables including ln(mkt cap) and ln(mkt cap)^2, and find a significant coefficient on ln(mkt cap)^2, although they find an insignificant coefficient on ln(mkt cap) when ln(mkt cap)^2 is not included in the estimation. Because their sample of mutual fund holdings represents only 16.6% of the total value of the U.S. common stocks in the 2000-2004 period, their results may not be representative of the holdings in all institutional portfolios (63.5% of total U.S. market value at the end of 2004 in our sample.)

were to use other ways of defining deciles. A natural alternative to deciles of equal capitalization is deciles containing an equal number of stocks. Thus, we rank all NYSE and NASDAQ securities by market value and then form equal-number deciles with the first decile containing the largest stocks and the tenth decile the smallest. Recall that Lewellen (2011) presented his results using equal-number quintiles, although his deciles are based on NYSE breakpoints instead of being based on breakpoints using all NYSE and NASDAQ stocks as done here.

To see the effect of using this alternative, we replicate Table 2 using equal-number deciles (Table 4). In 1980, institutions overweight the largest-cap decile and underweight the remaining nine deciles. The main reason for the apparent difference from our results in section 3 is that the largest equal-number decile contains 76.7 percent of the entire market value of all stocks, so that this decile corresponds roughly to the first eight equal-cap deciles. This result should be expected, though, because institutions in 1980 overweighted the largest seven equal-cap deciles with a slight underweight in the eighth decile (Table 2). The remaining nine equal-number deciles correspond roughly to the two smallest equal-cap deciles, both of which institutions underweighted in 1980.

In 2010, the largest equal-number decile contains 77.3 percent of the market capitalization of all stocks, and institutions underweighted this decile with only 75.4 percent of their stock portfolio invested in this decile. From the analysis of equal-cap deciles, we know that in 2010 institutions underweighted the stocks in the largest five deciles and overweighted the stocks in the sixth through eighth decile. Thus, because the largest equal-number decile contains a substantial portion of the market portfolio, any analysis of this decile will hides significant trends within a broad range of stocks. [15]

In 1980, the second equal-number decile contains 11.6 percent of the market value of all stocks and corresponds roughly to the ninth equal-cap decile. Not surprisingly, both decile formulations show that institutions underweighted the stocks in these deciles. In 2010, both schemes show the same institutional overweights in the stocks in these deciles.

In contrast to the information contained in the first two equal-number deciles, the remaining equal-cap deciles provide more information about the institutional holdings of the smallest stocks. The bottom eight equal-number deciles correspond roughly to the smallest equal-cap

[15] Lewellen's largest equal-number quintile based on NYSE breakpoints contains 67.8 percent of the value of the market portfolio in 1980 and 74.9 percent in 2010.

decile in terms of market value. In 1980, these deciles, whether formed with equal number or equal capitalization, show similar institutional underweights. However, the equal-number deciles show that the greatest underweights occur with the very smallest stocks. In 2010, the smallest equal-cap decile shows that institutions held small stocks in roughly market proportions. The equal-number deciles show that institutions still underweight the very smallest stocks with underweights in the sixth through smallest decile. Stocks in these deciles represent 1.9 percent of the total market value of all stocks.[16] Thus, the equal-number deciles give more information than the equal-cap deciles about the smallest 1.9 percent of the market, but at the sacrifice of less information about those larger stocks representing nearly eighty percent of the market value of all stocks.

The stratification we use in this paper better highlights deviations from market portfolio weights, especially for larger stocks, than the equal-number stratification. If the objective is to understand market-wide phenomena, such as the investment performance of institutions relative to the market, the equal-number scheme has less power than the equal-cap scheme. On the other hand, if one is testing hypotheses about individual securities that do not involve market value, equal-number deciles are likely to have more power than our equal-cap deciles.

6. The Distribution of Stock Ownership by Institutional Characteristics

In this section, we explore differences in institutional ownership by institutional characteristics: we examine how ownership varies by institutional size; we compare the holdings of hedge funds to institutions of similar size; and we examine how ownership varies by type of institution.

6.1 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 on the number of companies that can be followed. And some institutional investors are legally limited with regard to the percentage of an individual

[16] See footnote 6 where we show the same result for a decomposition of the smallest equal-cap decile into smaller slices.

company's stock they can own, and others may perceive that federal and state diversification requirements require similar limitations.[17] Thus, one might conjecture that those larger active institutions that face practical limits on the number of securities they can hold *will limit their investments in mid- and small-cap 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.[18] SEC reporting requirements for holdings in excess of five percent, and possibly violations of statutory limits on investment in individual companies, impose further constraints. Such constraints, however, are not as binding on smaller institutions, *thus enabling them to include in their portfolios mid- and small-cap stocks*.

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, at the end of 2010 the largest quartile contained six institutions and the smallest contained 2991 institutions. And these smaller institutions manage substantially smaller portfolios than the larger institutions, enabling them to include smaller-cap stocks in their portfolios. The average market value of the assets reported by the smallest institutions is 1.1 billion dollars and the median is 0.29 billion dollars, while the average market value of the assets reported by the largest institutions is $488.7 billion and the median is $532.52 billion. The maximum value of assets under management is $13.70 billion.

We then cross-classify the holdings of the institutions by both manager-size quartiles and the equal-cap deciles described earlier. To conserve space, we limit this discussion to the quartile of largest institutions and the quartile of smallest institutions. As conjectured, the largest institutions overweight mega- and large-cap stocks relative to market weights, and underweight mid- and small-cap stocks for most of the sample from 1980 through 2007 (Figure 6, Panel A). Over time, however, the largest institutions gradually shifted their holdings of mega-cap stocks into mid- and small-cap stocks: the change in the average overweight of the mega-cap stocks

[17]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.)

[18] 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 of institutional investors.

between the first and second halves of our sample period is −7.26% (t = -4.69); in contrast, the change in the average underweight of the mid-cap and small-cap stocks between the first and second halves is 15.88% (t = 4.60) and 16.53% (t = 3.26) respectively. By December 2010, the largest institutions had virtually eliminated their overweight of the mega- and large-cap stocks, and dramatically reduced their underweight of mid- and small-cap stocks; in fact, the largest institutions had a slight overweight in mid-cap stocks after 2007. This shift towards smaller stocks is consistent with the growth among the large institutions in more quantitatively-oriented portfolio strategies, which call for portfolio weights that are close to market weights.

We noted above that the value of the securities that the smallest institutions report on Form 13F is substantially smaller than that reported by the larger institutions and conjectured that the smallest institutions have correspondingly greater flexibility to invest in smaller stocks. Panel B of Figure 6 confirms this conjecture – the smallest institutions did indeed increase their mid- and small-cap tilts to a much larger extent than did the larger institutions over the sample period. The smallest institutions overweighted mid-cap stocks for the entire period, increasing their overweight from five percent in 1980 to 52 percent in 2010. And their allocations to small-cap stocks exhibited a more dramatic increase over the period, beginning with a 39 percent *underweight* in 1980 and ending with a 51 percent *overweight* in 2010. The increases in the average overweights between the first and second halves of our sample period are 25.60% (t = 8.13) for the mid-cap stocks and 61.82% (t= 10.58) for the small-cap stocks. In contrast, the underweight by the smallest institutions of mega-cap stocks became more pronounced throughout the period, ending 2010 with an underweight of about 29 percent. The decrease in the average underweight of the mega-cap stocks between the first and second halves is −17.40% (t = −8.60).

6.2 Hedge Funds versus Non-Hedge Funds

In this section we explore the extent to which the proliferation of hedge funds in recent years contributed to the increased institutional holdings of mid-cap and small-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.[19] 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

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

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.

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. Our resulting HF sample at year-end 2010 consisted of 200 funds with equity holdings of $499 billion, or 2.92 percent of all stocks outstanding (Table 5).[20] We contrast the hedge fund and non-hedge fund ownership allocations in Figure 6C. Panel C differs from Panel B in that we report in Panel C the percentage over- and under-weighting separately for hedge funds and non-hedge funds for the years 1997 to 2010. Panel C clearly shows that relative to the other institutions in the smallest quartile HFs had on average a significantly larger overweight of mid-cap stocks (difference = 44.12%, t = 12.04) and small-cap stocks (difference = 38.06%, t = 6.13) over our sample period. After the financial crisis in 2007-2008, however, HFs significantly reduced their allocations to small-cap stocks, and during 2009 and 2010 the HF overweights of small-cap stocks were similar to those of the other small institutions. Throughout the entire 1997-2010 period, HFs also had a significantly larger underweight in mega-cap stocks relative to the other smallest quartile institutions (difference is 27.08%, t=16.41).

The results in Figure 6 show that HFs had significantly larger portfolio tilts to mid- and small-cap stocks than comparable small non-HF institutions. In addition, the HF share of the smallest institutional quartile's holdings of the mid-cap (small-cap) sector grew from 5.2% (9.4%) at December 1997 to 19.8% (15.9%) at December 2010.

[20] 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 5, the average values for the same period are 124 funds with total equity holdings of approximately $188 billion, a little less 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 $125 billion

6.3 Ownership by Type of Institution

Thomson classifies institutions into 5 types, and we briefly examine here the holdings for the four types of institutions that collectively represent 89.4 percent of institutional holdings at year end 2010—banks ($1,785 billion), insurance companies ($539), investment companies (primarily mutual funds, $1699), and investment advisors ($6,236)[21]. In Figure 7 we report under- and overweights relative to market weights separately for these four institutional types for the four market-cap groups studied above.[22]

The downward trend in institutional allocations to mega-cap stocks that we observed in section 3 appears to be mostly attributable to banks and investment advisors, although banks still overweighted the mega-cap stocks by the end of 2010. On the other hand, mutual funds (investment companies) consistently underweighted mega cap stocks throughout the sample period (Figure 7, Panel A).

At the other end of the market cap spectrum, the upward trend in institutional allocations to mid-cap stocks appears to be mainly driven by investment advisors, the largest of the industry types representing more than 54 percent of total institutional holdings at year-end 2010 (Panel C). In contrast, the upward trend in allocations to the small-cap stocks was evident in all four institutional types, although this trend was again most pronounced for the investment advisors (Panel D).

7. Changing Investment Strategies, Laws, and Regulations

The results in this paper raise the question of why institutions as a group gradually shifted their equity holdings from mega-cap to small-cap stocks, while maintaining an overweight in large-cap stocks. There are at least three factors that might have contributed to this shift. First, institutional investors, regulators, and lawmakers became more knowledgeable about how diversification reduces idiosyncratic risk, and the legal and regulatory environment evolved, albeit very slowly, to accommodate diversification into riskier smaller stocks. Second, the identification by Banz (1981) of a small stock premium led to increased institutional interest in these previously ignored stocks. Third, we present evidence that active managers might find it easier to add value with investments in smaller stocks than larger stocks.

[21] More specifically, the institution types we use are based on Thomson institutional categories, but updated by Brian Bushee (http://acct3.wharton.upenn.edu/faculty/bushee/).

[22] In order to reduce the noise in these graphs by institutional type, we have plotted the points at five-year intervals.

7.1 Evolution of Institutional Investment Standards.

A number of articles have discussed the changes in the meaning of investment prudency over the years: for example, Shattuck (1951), Badrinath, Gay, and Kale (1989), Del Guercio (1994), Schanzenbach and Sitkoff (2009), and Hankins, Flannery, and Nimalendran (2008). As these changes are important in understanding the shift from larger to smaller stocks, we summarize their salient points, beginning with some earlier literature. According to Shattuck's comprehensive summary of fiduciary responsibility in the twentieth century, the emphasis in institutional investing at the beginning of the twentieth century was the preservation of principal. The majority of states had "legal" lists of allowable investments for trusts, which almost always excluded equities.[23] Most other states utilized the "prudent man standard," as set forth in 1830 in *Harvard College v. Amory*. Although the prudent man standard allowed somewhat more flexibility in choosing investments, subsequent court cases made clear that safety of principal of each investment was paramount. Any fiduciary who invested in an asset not included in the legal list or deemed imprudent could be surcharged on the loss on that asset, even if the entire portfolio turned a profit. The legal focus was on the total risk of the individual security, which includes idiosyncratic risk, not on the contribution of that security to the risk of the portfolio. This resulted in very conservative institutional portfolios. Nevertheless, Shattuck observed that institutions gradually increased their allocations to equities over the first half of the 1900s. Data in the Institutional Investor Study (1971) confirms this observation.[24]

In 1952, Harry Markowitz published his seminal work on diversification. Yet, his work had very little immediate impact on the investment process. It was not until 1974 that Congress enacted the Employee Retirement Investment Security Act (ERISA), which covers only private pension funds, and established the principle that a security's risk should be evaluated in the context of a portfolio. As sometime happens, initial language from the Department of Labor meant to clarify the Act muddied this intent, resulting in confusion regarding interpretation and compliance with the law, thereby slowing institutional adoption.[25]

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[23] The laws and regulations for trusts are important in understanding the investment practices of that time. Not only do they apply directly to trusts, but they also provide an overview of prudent investment practices that would presumably apply to non-trust assets as well.

[24] As further evidence, New York had increased its allowable percentage in equities for personal trusts from zero percent in 1900 to thirty five percent in 1950.

[25] Schanzenbach and Sitkoff (2009) explain that the explanatory material that accompanied ERISA indicated that a security's risk should be evaluated in the context of a portfolio, but the total risk of the individual security is also relevant. The resulting confusion highlighted that the ultimately-accepted interpretation of a law is not always immediately apparent, and it may take years for legislators, regulators, and the courts to give precise meaning. An

To address trusts, which ERISA does not cover, the American Law Institute and the Uniform Law Commission in 1992 drafted the Restatement (Third) of Trusts, which stated that for personal trusts the risk of a security should be judged within the context of the portfolio; and in 1994, these organizations drafted similar language in the Uniform Prudent Investor Act (UPIA).[26] These two organizations draft pro forma language for new laws that individual states have the option of adopting verbatim or with modifications.[27] This adoption process takes time – not all states enact the proposed law at the same time, and some never do. Schanzenbach and Sitkoff (2009) report that by 2009 only 41 states had adopted some variant of UPIA.[28] Exploiting this slow adoption, they conduct an event study of the state-by-state adoption of UPIA and show that after a state adopts some variant of UPIA, bank trusts increase their percentage allocations to equities. This finding indicates that these changes in state laws relaxed the binding constraints on desired investment allocations. However, Schanzenbach and Sitkoff were not able to document the actual changes in the composition of the equity portfolios held by bank-administered trusts. Our analysis complements their study by showing that institutions shifted their equity investments to mid- and small-cap stocks.

In explaining the slow introduction of the idea that the risk of a security should be evaluated in the context of a portfolio instead of in isolation, Schanzenbach and Sitkoff suggest that there is always uncertainty as to how the courts will interpret new laws, and this uncertainty would retard the adoption of new investment techniques.[29] In addition, courts will only accept a case that is "ripe." A case is said to ripe only if someone has utilized a new technique;[30] further, a plaintiff will only sue if there are alleged damages, usually involving losses on all or a portion of a portfolio. Thus, a portfolio manager must utilize a new technique before knowing how the courts will judge its prudency, which creates uncertainty that further delays the resolution of the

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institution's interpretation of the new rules and corresponding investment decisions may turn out to be inconsistent with the ultimate interpretation of the law, resulting in litigation. This risk of litigation slows the adoption of the new laws. Further, the practices of investment managers trained in the old rules might also take years change.

[26] In 2006, the National Conference of Commissions on Uniform State Laws proposed the Uniform Prudent Management of Institutional Funds Act (UPMIFA), which extended the provisions of UPIA to charitable entities organized as corporations. As of this writing all states except Pennsylvania have adopted some variant of this proposed Act.

[27] Of note, the National Conference of Commissioners on Uniform State Laws proposed in 1972 for adoption by the states the Uniform Prudent Management of Institutional Funds Act (UMIFA). This Act is important as it allowed charities organized as corporations to focus on the total return of the investments, facilitating the investment in smaller stocks, which often pay low or no dividends. UPIA also focuses on total return.

[28] Hankins et al present similar data on the slow adoption of new investment polices by the states.

[29] Del Guercio is even more pessimistic, by asking "when the courts will be influenced" by the portfolio approach, citing a case from 1992 that adopted the old prudent man standards.

[30] We thank James Bredar for pointing out this additional delay in the judicial process.

prudency of a new technique. This uncertainty is consistent with the observation of Badrinath et al (1989) that as late as of 1988 many managers of private pension funds invested their portfolios so as to conform to both the new ERISA standard and the old Prudent Man Rule. Finally, we note that even if there were no uncertainty as to the prudency of a new technique, investors schooled under the old prudent man standard may take years to understand and evaluate a new technique before they chose to adopt it.

7.2 The Relative Returns of Small- and Large-Cap Stocks

The question is why institutions, while generally increasing their portfolio allocations to equities, also shifted from large to smaller stocks. This brings us to the second factor mentioned above – the small stock premium. Although the average returns of small stocks exceed the average returns of large stocks over long periods, it is worth pointing out that the magnitude and sign of this return difference varies over time. For example, the average monthly small-stock premium as measured by SmB, the size factor from Fama French (1993), was 0.46% (standard error = 0.22%) over the 1963-1979 period preceding Banz's study. In contrast, the average monthly value of SmB is 0.01% (0.17%) for the period 1980-1996. Gompers and Metrick (2001) relied on the reduction in the small-stock premium during this period to claim that the small stock premium had "disappeared," inaccurately attributing its disappearance to stable institutional demand for mega-cap stocks. For 2001-2010, covering the period after publication of Gompers and Metrick to the end of our sample period, the average value of SmB is 0.58% (0.25%). Based on this significant size premium in the most recent subperiod, as well as the significant average SmB value of 0.19% (0.10%) over the entire 1927-2012 period, it is safe to conclude that institutions might be attracted to the opportunities associated with investing in small-cap stocks.[31]

A low-cost way to capture the returns of small-cap stocks is by passive or indexed methods, but this turns out to represent a small percentage of the smaller stocks that institutions own. For example, the Micro-Cap Fund (formerly the 9-10 Fund) of Dimensional Fund Advisors, one of the premier passive small-cap managers, had $4.0 billion in assets under management at the end of 2010, only 0.23% of the total value of the $1.708 trillion in our tenth decile at year-end 2010 (derived from Table 2). And based on the Evestment Alliance database

[31] Given that this observed variation in the small-cap premium coincided with steadily increasing institutional allocations to mid- and small-cap stocks (as documented in section 3), it is unlikely that the small-cap premium was influenced by patterns in institutional investor behavior as suggested by Gompers and Metrick.

of U.S. asset managers at year-end 2010, only 22.6% of the $246.2 billion benchmarked to the Russell 2000 represented passive management, 77.4% represented active strategies. Thus, a significant portion of the institutional investor growth in smaller stocks documented in this paper likely represents actively managed portfolios. The growth of the hedge fund industry and our findings of hedge fund over-weights in smaller stocks (figure 6C) are consistent with growth in active management.

7.3 Informational Efficiency

Because active management relies on the identification of mispriced securities, a possible reason for the increased focus of institutional investors on smaller-cap stocks is that mispricing is more likely for smaller stocks than for larger stocks. In this regard, the literature documents that there are fewer analysts and investors examining the fundamentals of smaller companies than larger companies (e.g., Arbel and Strebel (1983), Beard and Sias (1997) and many others), so there may be more random noise in the pricing of smaller stocks than larger stocks. If investment managers can filter fundamental signals from noise via security analysis, it will be easier for an investment manager to add value by investing in smaller stocks than in larger stocks. To test this conjecture we ask whether the variability of individual security alphas (i.e., mispricing) is greater for small stocks than for large stocks.

We begin by computing weekly returns for each stock in the CRSP daily returns file, eliminating those weekly returns for which the stock did not trade on each eligible trading day during the week. We then estimate alphas relative to the three-factor model for each stock in every year in which it had fifty weekly returns.[32] For each of our four size groups (as defined in section 3.2) for each year, we calculate the cross-sectional standard deviation of the individual security alpha estimates. As the variability of the alphas within a group of stocks increases, the reward for successful security analysis may increase. In Figure 8, there is a clear inverse relation between these standard deviations and size groups that prevails throughout our sample period. On the basis of the Kendall Coefficient of Concordance (see, e.g., Siegel (1956), pages 229-237), the null hypothesis that the ranking of the estimated standard deviations across the cap deciles within a year are independent of other years is rejected at the one percent level. Also of interest is the lack of obvious time trends in these standard deviations within any size group; this

[32] Weekly factor returns are from Ken French's Website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

indicates the increasing institutional ownership trends documented above are not associated with any increase in the informational efficiency in the pricing of individual stocks.

8. Conclusion

In this paper we document trends in the growth of institutional ownership of common stock using 13F holdings data. Since 1980 institutional investors have gradually shifted their portfolio allocations from larger stocks to smaller stocks. As of 2010 institutions underweight the mega-cap stocks, overweight both large- and mid-cap stocks, and hold small-cap stocks roughly in market proportions. We also show that although these trends apply to institutions of all sizes, they are most pronounced for smaller institutions. And for the shorter fourteen-year period from 1997 through 2010, we find that of these smallest institutions, hedge fund portfolios exhibited the greatest shift towards smaller stocks.

Why did institutions gradually shift their equity holdings from larger-cap to smaller-cap stocks? We propose three changes and characteristics of the institutional investment environment that might have contributed to this shift. First, institutional investors, regulators, and lawmakers became more knowledgeable about how diversification reduces idiosyncratic risk, and the institutional investment environment evolved to accommodate diversification into more volatile smaller-cap stocks. Second, the identification of the small stock premium led to increased institutional interest in these previously-ignored stocks. Third, we present evidence that smaller stocks may be less efficiently priced and therefore active managers might find it easier to add value with investments in smaller stocks than larger stocks.

Though we have made suggestions as to why institutions changed their allocations among stocks of varying market values, we have not addressed why non-institutional investors have tilted the composition of their direct holdings away from smaller stocks toward larger stocks. One possible reason for this reallocation of small stock holdings is that institutional trading technology has improved relative to non-institutions, so that institutions have experienced an increasing ability to buy the illiquid smaller-cap stocks. Nor have we addressed the mechanisms that prompted non-institutional investors to shift from directly investing their portfolios to delegating the management of those portfolios to institutions. We leave these important topics for subsequent research.

Appendix

A1. The Errors

In performing diagnostics for this paper we identified two types of errors in the prices and shares in the Thomson/CDA 13F data as provided by WRDS for September 30, 1999 and June 30, 2000. The effect of these two errors is to substantially overstate quarterly returns computed with these data for the fourth quarter of 1999 and the third quarter of 2000. These two quarters occurred during the internet bubble, the subject of numerous academic studies that find abnormal performance of some institutional portfolios due to their holdings of technology-related stocks (e.g., Brunnermeier and Nagel (2004) , Griffin and Xu (2009), and Griffin, Harris, Shu and Topaloglu (2011)).[33] The errors are of two types: (a) the incorrect replacement of the prices at the *beginning* of each of these quarters with the prices from the *end* of the respective quarters; and (b) the incorrect adjustment of institutional holdings for stock splits and dividends.

To demonstrate the effect of the errors, consider the calculation of quarterly value-weighted returns for a portfolio of all institutions in the Thomson/CDA 13F database. First, aggregate the dollar value of the holdings of all institutions at the end of each quarter for each individual stock, using only data from the Thomson/CDA 13F data provided by WRDS.[34] Second, calculate quarterly buy-and-hold returns for this aggregated portfolio by taking a weighted average of the subsequent quarterly returns for each stock as provided by CRSP, where the weights are proportional to the previously calculated aggregate holdings for each stock. For comparison purposes, we also calculate a quarterly value-weighted portfolio return (the "market") for these same stocks, using weights based on the market values of each stock from CRSP instead of the aggregate holdings from Thomson/CDA.

Figure A1 plots the differences between the quarterly institution and market returns, and 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. The two errors discussed below explain virtually all of the differences in returns in these two quarters. Once we correct for these errors, 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.

[33] See also Binay (2005) who uses the Thomson 13F data to document abnormal performance for institutional portfolios over this period, but does not focus on technology stock holdings.
[34] We use the same sample of common stocks as described in Section 2of the paper.

A2. An Example of the Errors

As an illustration of the first error, the substitution of a later price for an earlier prices, consider the stock price of Toll Brothers. On June 30, 2000, Thomson/CDA recorded a price of $34.38, while CRSP recorded a price of $20.50 (Table A1, Panel A). On September 30, 2000, both Thomson/CDA and CRSP recorded a price of $34.38. It appears that Thomson/CDA replaced the price of Toll Brothers on June 30, 2000 with the price on 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 CRSP price for September 30, 2000. Similarly, Thomson/CDA replaced the prices for September 30, 1999 with December 31, 1999 prices.

One's intuition might suggest that this replacement of an earlier price with a later price would create a "look-ahead" bias. In calculating the return for a portfolio of an institution formed, for instance, on June 30, the weights attributed to those stocks with the larger subsequent returns would be greater than if the correct price were used and those with the smaller subsequent returns smaller weights. Such an overweighting of stocks with the larger subsequent returns and underweighting of stocks with the lower subsequent returns creates an upward bias in the return calculation.

As shown below, there are two caveats to this intuition: The first is that this intuition ignores dividends. The misstatement of the weights described above is due to price returns, while calculations of total portfolio returns include dividends. It is theoretically possible that the inclusion of dividends may override the effects of the "look-ahead" bias, but even in the presence of dividends, the empirical results show that the look-ahead bias dominates. The second caveat is that this intuition requires variability in price returns across stocks; if not, the weights in a portfolio at the beginning of either quarter would be the same, whether calculated with the correct prices or the subsequent prices.

The second error is that Thomson/CDA incorrectly multiplied the holdings for any stock at the end of quarter t that had a split in quarter t+1, by the split factor in quarter t+1. Consider the stock of Merrill Lynch which declared a two-for-one stock split on July 18, 2000 with a record date of August 24 (Table A1, Panel B). The holdings of Merrill Lynch by McGahan Greene McHugh Capital Management on June 30, 2000 serve to illustrate the error: In its 13F filing (retrieved from Edgar) McGahan reported that it held 96,000 shares, while Thomson/CDA reports that it held 192,000 shares on that day. Thus it appears that Thomson/CDA retroactively and incorrectly multiplied the actual shares held on that day by the split factor of 2.0. As above,

Thomson/CDA also replaced the June Merrill Lynch price with the September price. We chose this example because McGahan had no trades during quarter t+1 when the split occurred, and it clearly shows the incorrect adjustment. As a check on whether this error was repeated throughout the Thomson file, WRDS at our request compared a sample of the holdings reported in Thomson/CDA to those reported in the contemporaneously-filed 13F forms (retrieved from Edgar) for the twelve managers that had the largest holdings in the Thomson/CDA data.[35] With few exceptions, the comparisons are consistent with our finding.

As it turns out, with respect to this second error, Thomson/CDA made two compensating errors. The end-of-quarter price, which replaces the beginning-of-quarter price, although the wrong price, is "adjusted for splits", and the shares held by the investment manager are also "adjusted for splits." Had there been no split, the calculated value of the shares held at the beginning of the quarter would be the product of 96,000 and $132 (twice the price of $66), or $12,672,000. With the split, the calculated value is 192,000 and $66, or $12,672.000. Thus, this incorrect adjustment for splits is self-correcting, although the look-ahead bias still remains.

A3. The Correction

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 by replacing the price from Thomson/CDA with the price from CRSP, 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 correct the split error but use the price from Thomson/CDA, the 1999 outlier

[35] 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 SEC 13F reports in Edgar. For the sake of this exercise, WRDS included all holdings—not the restricted list used in this study. Among the eleven managers there were 41,580 holdings that could be matched to CRSP using the common CUSIP numbers. These 41,580 holding represented 7,104 issues, of which there were 914 with stock splits or dividends of 50 percent of more. For 897 of these 914 issues, the ratios of the Thomson holdings to the holdings in the SEC filings were equal to the split factor available in CRSP. The corresponding numbers for September 1999 are: 37,879; 6,865; 759; and 744.

declines to 6.66 percent and the 2000 outlier declines to 7.45 percent. Thus, the price adjustment is more important.

4. The Proof

Define for each holding of a 13F-reporting firm in security *i* at time *t* the following variables:

H_{it} equals the number of shares held of security *i*;
P_{it} equals the price of security *i*;
$g_{it} = \frac{s_{it}P_{it}}{P_{i,t-1}}$ is one plus the capital gains return, where s_{it} is the ratio of the shares after a stock dividend or a split to the shares before;
$d_{it} = D_{it}/P_{it}$, where D_{it} is the dividend per share paid at time t adjusted for any stock splits or dividends that occurred during the quarter; and
$r_{it} = g_{it} + d_{it}$ is the total return.

As shown above, the split error is self-correcting; Thus, we assume with no loss of generality that $s_{it} = 1$. The total buy-and-hold return on the portfolio from *t-1* to *t*, R_t, is

$$R_t = \sum_i \frac{H_{i,t-1}P_{i,t-1}}{\sum_j H_{j,t-1}P_{i,t-1}} r_{it} = \sum_i w_{it} r_{it} \tag{1}$$

With the substitution of the later price, the total return R'_t is

$$R'_t = \sum_i \frac{H_{i,t-1}P_{i,t}}{\sum_j H_{j,t-1}P_{j,t}} r_{it} = \sum_i \frac{H_{i,t-1}P_{i,t-1}g_{it}}{\sum_j H_{j,t-1}P_{j,t-1}\, g_{jt}} r_{it} = \sum_i w'_{it} r_{it} \tag{2}$$

Note that in the special case in which all of the g_{it}'s are the same, the g_{it}'s cancel out and w'_{it} equals w_{it} for all *i*. implying that R'_t equals R_t. There is no bias in this case.

If the g_{it}'s differ among securities, then there is a possible bias. Consider the difference between R'_t and R_t :

$$\begin{aligned}(R'_t - R_t) &= \sum_i (w'_{it} - w_{it})(r_{it}) = \sum_i (w'_{it} - w_{it})(g_{it} + d_{it}) \\ &= \left(\sum_i (w'_{it} - w_{it})(g_{it}) + \sum_i (w'_{it} - w_{it})(\, d_{it}) \right)\end{aligned} \tag{3}$$

We first show that as long as there is variability in the g_{it}'s across securities, the first term in equation (3) is positive. To demonstrate this, order the holdings according to the values of the g_{it}'s from high to low. If there is variability in the g_{it}'s, the numerator for the first security in the summation in equation (2), $H_{1,t-1}P_{1,t-1}g_{1t}$, will be proportionally larger than the numerators of the remaining securities, because the first g_{1t} must be positive and larger than all the other g_{it}'s whose minimum value is zero. Thus, with a standardization to make the weights sum to one, this first security's weight in the portfolio must be larger in equation (2) than it is in equation (1), and the sum of the remaining weights smaller. Now consider the numerator of the second security in the summation in equation (2) in the same way as the first security: if it is smaller than in equation (1), all the remaining terms will be smaller. If larger, consider the numerator of the third security in the summation in the same way as the second security. Ultimately, a numerator in the summation in equation (2) will be less than its value in equation (1). At that point all remaining numerator values in equation (2) will also be less than in equation (1), so that in equation (2) more weight will be placed on securities with relatively greater capital gain returns (i.e., greater g_{it}'s) and less on those securities with relatively lower capital gain returns (i.e., lower g_{it}'s) in comparison to the weights in equation (1), resulting in an overstatement.

Thus, we expect that the substitution of a later price for an earlier price will cause the first term in equation (3) to be positive. The value of the second term will depend upon the relative magnitudes of the variance of g_{it} and the variance of d_{it} and the correlation between g_{it} and d_{it} within the quarter.

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Authors	Sample		Methodology	Conclusions
	Composition	Period of Analysis		
Del Guercia (1996)	13f Institutions	1988-1991	Regression	Banks hold higher quality stocks than mutual funds; the quality of the holdings of other institutions fall between those of banks and mutual funds; no time trend noted
Falkenstein (1996)	Mutual Funds	1991 and 1992	Correlation and Regression	Funds averse to small firms, except for small-cap funds; no time trend indicated
Gompers and Metrick (2001)	13f Institutions	1980-1996	Correlation and Regression	Institutions overweight larger stocks; this preferences is stable over time
Bennett, Sias, and Starks (2003)	13f Institutions	Mar 1983 - Dec 1997	Correlation and Regression	Institutions overweight larger stocks. Though this overweight is less in the second half of their sample, institutions still overweight larger stocks at the end of sample period.
Griffin and Xu (2009)	Mutual & Hedge Funds	1980-2004	Regression	Hedge Funds prefer smaller stocks than Mutual Funds
Lewellen (2011)	13f Institutions	1980-2007	Tabulation by equal-number quintiles	Institutions overweight larger stocks, defined as those stocks that make up the top 90% of the market. By the end of the period, institutions hold these largest stocks roughly in proportion to market weights.

Table 1. Samples, Methodologies, and Conclusions from Related Papers in the Literature

	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. Percentage Distribution of Stock Ownership by Equal Market Cap Deciles (Year End 1980 and 2010)

Description: This table presents the percentage distribution of stock by equal 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.

Interpretation: At the beginning of our sample period institutions overweighted the seven largest equal-cap deciles and underweighted the smallest three deciles. By the end of our sample period, institutions had shifted their allocations away from the larger-cap stocks and into the smaller-cap stocks.

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

Description: 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.

Interpretation: From widely-divergent institutional holdings profiles at the beginning of our sample period, institutional holdings of NYSE and Nasdaq stocks are similarly allocated across the equal-cap decile groupings at the end of 2010.

	Equal-Number Market Cap Decile										
	Largest	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**Smallest**	**Total Value**
A. 1980											
All Stocks	76.72	11.64	5.03	2.68	1.60	1.00	0.64	0.38	0.22	0.08	1,375.93
All Institutions	86.51	9.07	2.77	0.97	0.40	0.16	0.07	0.03	0.01	0.00	473.26
Memo: All Stocks											
Market Value of Decile	1,056	160	69	37	22	14	9	5	3	1	
Cumulative Market Value	1,056	1,216	1,285	1,322	1,344	1,358	1,366	1,372	1,375	1,376	
Upper Bound of Decile	39.626	0.546	0.202	0.100	0.058	0.035	0.022	0.014	0.008	0.004	
B. 2010											
All Stocks	77.30	11.24	5.20	2.75	1.59	0.91	0.54	0.29	0.13	0.04	17,084.33
All Institutions	75.37	12.94	5.83	2.94	1.61	0.76	0.37	0.13	0.04	0.01	11,471.06
Memo: All Stocks											
Market Value of Decile	13,207	1,921	888	470	272	156	92	49	23	8	
Cumulative Market Value	13,207	15,128	16,015	16,485	16,757	16,913	17,005	17,054	17,077	17,084	
Upper Bound of Decile	368.712	7.015	2.640	1.358	0.771	0.443	0.262	0.149	0.073	0.032	

Table 4: Percentage Distribution of Stock Ownership by Equal-Number Market Cap Deciles (Year End 1980 and 2010)

Description: This table presents the percentage distribution of stock analyzed in this study by market cap-deciles, where each decile contains the same number of stocks. 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.

Interpretation: Equal-number deciles give more information than equal-cap deciles about the smallest 1.9 percent of the market, but at the sacrifice of less information about those larger stocks representing nearly eighty percent of the market value of all stocks.

year	Tot Value of HF Stock Holdings ($ millions)	% of Total Mkt	# Funds
1997	36,862	0.35%	35
1998	87,148	0.66%	75
1999	148,995	0.88%	79
2000	138,643	0.90%	91
2001	168,989	1.24%	119
2002	145,847	1.35%	127
2003	215,423	1.51%	138
2004	270,941	1.70%	145
2005	304,537	1.81%	135
2006	459,466	2.44%	169
2007	497,389	2.59%	175
2008	233,898	2.06%	173
2009	398,482	2.71%	191
2010	499,015	2.92%	200

Table 5: Characteristics of the Hedge Fund Sample

Description: Total hedge fund assets, number of hedge funds, and hedge fund holdings as a percent of total U.S. stock market value for hedge funds in smallest asset manager size quartile. Our hedge fund sample is described in section 6.2.

	June 30, 2000	September 30, 2000
A. Substitution of price from end of following quarter		
Toll Brothers common stock price:		
Thomson/CDA	34.38	34.38
CRSP	20.50	34.38
B. Sustitution of Later Price in the Presence of a Stock Split		
Merrill Lynch common stock:		
Thomson/CDA		
Price	66.00	66.00
Shares	192,000	192,000
Correct		
Price	115.00	66.00
Shares	96,000	192,000

Table A1: Illustrations of Thomson/CDA Errors

Panel A presents an example of the replacement of an earlier price with a later price. Prices are from Thomson/CDA and CRSP. *Panel B* presents an example of the incorrect stock split adjustment by Thomson/CDA of shares held by McGahan Greene McHugh Capital along with the replacement of an an earlier price with a later price. The correct prices come from CRSP and the correct holdings from Edgar.

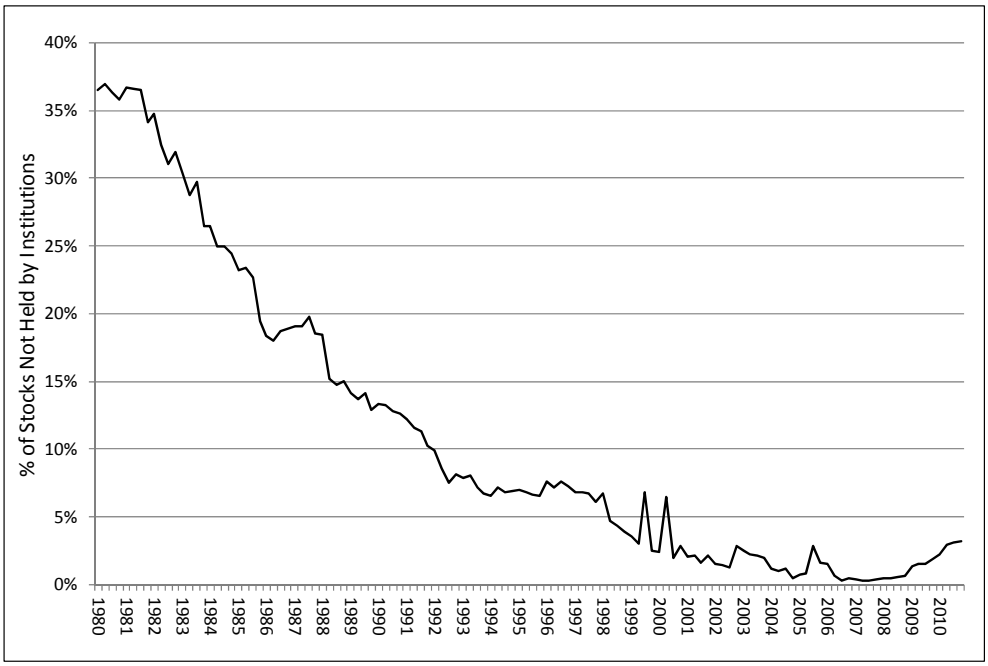

Figure 1: Percentage of Smallest Stocks Not Held by Institutions

Description: 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.

Interpretation: By the end of 2010, institutions held most of the stocks in the smallest equal-cap decile, with approximately maket proportions.

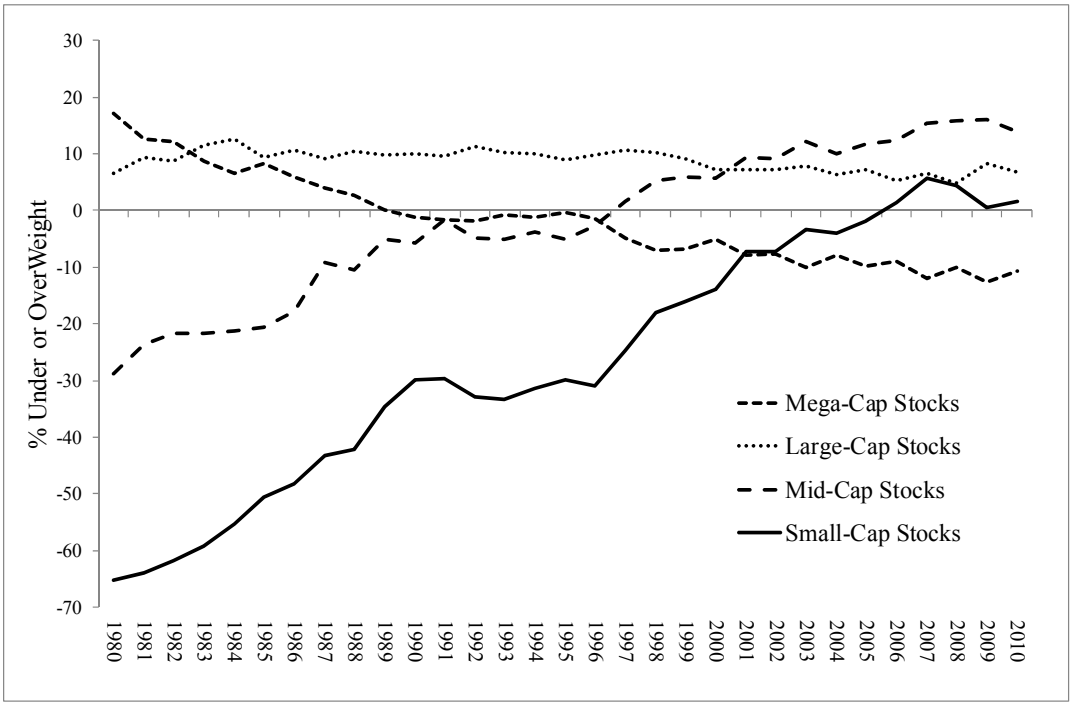

Figure 2. Time series of Under and Overweights by Groups of Equal Market Cap Deciles.

Description: Under- and Overweights relative ot market weights for four equal-cap-based groupings of stocks across all institutions, reported for year-end 1980 to year-end 2010. Holdings data are for all institutions in the Thomson/IDC 123F database.

Interpretation: Institutions have gradually shifted their holdings from larger to smaller stocks from 1980 to 2010 and now, relative to market weights, underweight jumbo-cap stocks, overweight mid-cap stocks, and hold small-cap stocks roughly in market proportions.

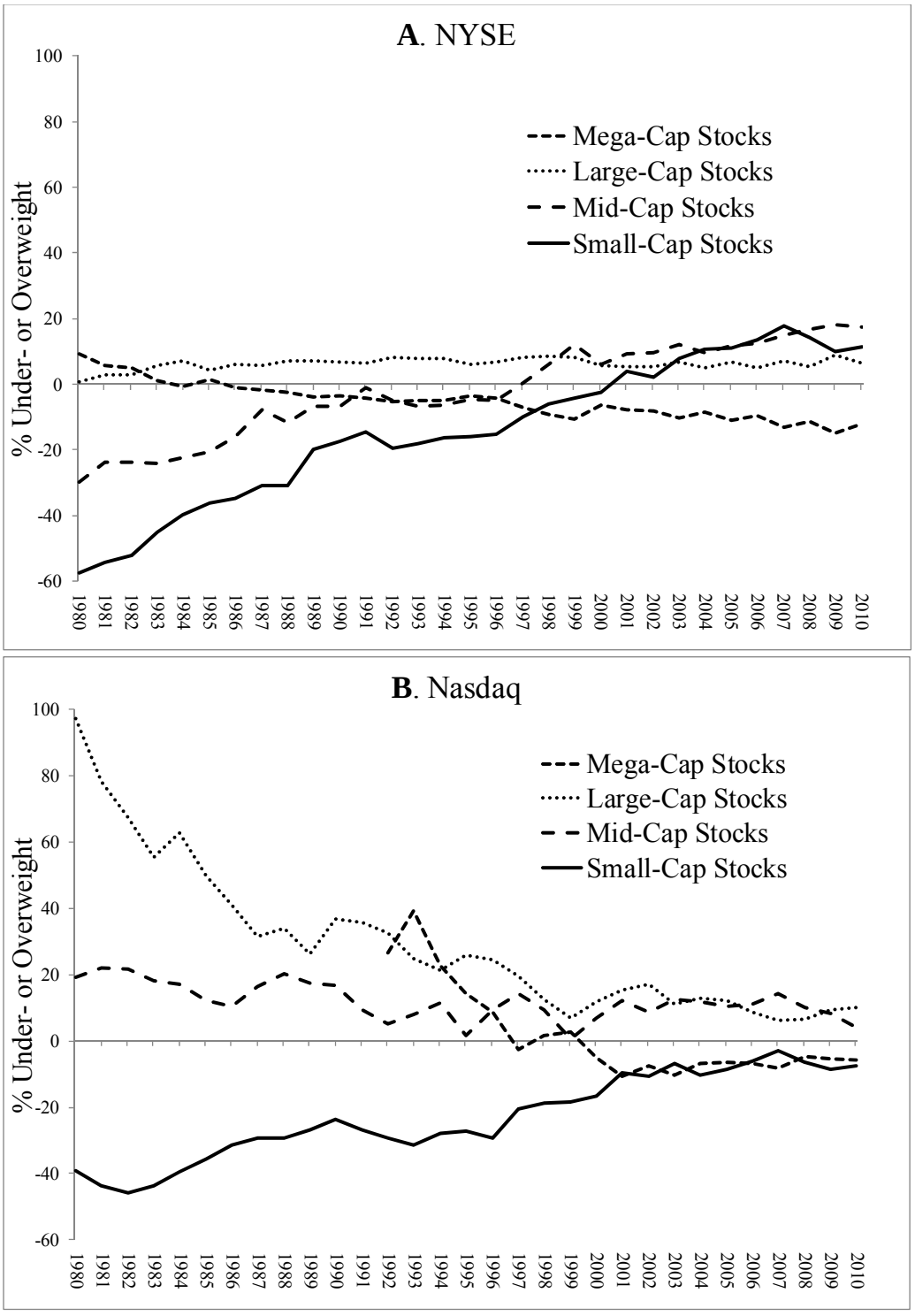

Figure 3. NYSE and NASDAQ Under- and Overweights by Groups of Equal-Cap Deciles

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

Interpretation: From widely-divergent institutional holdings profiles in the early years, by the end of the sample period institutional holdings of NYSE and Nasdaq stocks are similarly allocated across the equal-cap decile groupings.

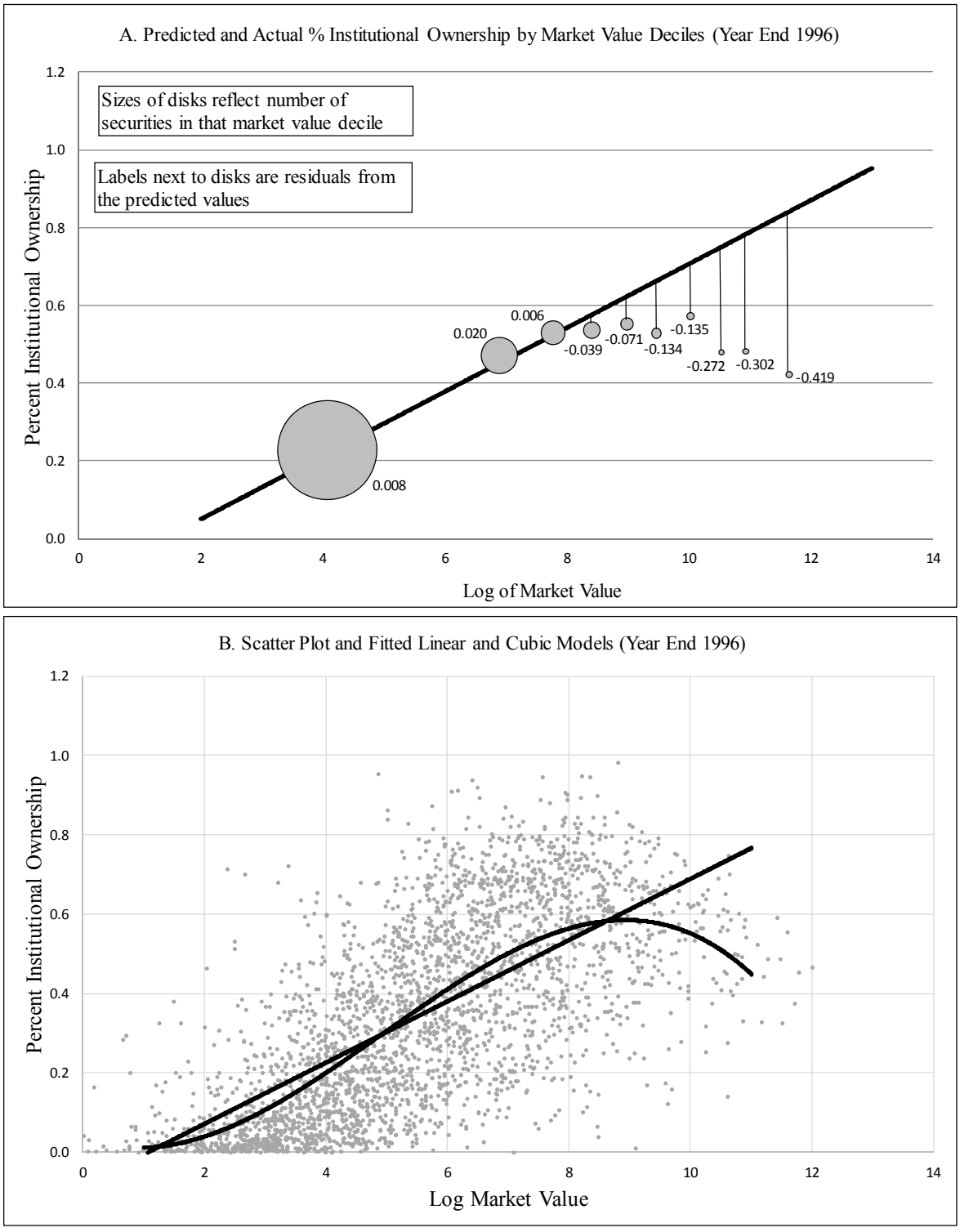

Figure 4. The Relation Between Percent Institutional Ownership and Log of Market Cap (Year End 1996)

Description: **A.** Plot of 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. **B**. Scatter plot of the actual data points with the fitted linear and cubic models superimposed on the data.

Interpretation: The relation between % institutional ownership and log of market cap is nonlinear.

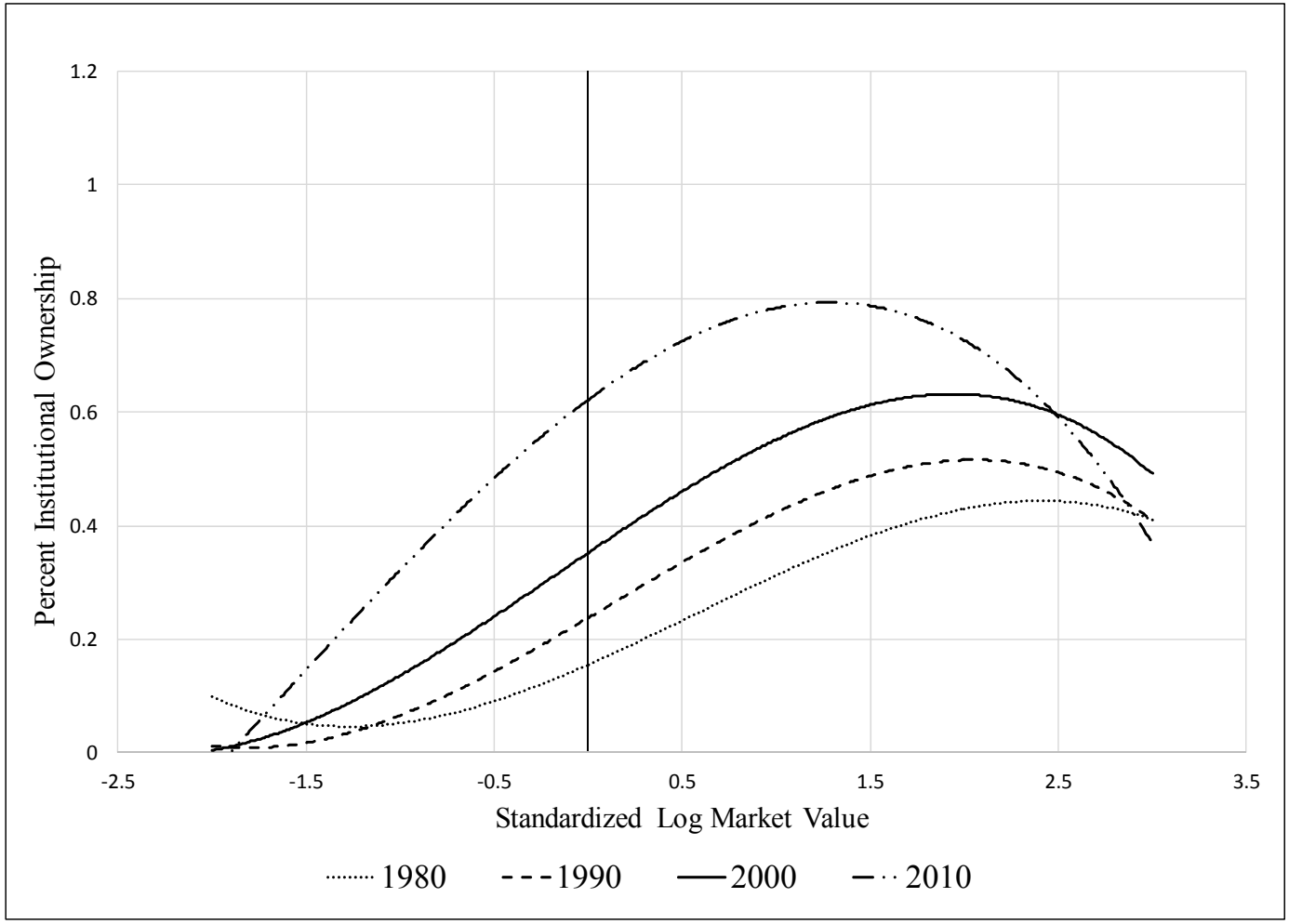

Figure 5. Fitted Cubic Model of the Relation Between Percent Institutional Ownership and Log of Market Cap (1980 to 2010)

Description: Plot of the cubic regression for year-end values at 1980, 1990, 2000, and 2010. Because the distribution of the logarithm of market value changes over time, we standardized market cap at each year end.

Interpretation: The relation between institutional ownership and market cap changes over time.

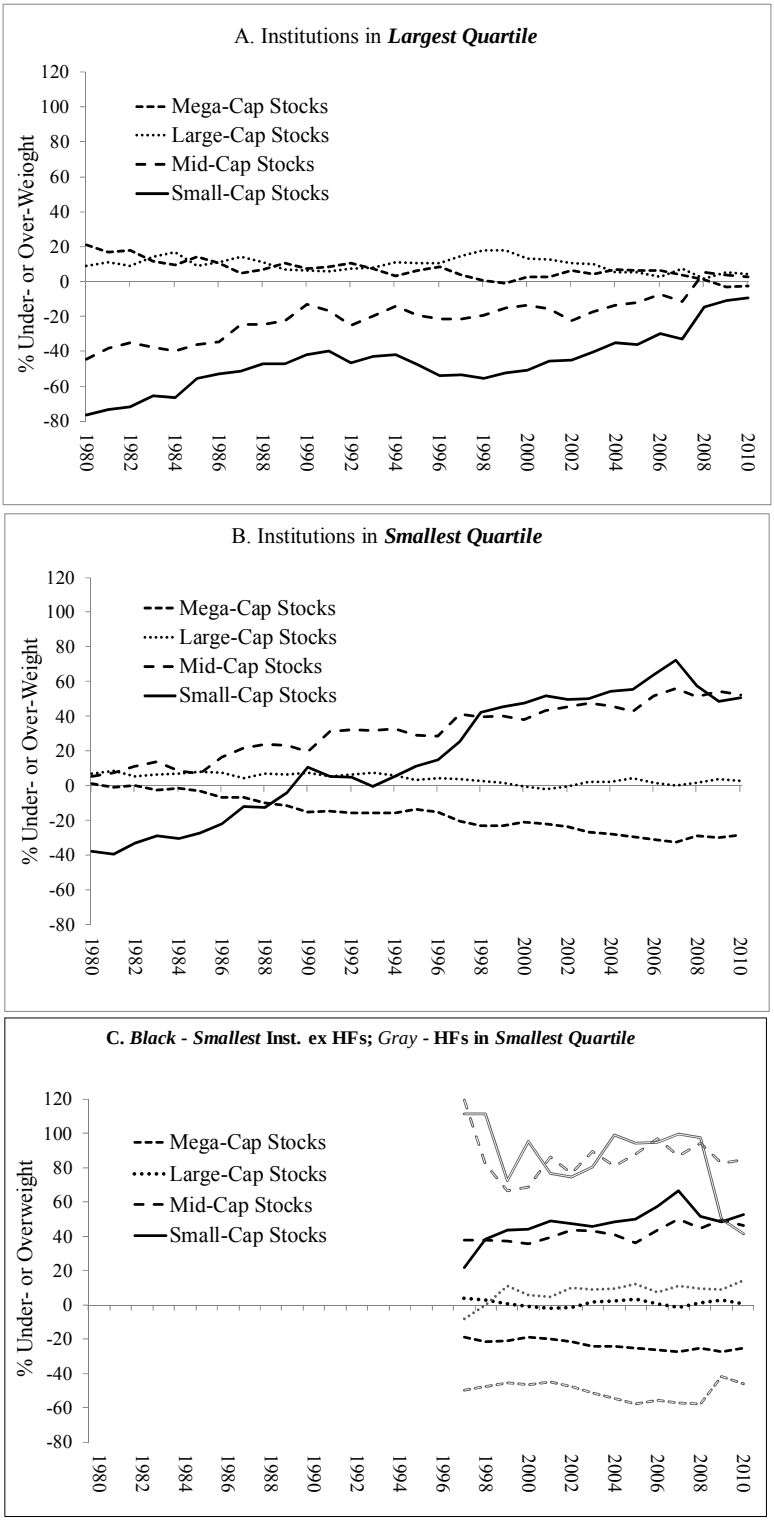

Figure 6. Under- and Over-weights for the Largest and Smallest Institutions

Description: Under- and over-weights relative to market weights for the largest and smallest quartiles of institution size. 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 for all institutions are reported for year end 1980 to year end 2010. Hedge fund results are for HFs in the smallest institution size quartile, and available for 1997 to 2010.

Interpretation: The smallest institutions increased their mid- and small-cap tilts to a much larger extent than did the larger institutions over the sample period. The small-cap tilt was even more pronounced for the hedge funds in the smallest

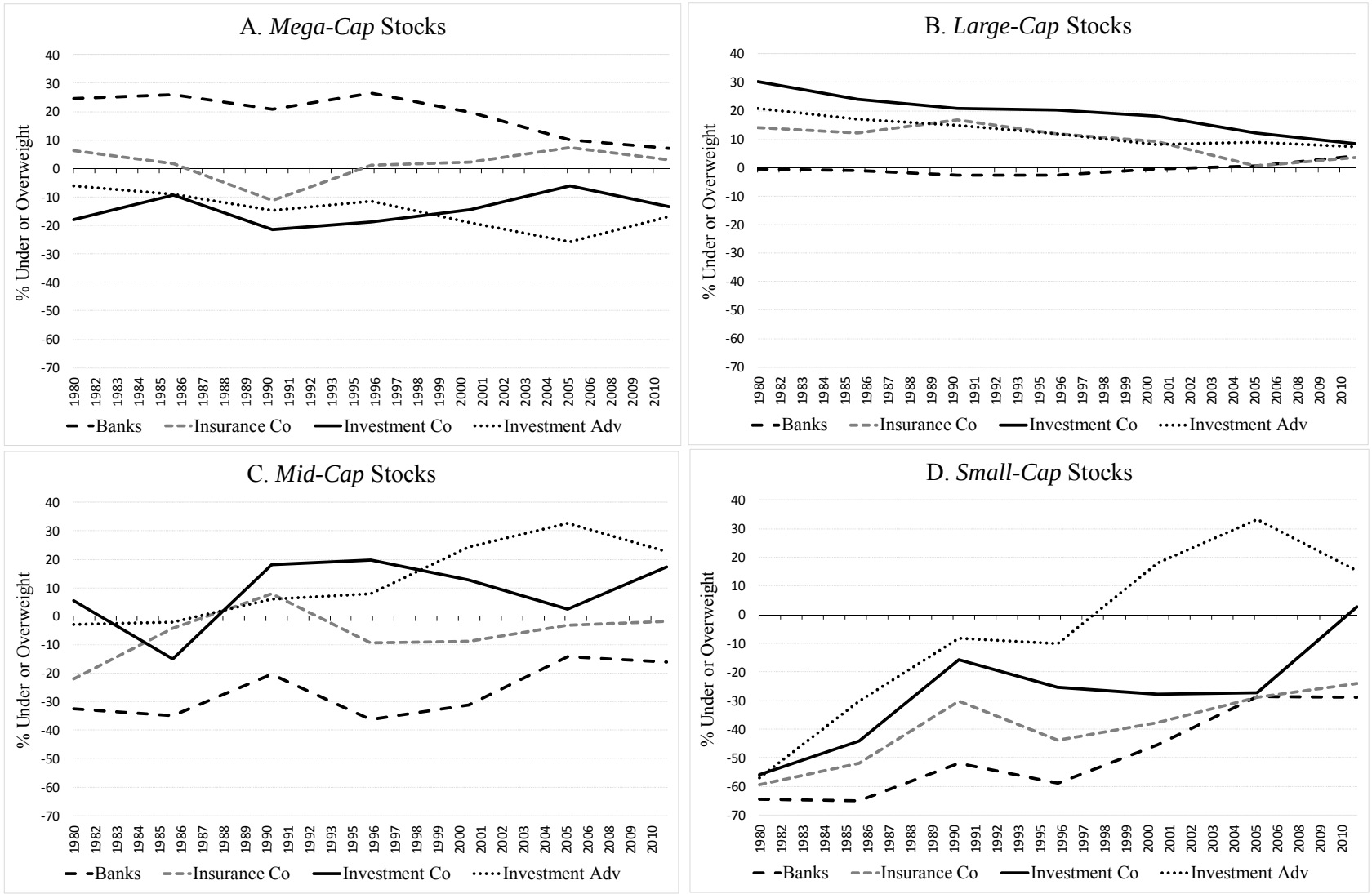

Figure 7. Time Series of Under and Overweights by Institution Type and by Groups of Equal Market Cap Deciles

Description: Under and Overweights relative to market weights for the four major types of institutional 13F filers, by groups of equal-cap deciles. The resultsare reported for year-ends 1980, 1985, 1990, 1995, 2000, 2005 and 2010. The institution types are based on Thomson institutional categories, as updated by Brian Bushee (http://acct3.wharton.upenn.edu/faculty/bushee/).

Interpretation: The downward trend in institutional allocations to jumbo-cap stocks is mostly attributable to banks and independent investment advisors. The upward trend in institutional allocations to small-cap stocks appears to be mainly driven by investment advisors, the largest of the industry types.

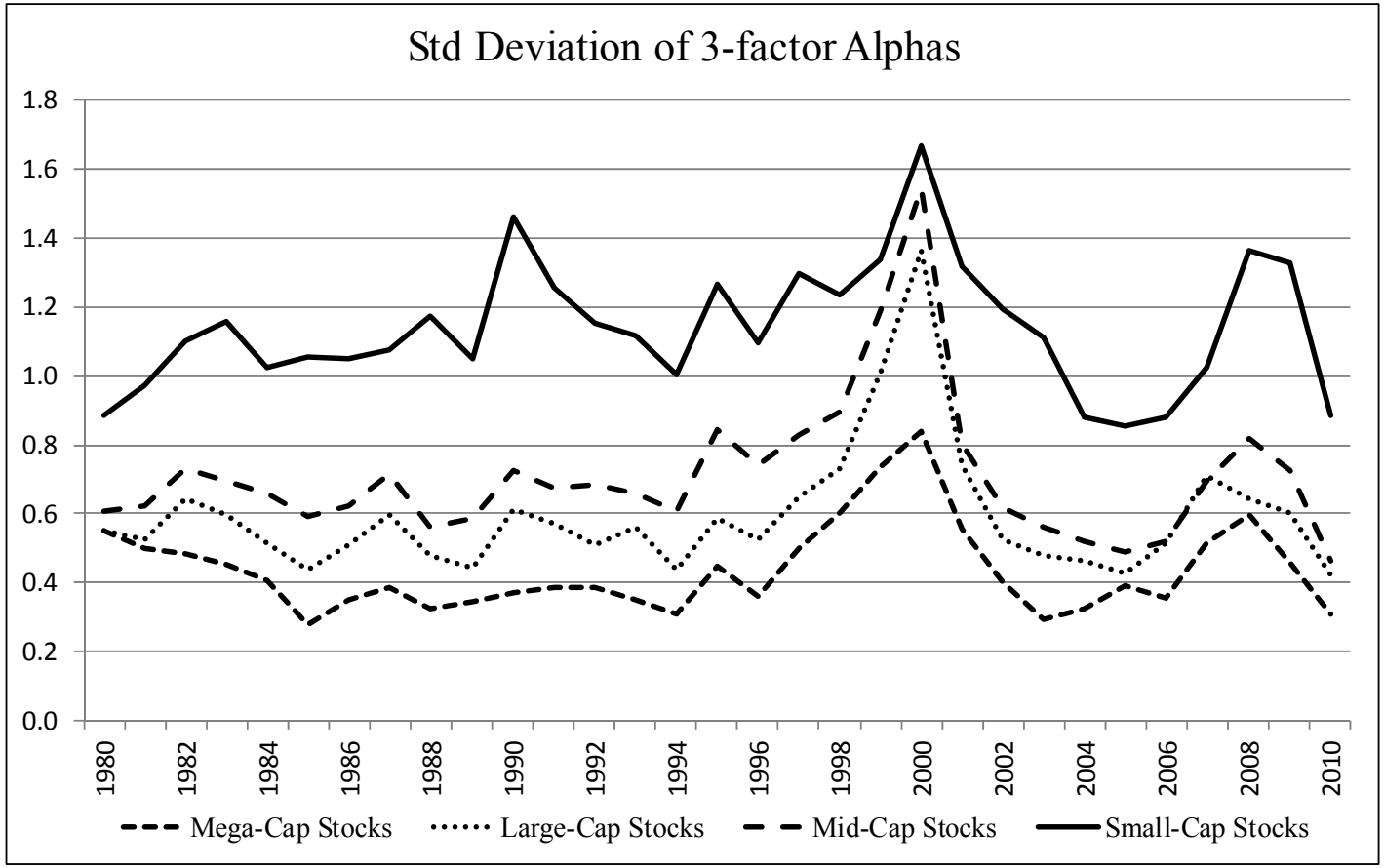

Figure 8. Standard Deviation of individual Security Alphas Estimated Relative to a Three-Factor Model

Description: This figure plots cross-sectional standard deviations of individual security alphas within each of our four size groups (as defined in section 3.1) for each year. Individual security alphas are estimated every year relative to the three-factor model of Fama and French (1993) using weekly returns; the individual regressions require a minimum of 50 weekly observations. We compute weekly returns for each stock in the CRSP daily returns file, eliminating those weekly returns for which the stock did not trade on each eligible trading day during the week.

Interpretation: An inverse relation between standard deviations of individual security alphas and equal-cap groups prevails throughout our sample period, with no obvious time trends.

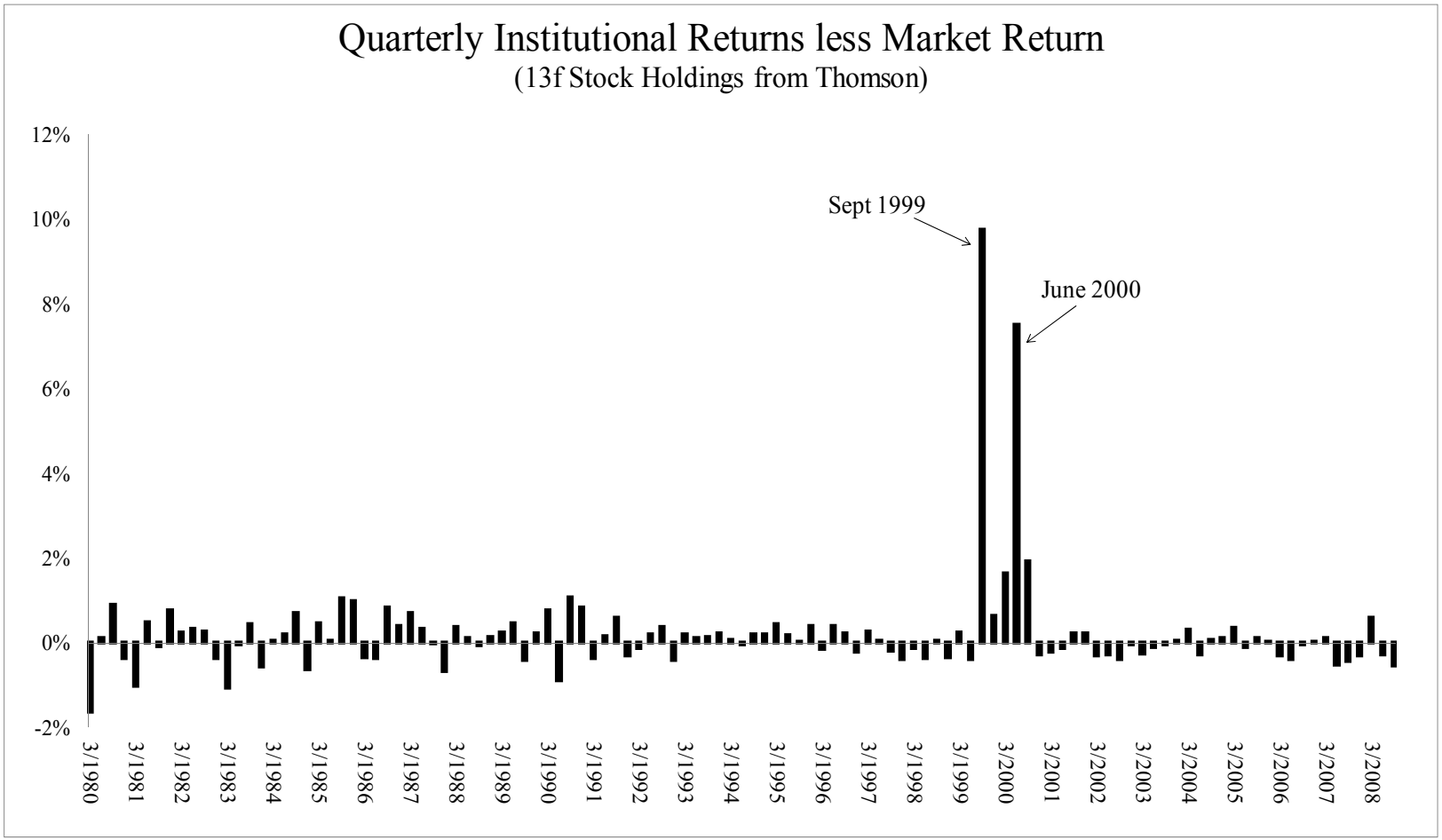

Figure A1. Outliers in Institutional Returns based on 13F Holdings Data

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 as taken from CRSP.