Greener Pastures and the Impact of Dynamic Institutional Preferences

James A. Bennett
University of Massachusetts Boston

Richard W. Sias
Washington State University

Laura T. Starks
University of Texas

Although institutional investors have a preference for large capitalization stocks, over time they have shifted their preferences toward smaller, riskier securities. These changes in aggregate preferences have arisen primarily from changes in the preferences of each class of institution, rather than changes in the importance of different classes. Evidence also suggests that recent growth in institutional investment combined with this shift in preferences helps explain why markets in general, and smaller stocks in particular, have exhibited greater firm-specific risk and liquidity in recent years. Additional analyses suggest that institutional investors moved toward smaller securities because such securities offer "greener pastures."

Institutional investors are now a dominant force in financial markets, representing a large fraction of equity ownership and an even larger proportion of trading volume. For example, in 1999 institutional investors accounted for more than 50% of total U.S. equity ownership, up from 7% in 1950 and 28% in 1970. Moreover, Schwartz and Shapiro (1992) estimate that institutions account for 70% of trading volume. This institutionalization of equity holdings almost certainly means that, for most firms, the price-setting marginal investor is an institution.

While institutional investors are a far-from-homogeneous group, they do have important common features that distinguish them from individual investors. For example, they typically hold much larger portfolios, leading to economies of scale in areas such as investment research and trade execution. In addition, institutional investors are usually evaluated and compensated based on investment performance, leading to similarities in incentives faced. Finally, institutions face constraints that can affect

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their investment decisions (e.g., prudent man regulations). These common factors appear to influence their portfolio decisions — extant work documents substantial correlations between institutional ownership and certain share characteristics such as market capitalization, liquidity, and share price [Badrinath, Kale, and Ryan (1996), Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001)].

Although previous research has examined the relations between institutional holdings and firm characteristics ("institutional preferences") on a cross-sectional basis, studies have not examined whether these relations change over time, how changes occur, how changes in institutional preferences impact security markets, or what may motivate such changes. In this study we address four important economic questions: (1) Do aggregate institutional preferences change over time? (2) Do shifts in institutional preferences result from changes in the preferences of each type of institutional investor or from changes in the relative importance of different types of institutional investors? (3) Do shifts in institutional preferences affect securities markets? (4) Why do institutional investors' preferences change?

Our results reveal that institutional investors' preference for large, safe stocks has declined over time in favor of smaller, riskier stocks. This shift in preferences has two potential explanations. The first is that aggregate institutional preferences have changed simply because the relative importance of the different types of institutional investors has changed. Disproportionate growth across classes of institutional investors possessing heterogeneous preferences will cause aggregate preferences to more closely resemble the preferences of the now more important types of institutional investors. An alternative possibility is that changes in aggregate preferences are induced by changes in the preferences of one or more classes of professional investors, independent of any shifts in relative importance.

These explanations are not mutually exclusive — in fact, we find that different types of institutional investors experience different growth rates *and* that their preferences change over time. We perform a variance decomposition to distinguish between the competing explanations. Results reveal that 93% of the time-series variation in aggregate preferences is due to changes in the preferences of different types of institutional investors, 4% is apportioned to changes in the relative importance of the different types, and the remaining 3% is due to interaction effects.

We also examine the impact of the combination of institutional investors' shift in preferences and the growing importance of institutional investors on trading activity and volatility. Recent studies document marketwide increases in share turnover and firm-specific risk in the past two decades [Chordia, Roll, and Subrahmanyam (2001), Campbell et al. (2001)]. Several factors likely contribute to these patterns. Chordia, Roll, and Subrahmanyam, for example, posit that the temporal decline in transaction costs may be partially responsible for increases in volume and volatility. We hypothesize that the growth in institutional ownership may also contribute to these patterns. We further hypothesize that institutional growth, combined with shifting preferences, suggests increases in share turnover and firm-specific volatility should be proportionally greater for smaller capitalization securities. We find evidence consistent with both hypotheses: subsequent levels of turnover and firm-specific risk are positively related to lag changes in institutional ownership, and increases in turnover and firm-specific risk have been more pronounced among smaller capitalization securities.

There are two possible explanations for the shift in institutional preferences. First, Gompers and Metrick (2001) argue that demand shocks associated with the growth in institutional ownership and institutional investors' historical preference for large capitalization securities have increased large stock valuations (or equivalently, institutional demand shocks are responsible for the disappearance of the small firm effect in recent periods). An alternative, although not mutually exclusive, possibility is that smaller stocks may provide greater opportunities for institutional investors to exploit their informational advantages. Both explanations suggest the shift in preferences occurs because smaller stocks offer institutional investors "greener pastures."[1]

Our empirical evidence supports both explanations. First, we find that increased institutionalization has coincided with a significant decline in the average book-to-market ratio of larger firms, resulting in relatively more attractive valuations for smaller firms. In addition, we find evidence of institutional demand shocks — future returns are positively related to current levels of institutional ownership [Gompers and Metrick (2001) find a similar result]. Nonetheless, our evidence suggests that institutional investors have an informational advantage — even after controlling for the level of institutional ownership (as a proxy for demand shock effects), *changes* in institutional demand predict future returns. The results, however, are sensitive to how changes in institutional demand are measured. Although we find little evidence that changes in the fraction of shares held by institutional investors forecast returns, we do find that the Lakonishok, Shleifer, and Vishny (1992) measure of institutional herding is able to forecast future returns, even after controlling for security characteristics and levels of institutional ownership. In addition, our results reveal institutional investors' ability to forecast returns is inversely related to capitalization.

[1] Chan, Chen, and Lakonishok (2002) note, however, that shifts in preferences may result from agency and behavioral issues rather than from attempts to maximize risk-adjusted performance. They find, for example, that poor-performing mutual funds are more likely to change their "style."

The balance of the article is organized as follows. We review the data in Section 1. In Section 2 we develop our methodology for examining preferences and document time variation in aggregate institutional preferences. Section 3 considers possible explanations for these changes by examining homogeneity of preferences across investor classes, changes in the relative importance of each class over time, and changes in the preferences of each class over time. We distinguish between competing explanations by partitioning the time-series variance in aggregate preferences between the portion due to changes in the relative importance of each class and the portion due to changes in preferences of each class. We explore the impact of the shift in institutional preferences on liquidity and volatility in Section 4. Section 5 examines possible explanations for the shift in institutional preferences. Conclusions are presented in Section 6.

1. Data

The primary data for this study come from two sources. Security characteristics are gathered from the Center for Research in Security Prices (CRSP) monthly data. Institutional ownership for each security for each quarter between March 1983 and December 1997 (a total of 60 quarters) comes from CDA Spectrum and is derived from institutional investors' 13F filings. (All institutional investors with more than $100 million in equity ownership must report their holdings to the SEC in quarterly 13F filings.)[2] All New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Nasdaq securities with adequate CRSP data are included in the analysis.[3]

Our analysis focuses on nine stock characteristics: three measures of risk (beta, return standard deviation, and firm-specific volatility), three measures intended to correspond to institutional investment constraints (firm size, firm age, and dividend yield), two measures of liquidity (share price and share turnover), and one measure used to control for momentum trading (lag return). These characteristics are similar to those used in extant literature [Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001)]. Beta is estimated as the sum of the coefficients in a regression of the firm's monthly return on the contemporaneous and lag one-month CRSP NYSE-AMEX value-weighted index over the previous 24 to 60 months (depending on availability). Standard deviation is estimated as the natural logarithm of the standard deviation of monthly

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[2] Institutions are required to report all material equity positions, currently defined as positions of more than 10,000 shares or $200,000 in value.

[3] To ensure our results are not driven by the inclusion of very small firms, we repeat all analyses excluding the smallest quartile of firms (each quarter). Our results (not reported to conserve space) remain essentially unchanged.

returns over the previous 24 to 60 months (depending on availability).[4] Firm-specific volatility is calculated as the natural logarithm of one plus firm-specific risk measured over the current quarter.[5] Firm size is measured as the natural logarithm of equity capitalization and firm age is defined as the natural logarithm of the number of months of CRSP listing since December 1972 (the starting date for CRSP Nasdaq return data). Dividend yield is measured as the natural logarithm of one plus the average monthly dividend yield over the previous 12 months. Share price is measured as the natural logarithm of one plus the quarter-end share price, and share turnover is defined as the natural logarithm of one plus the average ratio of monthly volume to number of shares outstanding in the current quarter. The characteristics are updated every quarter for each firm. The number of securities with adequate data ranges from 4345 in the first quarter of 1983 to 6779 in the last quarter of 1997.

The institutional ownership data identify the number of shares held by institutional investors and classify owners into one of five groups: bank trust departments, insurance companies, mutual funds, independent investment advisors, and other (unclassified) institutional investors. For any particular firm, the fraction of outstanding shares held by institutional investors in aggregate is simply the sum of fractional ownership over the five classes. The classifications (made by CDA Spectrum) are potentially inexact — for example, independent money managers who also manage mutual funds are classified as mutual funds if more than 50% of managed assets are in mutual funds.

We begin the analysis by computing, each quarter, mean cross-sectional firm characteristics and fractional institutional ownership (in aggregate and by type). Panel A of Table 1 reports the time-series mean, median, minimum, and maximum of these 60 cross-sectional averages. Over the 1983 to 1997 sample period, institutional investors held 23% of each firm's shares, on average. Together, bank trust departments and independent investment advisors held, on average, about 17% of each firm's shares, and accounted for approximately 73% of all shares held by institutions. Insurance companies, mutual funds, and unclassified institutional investors each accounted, for, on average, 7% to 13% of aggregate institutional shareholdings.

[4] To account for non-linearities, Falkenstein (1996) uses both return standard deviation and return variance in a regression of mutual fund ownership on share characteristics. We find, however, that accounting for the non-linearity by using the natural logarithm of return standard deviation results in a higher raw and adjusted R^2 than using both standard deviation and variance.

[5] Quarterly firm-specific risk is calculated as the three-month average of the Campbell, Lettau, Malkiel, and Xu (2001) monthly firm-specific risk measure. Specifically, we assign firms to one of 49 industries (see Fama and French (1997) for industry classification codes) and compute daily industry returns as the equal-weighted average return across firms in the industry. Daily firm-specific returns are defined as the difference between a firm's return and its industry return. Monthly firm-specific risk is computed by summing the squared daily values of firm-specific returns.

Table 1
Descriptive statistics

	Mean	Median	Minimum	Maximum
Panel A: Percentage institutional ownership				
% Total	0.2277	0.2179	0.1544	0.3093
% Ind. inv. advisers	0.1141	0.1174	0.0509	0.1583
% Bank trust depts.	0.0515	0.0507	0.0400	0.0620
% Mutual funds	0.0286	0.0170	0.0115	0.0715
% Insurance	0.0184	0.0175	0.0153	0.0231
% Unclassified	0.0151	0.0151	0.0110	0.0200
% Market capitalization	0.4462	0.4500	0.3430	0.5258
Panel B: Share characteristics				
Beta	1.28	1.30	1.03	1.58
Standard deviation	13.82%	13.87%	12.62%	15.05%
Firm-specific risk	4.34%	4.20%	1.67%	10.03%
Size ($000)	687,345	604,326	351,821	1,519,337
Age (months)	124	121	103	139
Dividend (%/month)	0.16	0.15	0.13	0.25
Price ($)	18.90	18.40	12.70	28.57
Turnover	6.50%	5.90%	3.67%	11.08%
Lag 6-month return	8.35%	8.16%	−25.99%	52.21%
Number of firms	5,425	5,449	4,345	6,779

Each quarter between March 1983 and December 1997 (60 quarters) we estimate the cross-sectional average fraction of shares held by institutional investors (overall and by type) and share characteristics. Beta is estimated as the sum of the coefficients in a regression of the firm's monthly return on the contemporaneous and lag one-month CRSP NYAM value-weighted index over the previous 24 to 60 months (depending on availability). Standard deviation is estimated from monthly returns over the previous 24 to 60 months (depending on availability). Firm-specific risk is estimated as the squared difference between daily firm returns and associated industry returns summed each month and averaged over the three months in the current quarter. Firm age is given as the number of months since December 1972 for which the firm has CRSP return data. Dividend yield is measured as the average monthly dividend yield over the previous 12 months. Share price is given as the quarter-end share price. Turnover is defined as the ratio of monthly volume to number of shares outstanding averaged over the three months in the current quarter. Lag return is the cumulative return for the firm over the previous six months. The time-series mean, median, minimum, and maximum of the 60 quarterly cross-sectional averages are reported above.

By the end of 1997, institutions held approximately 31% of each firm's shares on average (the maximum reported in the first row of Table 1). Average fractional ownership of 31% is not directly comparable to the 50% ownership discussed in the introduction because fractional institutional ownership tends to be larger in large capitalization stocks. The last row in panel A reports the fraction of market capitalization held by institutional investors in aggregate. The maximum of 53% (from December 1997) reveals that as of the end of 1997, professional investors controlled a little over half of the market capitalization.

The results reported in Table 1 also show substantial time variation in mean ownership level by each type of institutional investor. Average holdings of independent investment advisors, for example, range from a minimum of 5.1% of each firm's shares to a maximum of 15.8%. Figure 1, which displays the average fraction of shares held by each type of institutional investor across the sample period, reveals three striking insights into the dynamics of U.S. institutional ownership. First, most of

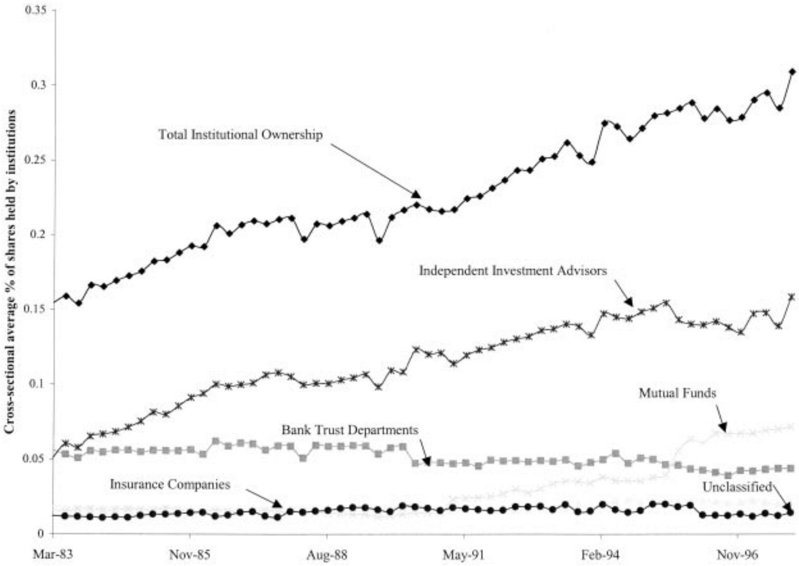

Figure 1.

the growth in institutional ownership over the period results from independent investment advisor growth. Second, although bank trust departments account for a large share of institutional ownership, their importance declined in the 1990s. Third, there is strong growth in mutual fund ownership beginning in 1990.

Panel B in Table 1 reports the time-series mean, median, minimum, and maximum of the 60 quarterly cross-sectional mean firm characteristics. For ease of interpretation, summary statistics reported in Table 1 are based on raw values, for example, the average share price rather than the average natural logarithm of one plus share price. The average firm has 10 years of CRSP return data since 1972, sells for \$19 per share, and has a beta of 1.28. The average beta is greater than one because we report the average (equal-weighted) beta calculated using the value-weighted CRSP index. The ranges between the minimum and maximum values of the quarterly average characteristics indicate substantial time-series variation. The cross-sectional *average* share price, for example, ranges from a minimum of \$12.70 to a maximum of \$28.57.

As an initial indication of the relations between institutional ownership and share characteristics, we estimate, each quarter, a correlation matrix of the explanatory variables and the levels of institutional ownership. Table 2 reports the time-series average of the 60 quarterly cross-sectional correlation matrices. Panel A reports the time-series average of the cross-sectional correlations between stock characteristics and the fraction

Table 2
Average cross-sectional correlations between institutional ownership and share characteristics

	Beta	Standard deviation	Firm-specific risk	Size	Age	Dividend yield	Price	Turnover	Lag return
Panel A: Correlation between institutional ownership and share characteristics									
% Total	0.0381	−0.2652	−0.2472	0.6533	0.2884	0.0316	0.5973	0.2476	0.0508
% Ind. inv. advisers	0.0852	−0.1571	−0.2091	0.4847	0.1973	−0.0335	0.4754	0.2815	0.0538
% Bank trust depts.	−0.0560	−0.3087	−0.1892	0.5269	0.3001	0.1078	0.4859	0.0626	0.0309
% Mutual funds	0.0408	−0.1353	−0.1516	0.4131	0.1350	0.0060	0.3757	0.2010	0.0431
% Insurance	0.0048	−0.1424	−0.1157	0.3672	0.1658	0.0364	0.2897	0.0985	0.0112
% Unclassified	0.0114	−0.1488	−0.1174	0.3869	0.1694	0.0293	0.3007	0.0920	−0.0016
Panel B: Share characteristics									
Beta	1.0000								
Standard deviation	0.4593	1.0000							
Firm-specific risk	0.1218	0.4070	1.0000						
Size	−0.0469	−0.5006	−0.3794	1.0000					
Age	−0.1216	−0.2753	−0.1580	0.3254	1.0000				
Dividend yield	−0.2384	−0.4870	−0.1641	0.2340	0.1268	1.0000			
Price	−0.1457	−0.6346	−0.4731	0.8048	0.3230	0.2517	1.0000		
Turnover	0.1974	0.2114	0.0444	0.1427	−0.0978	−0.1168	0.1167	1.0000	
Lag 6-month return	0.0138	−0.0112	−0.0869	0.1445	0.0431	0.0306	0.2229	0.1393	1.0000

Each quarter between March 1983 and December 1997 we estimate the cross-sectional correlation between share characteristics and the fraction of shares held by institutional investors (in aggregate and by investor classification). This table presents the time-series average of the 60 quarterly cross-sectional correlations. Panel A presents the mean correlation between share characteristics and the institutional ownership measures (overall and by type). Panel B presents the mean correlations between the share characteristics. Beta is estimated as the sum of the coefficients in a regression of the firm's monthly return on the contemporaneous and lag one-month CRSP NYAM value-weighted index over the previous 24 to 60 months (depending on availability). Standard deviation is estimated as the natural logarithm of monthly return standard deviation over the previous 24 to 60 months (depending on availability). Firm-specific risk is estimated as the natural logarithm of one plus the average monthly estimate of firm-specific risk in the current quarter. The monthly estimate is generated as the squared difference between daily firm returns and associated industry returns summed each month. Firm size is measured as the natural logarithm of equity capitalization. Firm age is given as the natural logarithm of the number of months since December 1972 for which the firm has CRSP return data. Dividend yield is measured as the natural logarithm of one plus the average monthly dividend yield over the previous 12 months. Share price is given as the natural logarithm of one plus the quarter-end share price. Turnover is defined as the natural logarithm of one plus the monthly turnover averaged over the three months in the current quarter. Monthly turnover is given as the ratio of monthly volume to number of shares outstanding. Lag return is the cumulative return for the firm over the previous six months.

of shares held by institutional investors (in aggregate and by type), whereas Panel B reports the time-series averages of the cross-sectional correlations between the characteristics.

Results in panel A show that for six of the nine characteristics, the correlations with aggregate institutional ownership are of the same sign across all types of institutional investors. For each characteristic, however, there is substantial variation in the magnitude of the average correlations across the different types of institutional investors. The average correlation between turnover and ownership by independent investment advisors, for example, is more than four times the average correlation between turnover and ownership by bank trust departments. By themselves, these pairwise correlations suggest that aggregate institutional ownership is positively related to systematic risk, capitalization, firm age, dividend yield, share price, turnover, and lag return, and inversely related to total risk and firm-specific risk. However, the strong correlations between the characteristics (shown in panel B) suggest that the correlations presented in panel A should be interpreted with caution. To control for these interrelations among the characteristics, we use multivariate regression analysis in the following sections.[6]

2. Changes in Institutional Preferences Over Time

2.1 Standardized regression methodology for comparisons

The magnitude of an ordinary regression coefficient depends on the scale of both the dependent variable and independent variables. In our case, this leads to problems when comparing coefficients over time or across investor types due to changes in the scales of both dependent and independent variables. For example, total institutional ownership doubles over the period under consideration. If institutional investors exhibit constant preferences over time for the level of a firm's share price (i.e., the correlation between share price and the fraction of shares held by institutional investors remains unchanged), the estimated coefficient will double over the period simply from the doubling of the ownership. In addition, because the magnitude of the estimated coefficient is also a function of the scale of the *independent* variables, time-series variation in raw coefficient estimates will arise as a result of time-series changes in the magnitudes of the characteristics. Similarly differences in the relative size

[6] About 6.5% of the firms in our sample have no reported institutional ownership. Because some observations are censored (i.e., have zero institutional ownership), we also estimated a Tobit model and found the estimated coefficients to be qualitatively equivalent to the multivariate regression model we use. We use the latter model for three reasons: the results are qualitatively identical, few of the sample firms are censored, and there is a distinct advantage due to the linear nature of our variance decomposition.

of different institutional investor classes make cross-investor comparison of raw regression coefficients meaningless.

To overcome these issues, we standardize both the independent and dependent variables, each quarter, such that all variables have the same mean (zero) and standard deviation (one). The interpretation of such standardized regression coefficients is the expected standard deviation change in the dependent variable given a one standard deviation change in the independent variable.

Specifically the standardized value of characteristic j for security i is given as $(x_{i,j} - \bar{x}_j)/s_j$, where $\bar{x}_j$ is the cross-sectional average of characteristic j and s_j is the cross-sectional standard deviation of characteristic j. Then the regression of y on j independent (nonstandardized) variables estimated as

$$\hat{y}_{\mathrm{i}} = b_0 + b_1 x_{i1} + b_2 x_{i2} + \cdots + b_j x_{ij} \tag{1}$$

can be rewritten as

$$\left(\frac{\hat{y}_i - \bar{y}}{s_y}\right) = \frac{b_1 s_1}{s_y}\left(\frac{x_{i1} - \bar{x}_1}{s_1}\right) + \frac{b_2 s_2}{s_y}\left(\frac{x_{i2} - \bar{x}_2}{s_2}\right) + \cdots + \frac{b_j s_j}{s_y}\left(\frac{x_{ij} - \bar{x}_j}{s_j}\right). \tag{2}$$

The coefficient $b_j s_j / s_y$ is the standardized regression coefficient for characteristic j, henceforth denoted β_j. Note that because all variables in Equation (2) are mean zero, the intercept is zero. Since the standardized regression coefficients are scale-free, we can directly compare coefficients across time, across different types of institutional investors, and across characteristics. In addition, because standardization is simply a linear rescaling of the original variables, the correlation coefficients between the variables, the t-statistics of the standardized coefficients, and the R^2s of the standardized regressions are identical to their values calculated using raw data.

2.2 The dynamic nature of aggregate preferences

We estimate, each quarter, a cross-sectional standardized regression of aggregate institutional ownership on the nine share characteristics. These 60 cross-sectional regressions have relatively high explanatory power, with an average R^2 of 51.05%. The first row in each cell in Table 3 (panel A) reports the average coefficient from these 60 cross-sectional regressions. The second row in each cell reports, in parentheses, the fraction of the estimated coefficients that are positive followed by the fraction of the positive coefficients that differ significantly from zero at the 5% level or

Table 3
Tests for changes in aggregate preferences

Period	Beta	Standard deviation	Firm specific risk	Size	Age	Dividend yield	Price	Turnover	Lag return
Panel A: Entire sample period									
831–974 ($n = 60$)	0.0372	0.0681	0.0100	0.4377	0.1012	−0.0920	0.2912	0.1378	−0.0987
	(0.73/0.89)	(0.78/0.75)	(0.72/0.44)	(1.00/1.00)	(1.00/0.98)	(0.00/.)	(1.00/1.00)	(1.00/1.00)	(0.00/.)
	(0.27/0.69)	(0.22/0.31)	(0.28/0.12)	(0.00/.)	(0.00/.)	(1.00/0.95)	(0.00/.)	(0.00/.)	(1.00/1.00)
Panel B: Subperiod analysis									
831–902 ($n = 30$)	0.0415	0.0037	0.0070	0.4920	0.0967	−0.0716	0.2081	0.1464	−0.1018
	(0.77/0.87)	(0.57/0.29)	(0.60/0.33)	(1.00/1.00)	(1.00/0.97)	(0.00/.)	(1.00/1.00)	(1.00/1.00)	(0.00/.)
	(0.23/0.43)	(0.43/0.31)	(0.40/0.08)	(0.00/.)	(0.00/.)	(1.00/0.90)	(0.00/.)	(0.00/.)	(1.00/1.00)
903–974 ($n = 30$)	0.0328	0.1324	0.0129	0.3835	0.1058	−0.1124	0.3743	0.1292	−0.0957
	(0.70/0.90)	(1.00/1.00)	(0.83/0.52)	(1.00/1.00)	(1.00/1.00)	(0.00/.)	(1.00/1.00)	(1.00/1.00)	(0.00/.)
	(0.30/0.89)	(0.00/.)	(0.17/0.20)	(0.00/.)	(0.00/.)	(1.00/1.00)	(0.00/.)	(0.00/.)	(1.00/1.00)
z-statistic	−0.72	6.65**	1.77	−5.40**	0.95	−4.50**	6.63**	−2.62**	0.75

Each quarter between March 1983 and December 1997 we estimate a cross-sectional regression of the fraction of shares held by institutional investors on nine share characteristics. The number of securities in each cross-sectional regression ranges from 4345 to 6779. Both the level of institutional ownership and share characteristics are standardized each quarter, that is, rescaled to have a mean of zero and a standard deviation of one. The first number in each cell reports the time-series average coefficient from the quarterly regressions. The second row in each cell reports the fraction of the regressions with a positive coefficient associated with the characteristic followed by the fraction of positive coefficients that are statistically significant [at the 5% level or better based on White's (1980) heteroscedasticity-consistent covariance estimator]. The third row in each cell reports the fraction of the regressions with a negative coefficient associated with that characteristic followed by the fraction of negative coefficients that are statistically significant. Results are reported for the entire sample period (panel A) and for two subperiods (panel B): the first quarter of 1983 through the second quarter of 1990 and the third quarter of 1990 through the fourth quarter of 1997. The last row presents the results of a Wilcoxon ranked-sum test of the null hypothesis that the coefficient estimates in the first period equal the coefficient estimates in the second period. The average R^2 for the 60 cross-sectional regressions is 51.05%. All variables are as defined in Table 2. ** indicates statistical significance at the 1% level; * indicates statistical significance at the 5% level.

better.[7] Similarly the third row reports the fraction of estimated coefficients that are negative followed by the fraction of negative coefficients that differ significantly from zero at the 5% level or better. For example, the mean standardized coefficient on beta suggests, on average, a firm with a one standard deviation greater beta would have a 3.72% standard deviation greater institutional ownership. The aggregate institutional ownership is positively related to beta in 73% of the regressions. When the coefficient is positive, it differs significantly from zero (at the 5% level or better) in 89% of the cases.

The results in panel A show that, over the entire sample period, aggregate institutional ownership is positively related to the three risk measures. The magnitude of the relation is low, however, and the positive relation is certainly not universal. Between 22% and 28% of the quarterly regressions show negative coefficients, some of which are statistically significant. Unlike the somewhat mixed results for the risk measures, the relation of the remaining measures to institutional ownership are unambiguous in their signs and significance levels. Institutional investors are attracted to larger stocks, older stocks, and, controlling for other factors, avoid high dividend yield stocks. The strong positive relations between institutional ownership and share price or turnover indicate that liquidity is an important factor in institutional investment decisions. Finally, there is a negative relation between institutional ownership and lag return.

The signs on coefficients reported in Table 3 are consistent with Falkenstein (1996) and Gompers and Metrick (2001), who interpret the negative relation between the level of institutional ownership and lag return (controlling for other factors) as evidence that institutions are not positive feedback traders. A negative coefficient associated with lag return, however, does not necessarily suggest negative feedback trading, given positive coefficients associated with size and price. In unreported results, a regression of *changes* in institutional ownership on the nine characteristics reveals a positive relation between lag return and changes in institutional ownership. Together the results suggest that institutional investors in aggregate are momentum investors — moving toward (away from) securities that have recently increased (decreased) in value. Although they move toward stocks with positive lag returns, the move is not so great that the level of institutional ownership following large returns is greater than expected given capitalization and share price. Thus in a regression of the level of institutional ownership on lag return (and the other characteristics), a negative coefficient only suggests that firms that

[7] Problems associated with cross-sectional and time-series heteroscedasticity are well documented [see, e.g., Ferson and Harvey (1999)]. To control for heteroscedasticity across firms, we use White's heteroscedasticity-consistent covariance estimates. In addition, given our concern regarding times-series heteroscedasticity, we report the fraction of cross-sectional estimates that are positive and statistically significant rather than aggregating across time.

recently became large (small) have lower (larger) levels of institutional ownership than firms that have been large (small) for some time. Although the analysis reveals institutional investors are positive feedback traders (i.e., they tend to buy stocks that have recently increased in value), the results do not necessarily suggest institutional positive feedback trading is motivated by an attraction to securities with high lag returns. Institutions may engage in momentum trading, for example, because they prefer to hold larger or higher-priced stocks.

Because the variables are standardized, we can directly compare the coefficients associated with each characteristic. Doing so, it is clear that institutional investors consider size and share price as the most important characteristics — the average coefficients associated with share price and size are more than double the absolute value of any of the other coefficients.

To examine whether preferences have changed over time, in panel B we partition the analysis into two 7.5-year periods (March 1983 through June 1990 and September 1990 through December 1997). The last row in panel B reports the results of a Wilcoxon ranked-sum test of the null hypothesis that aggregate institutional preferences (i.e., estimated standardized coefficients) are identical across the two periods. The results indicate that we can reject the null hypothesis (at the 1% level) of unchanged aggregate preferences for five of the nine characteristics, and support the hypothesis that institutional investors have become more willing to hold less conservative securities. Institutions move from a slight preference for securities with higher total risk (standard deviation) in the early period to a much stronger preference for return volatility in the more recent period. Results show not only a large shift in the magnitude of the total risk coefficient, but also a large change in the signs of the quarterly regressions and significance levels. In the early part of the sample period, 57% of the quarterly regressions exhibit a positive coefficient on standard deviation, with 29% of these coefficients statistically significant. In sharp contrast, during the second half of the sample period, 100% of the coefficients are positive and all differ significantly from zero. Similarly the percntage of positive coefficients on firm-specific risk increased from 60% to 83% across the two periods. Institutional investors also exhibit a significantly weaker preference for large capitalization securities and an increasing aversion to dividend yield in the more recent period.

This shift in preferences toward smaller, more risky firms is not indiscriminant. As they increased their preferences for smaller firms, institutional investors significantly increased their preferences for holding more liquid securities. This can be seen from an examination of the coefficients associated with our liquidity measures (price and turnover). Institutions increased their preferences for high-priced stocks, yet also decreased their attraction to turnover. Because the coefficients are standardized, we can evaluate the net effect of these changes. Institutional investors' increased preference for higher-priced stocks is much greater than their decreased preference for turnover. Thus the results suggest that, overall, institutional investors exhibit a stronger liquidity preference in the latter period.

As noted previously, the share characteristics selected for this study are largely based on those used in previous studies [e.g., Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001)]. It is possible, however, that our results are influenced by omitted risk factors, for example, Fama and French's (1993) three-factor model. To ensure that our results are not driven by the exclusion of such factors, we repeat the analysis but add, for each firm, three additional "characteristics:" firm sensitivities to size (SMB), value (HML), and momentum (UMD) factor-mimicking portfolios.[8] Although results are not reported (to conserve space), the results remain qualitatively identical — institutional investors have moved toward smaller, riskier stocks over time.

3. Understanding Changes in Aggregate Institutional Preferences

One possible explanation for the shift in aggregate institutional preferences toward less conservative securities is that more conservative types of institutional investors (e.g., bank trust departments) have become relatively less important over time while less conservative types (e.g., mutual funds) have become more important. Alternatively, changes in aggregate preferences may have resulted from changes in the preferences of each type of institutional investor. We examine these two explanations in a four-step process. First, we document heterogeneity in preferences across different types of institutional investors. (Absent heterogeneity, changes in relative importance would be irrelevant.) Second, we test whether the relative importance of each institutional investor class changes over time. Third, we test whether each institutional investor type's preferences change over time. Last, we estimate a variance decomposition to partition the time-series variance in aggregate preferences into the portion due to changes in the relative importance of each class and the portion due to changes in the preferences of each class.

3.1 Preference heterogeneity across types of institutions

Because aggregate institutional ownership is a linear combination of ownership by each type of institutional investor, we can express the standardized coefficients from a cross-sectional regression of aggregate

[8] Factor sensitivities are estimated quarterly by regressing monthly stock returns on the size (SMB), value (HML), and momentum (UMD) factor-mimicking portfolio returns over the previous 24 to 60 months (depending on data availability). We thank Ken French for providing the data on the factors.

institutional ownership on the share characteristics as a function of the coefficients from the regressions for each type of investor. Specifically the coefficient associated with characteristic *j* from the regression of aggregate institutional ownership on the nine share characteristics can be written as

$$\beta_{total,j} = \frac{s_{indep}}{s_{total}}\beta_{indep,\,j} + \frac{s_{banks}}{s_{total}}\beta_{banks,\,j} + \frac{s_{mf}}{s_{total}}\beta_{mf,\,j} + \frac{s_{ins}}{s_{total}}\beta_{ins,\,j} + \frac{s_{unclassified}}{s_{total}}\beta_{unclassified,\,j}, \qquad (3)$$

where $\beta_{total,j}$ is the standardized regression coefficient associated with characteristic j and aggregate institutional ownership and s_{total} is the cross-sectional standard deviation of aggregate institutional ownership.[9] Similarly $\beta_{banks,j}$ and s_{banks} are the standardized coefficient and cross-sectional standard deviations, respectively, for bank trust ownership. The other variables are likewise defined for each of the other institutional classifications. Equation (3) demonstrates that aggregate preferences are a function of each type of institutional investor's preferences (e.g., $\beta_{banks,j}$) and the impact of that type's preferences on aggregate preferences (e.g., s_{banks}/s_{total}).

In general, an increase in ownership by an institutional investor class will increase the investor class' preference impact. For example, a doubling of mutual funds' current portfolio would result in a doubling of their standard deviation (s_{mf}), but not change their standardized coefficient (β_{mf}). Such a change would impact aggregate preferences, however, because mutual fund preferences would account for a larger portion of aggregate preferences.[10]

Each quarter, we estimate multivariate cross-sectional standardized regressions of ownership by each class of institutional investor on the nine share characteristics. The format of each cell in Table 4 is identical to that of Table 3. The last column in Table 4 reports the average *p*-value from the *F*-statistic associated with the hypothesis that each of the investor types exhibit homogeneous preferences for that characteristic, that is, the estimated standardized coefficients are the same for each type of

[9] Because covariances are linear in the arguments and total institutional ownership is the sum of the ownership by each type of investor, the sum of coefficients based on raw (nonstandardized) data for each investor type equals the coefficient based on aggregate institutional ownership (i.e., $b_{total} = b_{banks} + \cdots + b_{other}$). In addition, the raw coefficient can be written as a function of the standardized coefficient (e.g., $b_{banks} = \beta_{banks} * s_{banks}/s_j$). Substituting the latter into the former and rearranging terms yields Equation (3).

[10] A doubling of mutual fund ownership would cause the cross-sectional standard deviation of mutual fund ownership to double. Mutual funds' preference impact (s_{mf}/s_{total}) would not double because a doubling of mutual fund ownership would also increase the cross-sectional standard deviation of total institutional ownership. Because changes in ownership are less than perfectly positively correlated across institutional investor classes, the change in the cross-sectional standard deviation of total institutional ownership would be smaller than the change in the cross-sectional standard deviation in mutual fund ownership, yielding an increase in mutual funds' "preference impact."

Table 4
Regressions of standardized ownership by institutional classification on standardized share characteristics

	Independent investment advisors	Bank trust departments	Mutual funds	Insurance companies	Unclassified	Average p-value
Beta	0.0615	−0.0029	0.0196	0.0023	0.0041	0.1203
	(0.82/0.84)	(0.38/0.49)	(0.82/0.59)	(0.57/0.53)	(0.55/0.55)	(0.65)
	(0.18/0.45)	(0.62/0.38)	(0.18/0.82)	(0.43/0.46)	(0.45/0.19)	
Standard deviation	0.0800	−0.0103	0.0749	0.0367	0.0349	0.1101
	(0.95/0.65)	(0.53/0.34)	(0.88/0.64)	(0.85/0.55)	(0.85/0.67)	(0.68)
	(0.05/0.00)	(0.47/0.64)	(0.12/0.00)	(0.15/0.11)	(0.15/0.11)	
Firm-specific risk	−0.0269	0.0505	0.0066	0.0160	0.0234	0.0281
	(0.07/0.25)	(1.00/0.97)	(0.70/0.12)	(0.82/0.57)	(1.00/0.65)	(0.82)
	(0.93/0.63)	(0.00/.)	(0.30/0.00)	(0.18/0.18)	(0.00/.)	
Size	0.2356	0.3546	0.2842	0.3569	0.3925	0.0019
	(1.00/1.00)	(1.00/1.00)	(1.00/1.00)	(1.00/1.00)	(1.00/1.00)	(0.98)
	(0.00/.)	(0.00/.)	(0.00/.)	(0.00/.)	(0.00/.)	
Age	0.0675	0.1282	0.0246	0.0630	0.0600	0.0562
	(0.98/0.92)	(1.00/1.00)	(0.83/0.72)	(1.00/0.90)	(1.00/0.90)	(0.85)
	(0.02/0.00)	(0.00/.)	(0.17/1.00)	(0.00/.)	(0.00/.)	
Dividend yield	−0.1069	−0.0357	−0.0497	−0.0327	−0.0460	0.0125
	(0.00/.)	(0.05/0.00)	(0.05/0.00)	(0.05/0.00)	(0.00/.)	(0.97)
	(1.00/1.00)	(0.95/0.68)	(0.95/0.68)	(0.95/0.74)	(1.00/0.92)	
Price	0.3305	0.2010	0.2020	0.0274	0.0224	0.0001
	(1.00/1.00)	(1.00/1.00)	(1.00/0.93)	(0.62/0.49)	(0.53/0.56)	(1.00)
	(0.00/.)	(0.00/.)	(0.00/.)	(0.38/0.00)	(0.47/0.07)	
Turnover	0.1832	0.0054	0.1189	0.0456	0.0339	0.0001
	(1.00/1.00)	(0.50/0.33)	(1.00/1.00)	(0.95/0.61)	(0.90/0.67)	(1.00)
	(0.00/.)	(0.50/0.20)	(0.00/.)	(0.05/0.00)	(0.10/0.33)	
Lag return	−0.0821	−0.0677	−0.0569	−0.0526	−0.0693	0.1178
	(0.00/.)	(0.00/.)	(0.02/0.00)	(0.00/.)	(0.00/.)	(0.65)
	(1.00/0.95)	(1.00/1.00)	(0.98/0.92)	(1.00/0.95)	(1.00/0.92)	
Average R^2	34.77%	31.89%	22.15%	15.19%	16.98%	

Each quarter between March 1983 and December 1997 we estimate cross-sectional regressions of fractional institutional ownership (for each class of institutional investor) on nine share characteristics. The number of securities in each cross-sectional regression ranges from 4345 to 6779. Both the institutional ownership measures and share characteristics are standardized each quarter, that is, rescaled to have a mean of zero and a standard deviation of one. The first number in each cell reports the time-series average coefficient from the 60 quarterly regressions. The second row in each cell reports the fraction of the 60 regressions with a positive coefficient associated with the characteristic followed by the fraction of positive coefficients that are statistically significant [at the 5% level or better based on White's (1980) heteroscedasticity-consistent covariance estimator]. The third row in each cell reports the fraction of the 60 regressions with a negative coefficient associated with that characteristic followed by the fraction of negative coefficients that are statistically significant. The average R^2 from the 60 regressions are reported in the last row. Each quarter, we also compute an F-statistic associated with a likelihood ratio test of the hypothesis that the coefficients associated with that characteristic are equal for independent investment advisors, bank trust departments, mutual funds, insurance companies, and unclassified institutional investors. The mean p-value associated with these F-statistics is reported in the last column. The last column also reports (in parentheses) the fraction of the F-statistics that are statistically significant at the 5% level or better. All variables are as defined in Table 2.

institutional investor.[11] The second line in the last column reports the fraction of the F-statistics that have p-values less than 5%.

The results in Table 4 reveal that although different types of institutional investors tend to be attracted to the same characteristics (i.e., the signs tend to be the same across columns), there is substantial heterogeneity in their preferences (i.e., magnitudes differ). For example, on average, a one standard deviation greater share price is associated with a 3% standard deviation greater holding by insurance companies, but a 33% standard deviation greater holding by independent investment advisors. For every characteristic considered, in at least 65% of the 60 quarterly cross-sectional regressions we reject (at the 5% level) the hypothesis that different types of institutional investors exhibit homogeneous preferences.[12]

Independent investment advisors and mutual funds appear to be the least conservative institutions — exhibiting the highest average preferences for return standard deviation and beta, and the weakest preferences for capitalization. As shown in Figure 1, these two investor types account for much of the growth in aggregate institutional ownership over our sample period. Consistent with Del Guercio (1996), we find that bank trust departments have much more conservative preferences. Specifically banks have, on average, negative coefficients associated with both beta and standard deviation and among the strongest preferences for large stocks and older stocks.

3.2 Tests for changes in the impact and preferences of each class

Changes in aggregate preferences could be due either to changes in the preferences of one or more classes of institutional investors or to changes in the relative importance (i.e., preference impact) of different types of institutional investors. In this section we examine time variation in preference impacts and preferences for each type of institutional investor.

To formally examine the hypothesis that the relative importance of different classes of institutional investors has changed over time, each quarter we compute the preference impact of each class ($k = 1$ to 5) of institutional investor (i.e., the ratio of the cross-sectional standard deviation of ownership by that investor class to the cross-sectional standard deviation of aggregate institutional ownership, s_k/s_{total}). We then partition these quarterly estimates into the two 7.5-year periods used previously.

[11] Because we use the same set of independent variables and ownership by different types of institutional investors is positively cross-correlated, we estimate a multivariate regression (i.e., multiple *dependent* variables) that allows us to compute an F-statistic from a likelihood ratio test (Wilk's lambda) that accounts for residual correlation between the different investor types. See Jobson (1992) for a complete discussion of the multivariate regression model.

[12] As a robustness check, we repeat the analysis including sensitivities to size, value, and momentum factor-mimicking portfolios (see Section 2.2). Results remain qualitatively identical (specific results are not reported to conserve space).

The first column in Table 5 reports each period's mean preference impact for each institutional investor class as well as the results of a Wilcoxon ranked-sum test of the null hypothesis that the two periods' mean preference impacts are identical.

Consistent with the implications of Figure 1, the results in the first column of Table 5 show that all five classes of institutions experience statistically significant shifts in importance over the two subperiods. The relative importance of bank trust departments, insurance companies, and unclassified institutional investors declines over time, whereas the impact of mutual funds and independent investment advisors increases over time.

The evidence in the first column of Table 5 is consistent with the explanation that changes in aggregate institutional preferences are due to a decline in the relative impact of more conservative investors and a corresponding increase in the role of less conservative investors. This does not rule out, however, the competing explanation that shifts in aggregate preferences might be due to shifts in preferences of the various types of institutional investors, independent of any changes in their relative importance. The remaining columns in Table 5 report the time-series mean standardized coefficient for each characteristic over each sample subperiod by institutional classification. As before, the results of Wilcoxon ranked-sum tests that coefficient estimates in the first period equal those in the second period are reported in the third row of each panel.

The results clearly support the hypothesis that shifts in aggregate preferences are at least partially due to shifts in the preferences of each investor class. In the more recent period, all institutional investors exhibit stronger preferences for return standard deviation (the z-statistics are statistically significant at the 1% level for each class), and all investors other than independent investment advisors significantly increased their preferences for firm-specific risk. Similarly most types of institutions exhibit weaker preferences for capitalization and a stronger avoidance of high dividend yield securities in the second period. We also find uniformly stronger preferences for share price in the more recent period (z-statistics are statistically significant at the 1% level for each class). Alternatively, most institutional investors appear less attracted to turnover. Overall, the results suggest that most investor classes have moved toward smaller, riskier stocks over time.

3.3 The role of changing preferences and changing preference impacts

Table 5 shows that both changes in each investor classes' preferences and preference impacts help explain the changes in aggregate institutional preferences. We determine the relative contribution of each by decomposing the time-series variance in aggregate preferences. We begin the analysis by estimating the contribution made by each class of institutional investor to changes in aggregate preferences. We then decompose each

Table 5
Tests for changes in preferences and preference impact over time by investor class

	Preference impact	Beta	Standard deviation	Firm-specific risk	Size	Age	Dividend yield	Price	Turnover	Lag return
Panel A: Independent investment advisors										
831–902 ($n=30$)	0.5118	0.0720	0.0290	−0.0206	0.2852	0.0615	−0.0871	0.2797	0.2049	−0.0923
903–974 ($n=30$)	0.5524	0.0509	0.1311	−0.0331	0.1860	0.0735	−0.1268	0.3812	0.1616	−0.0719
z-statistic	3.41**	−1.43	6.02**	−1.29	−5.52**	1.43	−3.98**	6.51**	−3.91**	2.14*
Panel B: Bank trust departments										
831–902 ($n=30$)	0.3805	−0.0012	−0.0435	0.0369	0.4127	0.1006	−0.0200	0.1448	0.0167	−0.0653
903–974 ($n=30$)	0.2810	−0.0046	0.0229	0.0642	0.2965	0.1557	−0.0513	0.2573	−0.0058	−0.0701
z-statistic	−6.56**	−0.41	5.06**	5.58**	−6.19**	4.24**	−5.30**	5.74**	−3.79**	−1.10
Panel C: Mutual funds										
831–902 ($n=30$)	0.1513	0.0238	0.0173	0.0018	0.2624	0.0391	−0.0437	0.1318	0.1141	−0.0557
903–974 ($n=30$)	0.2529	0.0154	0.1326	0.0115	0.3058	0.0101	−0.0557	0.2723	0.1238	−0.0580
z-statistic	5.97**	−0.26	6.44**	2.96**	1.69	−1.66	−0.85	6.54**	1.60	−0.21
Panel D: Insurance companies										
831–902 ($n=30$)	0.1956	0.0023	0.0116	0.0018	0.3531	0.0667	−0.0268	−0.0105	0.0696	−0.0546
903–974 ($n=30$)	0.1708	0.0023	0.0618	0.0303	0.3608	0.0594	−0.0385	0.0653	0.0216	−0.0507
z-statistic	−4.77**	0.07	5.69**	5.82**	1.13	−1.25	−2.79**	5.70**	−4.95**	0.67
Panel E: Unclassified institutional investors										
831–902 ($n=30$)	0.1918	−0.0020	0.0197	0.0159	0.4234	0.0472	−0.0433	−0.0236	0.0258	−0.0589
903–974 ($n=30$)	0.1473	0.0103	0.0502	0.0308	0.3615	0.0728	−0.0488	0.0685	0.0421	−0.0796
z-statistic	−5.57**	2.68**	3.51**	4.22**	−3.64**	3.36**	−1.91	5.43**	1.77	−2.91**

Each quarter between March 1983 and December 1997 we compute the "preference impact" of each institutional investor class as the ratio of the cross-sectional standard deviation of holdings by that investor class to the cross-sectional standard deviation of aggregate institutional holdings. We then report the mean preference impact of each institutional investor class for two subperiods: The first quarter of 1983 through the second quarter of 1990 and the third quarter of 1990 through the fourth quarter of 1997. These averages are reported in the first column. We also present the results of a Wilcoxon ranked-sum test of the null hypothesis that the preference impacts in the first period equal the preference impacts in the second period. In addition, we estimate quarterly cross-sectional regressions of institutional ownership for each institutional investor class on nine share characteristics. Both the institutional ownership measures and share characteristics are standardized each quarter, that is, rescaled to have a mean of zero and a standard deviation of one. We report the mean coefficient for each institutional investor class for the two subperiods as well as the results of a Wilcoxon ranked-sum test of the null hypothesis that the coefficient estimates in the first period equal the coefficient estimates in the second period. All variables are as defined in Table 2. ** indicates statistical significance at the 1% level; * indicates statistical significance at the 5% level.

contribution into the portion due to changes in preference impacts and the portion due to changes in preferences.

The time-series variance in aggregate preferences can be written as (we denote cross-sectional standard deviation as "*s*" and time-series standard deviation as "σ")

$$\sigma^2(\beta_{total}) = \sum_{k=1}^{5} \sigma^2\left(\frac{s_k}{s_{total}}\beta_k\right) + \sum_{k=1}^{5}\sum_{m=1,m\neq k}^{5} cov\left(\frac{s_k}{s_{total}}\beta_k, \frac{s_m}{s_{total}}\beta_m\right). \quad (4)$$

Therefore we can directly measure the percentage contribution each class of institutional investor makes to time-series variation in aggregate preferences by restricting the right-hand side of Equation (4) to a single investor class and dividing by the time-series variance in aggregate preferences:

$$\%\ of\ \sigma^2(\beta_{total})\ due\ to\ class\ k = \frac{\sigma^2\left(\frac{s_k}{s_{total}}\beta_k\right) + \sum_{m=1}^{4} cov\left(\frac{s_k}{s_{total}}\beta_k, \frac{s_m}{s_{total}}\beta_m\right)}{\sigma^2(\beta_{total})}. \quad (5)$$

The first row in each panel of Table 6 reports the contribution made by that type of institutional investor to the time-series variation in aggregate preferences for each characteristic [i.e., Equation (5)]. Although each type of institution's relative contributions tend to correspond closely to the relative fractional ownerships reported in Table 1, there is some variation across the characteristics.

We next examine the relative importance of changes in preference impacts versus changes in preferences in explaining time-series changes in aggregate preferences. Specifically, for each characteristic and investor class, we estimate the importance of the components of Equation (3), for example, changes in s_{banks}/s_{total} versus changes in β_{banks}. Because the contribution made by a specific investor class to aggregate preferences is the product of their own preference impact and their own preferences [e.g., $(s_{banks}/s_{total}) * \beta_{banks}$], the time-series variance in aggregate preferences is not a linear function of their preference impacts and preferences. Thus, following the methods of Ferson and Harvey (1991), we estimate the relative importance of each by assuming the other is a constant. Specifically, for a given characteristic, we estimate the fraction of time-series variance in aggregate preferences attributed to changes in the preference impact of institutional investor type k by

$$\%\ of\ \sigma^2(\beta_{total})\ due\ to\ \Delta impact_k = \frac{E(\beta_k)\sigma^2\left(\frac{s_k}{s_{total}}\right) + E(\beta_k)\sum_{m=1}^{4} E(\beta_m) cov\left(\frac{s_k}{s_{total}}, \frac{s_m}{s_{total}}\right)}{\sigma^2(\beta_{total})}, \quad (6)$$

Table 6
Explaining time-series variation in aggregate preferences

	Beta	Standard deviation	Firm-specific risk	Size	Age	Dividend yield	Price	Turnover	Lag return	Average
Panel A: Independent investment advisors										
Total	0.6475	0.4390	0.4935	0.2845	0.4162	0.6021	0.4031	0.8397	0.6048	0.5256
Preferences	0.5932	0.3766	0.4328	0.3623	0.3499	0.6122	0.2834	0.8706	0.6003	0.4979
Impact	0.0033	0.0019	0.0162	−0.0220	−0.0053	0.0100	0.0103	0.0748	−0.0019	0.0097
Interaction	0.0511	0.0606	0.0444	−0.0557	0.0716	−0.0202	0.1093	−0.1056	0.0063	0.0180
Panel B: Bank trust departments										
Total	0.1298	0.1791	0.2187	0.5664	0.2753	0.1302	0.1526	0.1555	0.1123	0.2133
Preferences	0.1255	0.1380	0.2228	0.2729	0.2907	0.1546	0.2261	0.1765	0.1017	0.1899
Impact	0.0002	0.0006	0.0510	0.0644	0.0324	−0.0032	−0.0096	−0.0042	0.0088	0.0156
Interaction	0.0040	0.0405	−0.0552	0.2292	−0.0478	−0.0213	−0.0639	−0.0168	0.0018	0.0078
Panel C: Mutual funds										
Total	0.0955	0.2784	0.0692	−0.0378	0.1481	0.1685	0.2675	−0.1237	0.1364	0.1113
Preferences	0.0796	0.1607	0.1011	0.0668	0.0855	0.1294	0.1579	0.0594	0.1402	0.1089
Impact	0.0008	0.0042	−0.0047	−0.0423	−0.0068	0.0004	0.0071	0.0757	−0.0093	0.0028
Interaction	0.0150	0.1135	−0.0272	−0.0623	0.0695	0.0387	0.1026	−0.2588	0.0055	−0.0004
Panel D: Insurance companies										
Total	0.0865	0.0691	0.1198	0.0652	0.0717	0.0624	0.0768	0.0377	0.0779	0.0741
Preferences	0.0830	0.0664	0.1480	0.0459	0.0529	0.0732	0.0734	0.1121	0.0811	0.0818
Impact	0.0000	−0.0004	0.0031	0.0172	0.0043	−0.0002	−0.0003	−0.0070	0.0024	0.0021
Interaction	0.0035	0.0031	−0.0314	0.0021	0.0145	−0.0106	0.0037	−0.0674	−0.0056	−0.0098
Panel E: Unclassified										
Total	0.0408	0.0344	0.0989	0.1216	0.0887	0.0368	0.0999	0.0907	0.0686	0.0756
Preferences	0.0369	0.0346	0.1030	0.0303	0.0796	0.0453	0.0880	0.0229	0.0630	0.0560
Impact	−0.0001	−0.0010	0.0119	0.0410	0.0082	−0.0015	−0.0005	−0.0128	0.0059	0.0057
Interaction	0.0040	0.0008	−0.0159	0.0504	0.0009	−0.0070	0.0125	0.0806	−0.0004	0.0140

Table 6
Continued

	Beta	Standard deviation	Firm-specific risk	Size	Age	Dividend yield	Price	Turnover	Lag return	Average
Panel F: **Aggregate**										
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Preferences	0.9182	0.7763	1.0077	0.7781	0.8586	1.0147	0.8289	1.2415	0.9864	0.9345
Impact	0.0041	0.0052	0.0776	0.0583	0.0328	0.0057	0.0069	0.1264	0.0060	0.0359
Interaction	0.0777	0.2185	−0.0852	0.1636	0.1087	−0.0204	0.1641	−0.3679	0.0076	0.0296

Each quarter between March 1983 and December 1997 we compute the “preference impact” for each institutional investor class as the ratio of the cross-sectional standard deviation of ownership by that institutional investor class to the cross-sectional standard deviation of aggregate institutional ownership. We also compute the “preferences” as the standardized regression coefficients from quarterly cross-sectional regressions of fractional institutional ownership (overall and for each class of institutional investor) on nine share characteristics. Because aggregate preferences can be written as a linear function of the product of each investor classes’ preference impacts and preferences, we can directly estimate the fraction of time-series variation in aggregate preferences attributed to each institutional investor class. These estimates are reported in the first row of panels A through E. In addition, by assuming preference impacts (preferences) are constant, we can estimate the fraction of time-series variance in aggregate preferences attributed to changes in preferences (preference impacts). These estimates are reported in the second and third row of each panel. The remaining time-series variation in aggregate preferences is attributed to the interaction between preferences and preference impacts and is reported in the last row of each panel. All variables are as defined in Table 2.

where $\sigma^2(\beta_{total})$ and $\sigma^2(s_k/s_{total})$ are the time-series variance in the aggregate preference and institutional investor class k's preference impact, respectively. $E(\beta_k)$ and $E(\beta_m)$ are the time-series mean preferences for institutional investor class k and m ($m = 1$ to 4), respectively. The time-series covariances of preference impacts between institutional investor class k and the other four institutional investor types are given by the last term in the numerator.

Analogously, for a given characteristic, the importance of changing preferences by each class of institutional investor is estimated by holding preference impacts constant (where terms are analogously defined):

$$\% \text{ of } \sigma^2(\beta_{total}) \text{ due to } \Delta pref._k = \frac{E\left(\frac{s_k}{s_{total}}\right)\sigma^2(\beta_k) + E\left(\frac{s_k}{s_{total}}\right)\sum_{m=1}^{4} E\left(\frac{s_m}{s_{total}}\right) cov\left(\beta_k, \beta_m\right)}{\sigma^2(\beta_{total})}. \quad (7)$$

The balance of the time-series variation in aggregate preferences attributed to investor class k results from the interaction of preferences and preference impacts and is estimated as the difference between the time-series variance in the aggregate preference attributed to investor class k and sum of the portions due to changing preference impacts and changing preferences.

The estimates resulting from Equations (6) and (7) and the interaction effects for each institutional investor class are reported in the second, third, and fourth row, respectively, of panels A through E in Table 6. The relative importance of preferences and preference impacts, in aggregate, are found in panel F, and are determined by summing the figures in panels A through E. The results yield a striking pattern — changes in preferences have a much greater effect on aggregate preferences than changes in preference impacts. The last column in panel F reports that, on average, changing preference impacts account for only 4% of the time-series variation in aggregate preferences, while changing preferences by each class of institutional investor account for 93% (a similar pattern also holds for each investor class).[13] In sum, the results in Table 6 reveal that changing institutional preferences, and not changes in the relative importance of different classes of institutional investors, are primarily responsible for changes in aggregate institutional preferences.

[13] Although the time-series variance and covariance of changing preference impacts is the same for each characteristic [e.g., $\sigma^2(s_k/s_{total})$ in Equation (6) is the same for each characteristic], the importance of changing preference impacts differs across the characteristics because the mean preference vectors [e.g., $E(\beta_k)$] differ across characteristics.

4. The Impact on Turnover and Volatility

4.1 Dynamic preferences and small stock liquidity

The strong growth in institutional ownership shown in Figure 1 and by Gompers and Metrick (2001), coupled with Schwartz and Shapiro's (1992) evidence that institutional investors account for 50% of security ownership but 70% of trading volume, suggests that market trading volumes should have increased commensurately with the increase in institutional ownership. In fact, Chordia, Roll, and Subrahmanyam (2001) document such growth in share turnover. In this section we test whether growth in institutional ownership leads to growth in a firm's trading volume and whether the shift in institutional preferences causes smaller stocks to exhibit the greatest share turnover growth.

We begin by testing the hypothesis that an increase in institutional ownership increases share turnover by adapting the methodology used by Gompers and Metrick (2001) to investigate relations between share and ownership characteristics and subsequent returns. Specifically we regress next quarter's turnover on this quarter's values of our nine security characteristics and the change in institutional ownership over this quarter to test the hypothesis that changes in institutional ownership help explain cross-sectional variation in subsequent turnover after accounting for security characteristics:

$$Turnover_{i,t+1} = \sum_{j=1}^{9} \beta_{j,t} X_{i,j,t} + \beta_{10,t} \Delta\% \; Total_{i,t} + \varepsilon_{i,t}, \tag{8}$$

where for firm i, $Turnover_{i,t+1}$ is the standardized share turnover in the subsequent quarter $(t+1)$, $\Delta\% Total_{i,t}$ is the standardized change in the fraction of shares held by institutional investors over quarter t, and $X_{i,j,t}$ is the standardized value of characteristic j at the end of quarter t. Recall that one of these characteristics is the turnover in quarter t. Thus the regression examines whether cross-sectional variation in changes in institutional ownership explains cross-sectional variation in subsequent turnover, controlling for the firm's existing turnover and the other eight security characteristics. If institutions contribute to the observed increase in turnover, then changes in institutional ownership should be positively related to subsequent turnover. The time-series average coefficients from the 59 quarterly cross-sectional regressions and associated t-statistics (computed from time-series standard errors) are reported in the first column of panel A in Table 7. Consistent with the hypothesis that institutional investors contribute to the growth in market volume, we find that changes in institutional ownership forecast higher turnover.

Table 7
Institutional ownership, turnover, and firm-specific risk

Panel A: Regression results

Independent variables	Turnover_{t+1}	$\text{Firm-specific risk}_{t+1}$
Beta	0.0139	−0.0060
	(4.64)**	(−1.42)
Standard deviation	0.0763	0.0389
	(19.07)**	(6.36)**
Firm-specific risk	−0.0244	0.6118
	(−6.61)**	(40.11)**
Size	0.0461	0.0004
	(10.90)**	(0.13)
Age	−0.0309	−0.0068
	(−12.66)**	(−3.18)**
Dividend yield	−0.0124	−0.0077
	(−6.40)**	(−4.07)**
Price	0.0316	−0.1270
	(6.64)**	(−17.47)**
Turnover	0.7444	−0.0111
	(150.05)**	(−3.43)**
Lag return	−0.0107	−0.0983
	(−1.77)	(−27.21)**
Change in % total	0.0291	0.0102
	(10.47)**	(5.27)**

	Early (3/83–6/90)	Late (9/90–12/97)	z-statistic
Panel B: Turnover at small and large firms (in percent, $n = 60$ quarters)			
All firms	5.1086	7.5140	5.42**
Small firms	4.7888	7.1251	5.11**
Large firms	6.0046	7.6399	4.07**
Small/large	0.7987	0.9318	4.47**
Panel C: Firm-specific risk at small and large firms (in percent, $n = 60$ quarters)			
All firms	2.9099	4.8550	6.11**
Small firm	3.5603	6.3367	6.22**
Large firms	0.6456	0.7922	4.59**
Small/large	5.9723	8.2656	3.81**

Each quarter between June 1983 and December 1997 we estimate cross-sectional regressions of turnover in quarter $t+1$ on nine security characteristics in quarter t and the change in the fraction of shares held by institutional investors over quarter t. Both the independent and dependent variables are standardized each quarter, that is, rescaled to zero mean, unit variance. The first column in panel A reports the time-series average coefficient from these 59 cross-sectional regressions and associated t-statistics (computed from time-series standard errors). The second column in panel A reports the results of a similar analysis of firm-specific risk. We also compute the cross-sectional average turnover and firm-specific risk for all firms, small firms (bottom third of NYSE capitalization) and large firms (top third of NYSE capitalization) each quarter. In addition, we compute, each quarter, the ratio of the cross-sectional average small firm turnover (firm-specific risk) to the cross-sectional average large firm turnover (firm-specific risk). Panels B and C reports the time-series average of the quarterly cross-sectional averages over the early period (March 1983–June 1990) and the late period (September 1990–December 1997) for each group for turnover and firm-specific risk, respectively. The last column in panels B and C report the results of a Wilcoxon ranked-sum test of the null hypothesis that values in the early period do not differ from the values in the late period. All variables are as defined in Table 2. ** indicates statistical significance at the 1% level; * indicates statistical significance at the 5% level.

If institutions are partially responsible for the increase in turnover across all stocks, then the shift in institutional preferences toward smaller firms suggests that these firms should experience disproportionate turnover growth. To test this hypothesis, we compute the cross-sectional average turnover for (1) all firms, (2) small firms (bottom third in equity capitalization), and (3) large firms (top third in equity capitalization), each quarter.[14] The time-series averages of these quarterly cross-sectional averages are reported for the early (January 1983–June 1990) and late (September 1990–December 1997) periods in the first three rows of panel B in Table 7. The last row in panel B reports the time-series average ratio of small-firm turnover to large-firm turnover. The last column in panel B reports a z-statistic from a Wilcoxon ranked-sum test of the null hypothesis that the values in the early period do not differ from the values in the late period.

We document a significant increase in average turnover for all firms, small firms, and large firms. Moreover, consistent with the hypothesis that the shift in institutional preferences resulted in small stocks experiencing the greatest liquidity growth, the ratio of average small-firm turnover to average large-firm turnover increases over time (statistically significant at the 1% level).

4.2 Dynamic preferences and small stock firm-specific risk

Campbell et al. (2001) document an increase in firm-specific risk over the past few decades and suggest the increased institutionalization of markets as a possible explanation. Institutional investors may be responsible for increases in firm-specific risk for several reasons. First, institutional investors tend to have larger trade sizes than individual investors, which can lead to greater price changes. Second, Roll (1988) and Durnev et al. (2001) note that greater levels of informed trading will cause greater firm-specific volatility. If institutional investors are more likely to be informed than other investors (see Section 5.2), an increase in institutional ownership will increase firm-specific volatility. Third, Malkiel and Xu (2000) argue that institutions may be more likely to trade in the same direction (i.e., herd), thereby inducing greater volatilities among favored firms [see Sias (2003) for evidence of institutional herding]. Thus we hypothesize that the growth in firm-specific risk results, at least in part, from the growth in institutional ownership and that the shift in institutional preferences will cause smaller capitalization securities to exhibit the greatest growth in firm-specific risk.

To test whether the increase in firm-specific risk is related to increased institutionalization, we repeat the regression analysis in the previous section using firm-specific risk as the dependent variable (rather than turnover). Specifically we estimate quarterly regressions of next quarter's standardized firm-specific risk on this quarter's standardized values of

[14] Capitalization rankings are updated quarterly, based on beginning of quarter capitalization. Following Wermers (1999), we use NYSE capitalization breakpoints.

the nine security characteristics and the standardized change in the fraction of shares held by institutional investors over this quarter:

$$Firm\text{-}specific\ risk_{i,t+1} = \sum_{j=1}^{9} \beta_{j,t} X_{i,j,t} + \beta_{10,t} \Delta\% Total_{i,t} + \epsilon_{i,t}. \quad (9)$$

The second column of panel A in Table 7 reports the time-series average of the 59 cross-sectional regressions and associated t-statistics (computed from time-series standard errors). Supporting our hypothesis, we find that changes in institutional ownership are positively related to subsequent firm-specific risk even after controlling for current levels of firm-specific risk and the eight other security characteristics [the results are also consistent with Sias (1996)].

If institutional investors are responsible for the increase in firm-specific risk, then the shift in institutional preferences suggests smaller firms should have experienced the greatest growth in firm-specific risk. We test this hypothesis by comparing firm-specific risk for all firms, small firms, and large firms (as defined previously), as well as the ratio of the cross-sectional average firm-specific risk for small firms to the cross-sectional average firm-specific risk for large firms in the early and late periods. Results, reported in panel C of Table 7, reveal a significant increase in the average firm-specific risk for all firms, small firms, and large firms between the early and late periods. Moreover, consistent with the hypothesis that the shift in institutional preferences caused small stocks to become relatively more volatile, the ratio of average firm-specific risk at small firms to average firm-specific risk at large firms increased over time (statistically significant at the 1% level).

5. Why the Shift in Institutional Preferences?

Institutional investors may have decreased their preference for large stocks for several reasons. First, Gompers and Metrick (2001) argue that the disappearance of the small firm effect in recent years results from demand shocks associated with the strong growth in institutional ownership and institutional investors' historical preference for large capitalization securities. Thus institutional investors may have become more willing to hold smaller-capitalization securities because their own demand shocks have driven large-capitalization securities' valuations "too high." Alternatively we hypothesize that institutional investors may have shifted toward small stocks because such stocks provide the greatest opportunities for these investors to exploit their informational advantages, as increased institutionalization likely resulted in increased competition among institutional investors in the market for liquid, conservative, large-capitalization securities. Back, Cao, and Willard (2000) show that competition among informed traders will decrease expected profits to each informed trader.[15] That is, the increased institutionalization of large capitalization stocks likely resulted in fewer opportunities for institutional investors to exploit their informational advantages by trading large, safe stocks. Both are essentially "greener pastures" explanations, that is, if, ceteris paribus, institutional investors would prefer to hold larger, safer securities, small stocks must offer a relatively more attractive trade-off between risk and expected return over time to induce institutions to shift their preferences.

5.1 Large stock valuations

To examine Gompers and Metrick's hypothesis that institutional demand shocks have driven the value of large stocks too high (thus inducing the observed shift in preferences), we evaluate changes in book-to-market ratios for all firms, small firms, and large firms over the early and late periods. We begin by computing the book-to-market ratio for each firm-quarter with adequate data (CRSP capitalization and return and positive Compustat book values). To control for outliers, we use the natural logarithm of (1 + *book value*/*market value*) as our book-to-market measure. We then partition firms into three capitalization portfolios and compute the cross-sectional average of the book-to-market measure for all firms, small firms, and large firms (as defined previously). The first three rows of panel A in Table 8 report the time-series average of these cross-sectional averages for the early period (March 1983–June 1990) and the late period (September 1990–December 1997). The final row reports the time-series average of the quarterly ratio of the average small-firm book-to-market measure to average large-firm book-to-market measure. The last column reports Wilcoxon ranked-sum z-statistics associated with the null hypothesis that the values in the early period do not differ from the values in the later period.

The results reveal little evidence of changes over time in the average book-to-market measure for all firms or for small firms. Large firms, however, provide a strikingly different result. We document a statistically significant (at the 1% level) decline in the average large-firm book-to-market measure. Similarly we find a significant increase in the ratio of average small-firm to average large-firm book-to-market ratios. These results are consistent with the hypothesis that institutional preferences

[15] Recent research suggests institutional investors are better informed than other investors. See Grinblatt and Titman (1989, 1993), Daniel et al. (1997), Wermers (1999, 2000), Nofsinger and Sias (1999), Chakravarty (2000), Parrino, Sias, and Starks (2003), and Sias, Starks, and Titman (2002). Specifically, these studies reveal that securities institutional investors purchase outperform those they sell. Alternatively, many earlier studies [e.g., Gruber (1996)] find that mutual funds fail to outperform market averages. Wermers (2000) resolves these seemingly inconsistent results by attributing differences to transaction costs and the performance of nonstock holdings.

Table 8
Institutional ownership, valuation levels, and returns

Panel A: Book : market ratios at small and large firms ($n = 60$ quarters)

	Early (3/83–6/90)	Late (9/90–12/97)	z-statistic
All firms	0.5693	0.5602	−1.16
Small firms	0.5562	0.6094	0.73
Large firms	0.5223	0.4048	−5.82**
Small/large	1.1322	1.5109	6.63**

Panel B: Regression results

Independent variables	**Return$_{t+1}$**	**Return$_{t+1}$**
	0.0061	0.0063
Beta	(0.69)	(0.71)
	−0.0327	−0.0331
Standard deviation	(−2.51)*	(−2.54)*
	−0.0361	−0.0350
Firm-specific risk	(−3.34)**	(−3.26)**
	−0.0233	−0.0226
Size	(−2.47)*	(−2.38)*
	0.0129	0.0134
Age	(2.25)*	(2.33)*
	0.0074	0.0077
Dividend yield	(1.05)	(1.09)
	0.0184	0.0174
Price	(1.46)	(1.39)
	−0.0332	−0.0333
Turnover	(−3.72)**	(−3.74)**
	0.0512	0.0501
Lag return	(5.26)**	(5.19)**
	0.0191	0.0201
Beginning-of-quarter % total	(3.05)**	(3.24)**
	0.0017	
Change in % total	(0.50)	
		0.0116
Signed herding measure		(4.33)**

Each quarter, we compute the cross-sectional average book : market ratio for all firms, small firms (bottom third of NYSE capitalization), and large firms (top third of NYSE capitalization). We also compute, each quarter, the ratio of the cross-sectional average small firm book : market ratio to the cross-sectional average large firm book : market ratio. To control for outliers we define the book : market ratio as the natural logarithm of one plus the Compustat book value to CRSP market value. Panel A reports the time-series average of the quarterly cross-sectional averages over the early (March 1983–June 1990) and late periods (September 1990–December 1997) for each group. The last column in panel A reports the results of a Wilcoxon ranked-sum test of the null hypothesis that values in the early period do not differ from the values in the late period. Each quarter between June 1983 and December 1997 we estimate a cross-sectional regression of return in quarter $t+1$ on nine security characteristics in quarter t, the level of institutional ownership at the beginning of quarter t and the change in the fraction of shares held by institutional investors over quarter t. Both the independent and dependent variables are standardized each quarter, that is, rescaled to zero mean, unit variance. The first column in panel B reports the time-series average coefficients from these 59 cross-sectional regressions and associated t-statistics (computed from time-series standard errors). The second column in panel B reports the results for a similar analysis, but replaces the change in the fraction of shares held by institutional investors with the signed herding measure [the Lakonishok, Shleifer, and Vishny (1992) herding measure signed positive if the ratio of the number of institutions buying the security to the number trading the security that quarter is greater than the cross-sectional average ratio that quarter and negative if the ratio of the number of institutions buying the security to the number trading the security that quarter is less than the cross-sectional average ratio that quarter]. Firms must have at least five institutional traders to be included in the analysis. All variables are as defined in Table 2. **indicates statistical significance at the 1% level; *indicates statistical significance at the 5% level.

for small stocks have increased due to institutions, own large-firm demand shocks having driven large stock valuations to less attractive levels.

5.2 Institutional demand shocks and informed trading

Gompers and Metrick (2001) argue that if institutional demand shocks impact security returns, then cross-sectional variation in future returns should be positively related to current institutional ownership levels as a proxy for future institutional demand. Alternatively, if institutional investors can forecast returns, then cross-sectional variation in future returns will be related to *changes* in institutional ownership as a proxy for the level of informed institutional trading.[16] We employ Gompers and Metrick's methods to test for evidence of institutional demand shocks and whether institutional investors are better informed than other investors. Specifically we estimate quarterly cross-sectional regressions of next quarter's return on the nine security characteristics used in the previous sections (measured at the end of this quarter), the level of institutional ownership measured at the beginning of this quarter, and the change in institutional ownership over this quarter. To allow direct comparison across coefficients, we again standardize the dependent and independent variables. Moreover, to allow direct comparison with the next set of regressions, we include only those firms that are traded by at least five institutions during the quarter:

$$Return_{i,t+1} = \sum_{j=1}^{9} \beta_{j,t} X_{i,j,t} + \beta_{10,t} Total_{i,t-1} + \beta_{11,t} \Delta\% Total_{i,t} + \epsilon_{i,t}. \quad (10)$$

Average coefficients from the 59 cross-sectional regressions and associated t-statistics (computed from time-series standard errors) are reported in the first column of panel B in Table 8. Similar to Gompers and Metrick (2001), we find a statistically significant (at the 1% level) positive relation between institutional ownership levels and future returns, but little evidence of a substantial relation between future returns and changes in the fraction of shares held by institutional investors.

The results support the hypothesis that institutional demand shocks affect security returns, but fail to support the hypothesis that institutions are better informed than other investors. The results, however, appear to be inconsistent with Wermers (1999), who finds that future returns are related to the Lakonishok, Shleifer, and Vishny (1992) herding measure (as a proxy for the level of informed institutional trading). We next examine if our test of whether institutional investors are better informed is sensitive to the proxy for informed institutional trading.

[16] A similar implication arises from Chen, Hong, and Stein's (2002) "breadth" model. Specifically, Chen, Hong, and Stein develop a model suggesting changes in breadth (essentially the number of investors holding long positions) are related to subsequent returns.

We begin by computing the Lakonishok, Shleifer, and Vishny (1992) herding measure for each security i in quarter t as

$$H_{i,t} = |B_{i,t}/(B_{i,t} + S_{i,t}) - p_t| - AF_{i,t}, \tag{11}$$

where $B_{i,t}$ ($S_{i,t}$) is the number of institutional investors increasing (decreasing) their position in security i during quarter t. Thus $B_{i,t}/(B_{i,t} + S_{i,t})$ is the fraction of institutional investors changing their position in security i over quarter t that are buyers. The cross-sectional average of this fraction each quarter is given as p_t. The adjustment factor for security i in quarter t ($AF_{i,t}$) ensures that the expected value (under the hypothesis of no herding) of the herding measure is zero [see Lakonishok, Shleifer, and Vishny (1992) for a detailed discussion]. The "signed herding measure" (SHM) is then computed as the herding measure, signed positive (negative) if the term within absolute values is positive (negative). Following Wermers (1999), we require firms to have at least five institutional traders to be included in the analysis. We then estimate quarterly cross-sectional regressions of next quarter's standardized returns on the nine standardized security characteristics measured at the end of this quarter, the standardized level of institutional ownership measured at the beginning of this quarter, and the standardized signed herding measure computed over this quarter:

$$Return_{i,t+1} = \sum_{j=1}^{9} \beta_{j,t} X_{i,j,t} + \beta_{10,t}\%Total_{i,t-1} + \beta_{11,t} SHM_{i,t} + \epsilon_{i,t}. \tag{12}$$

Average coefficients from 59 cross-sectional regressions and associated t-statistics (computed from time-series standard errors) are reported in the second column of panel B in Table 8. As before, we document a positive relation (statistically significant at the 1% level) between institutional ownership levels and future returns, supporting the hypothesis that institutional demand shocks impact security returns. Consistent with the hypothesis that institutional investors have an informational advantage, we also document a positive relation between the SHM and future returns. In sum, the results in panel B suggest that institutional demand shocks impact returns *and* institutional investors have some forecasting ability. Evidence of their ability to forecast returns, however, is sensitive to the informed trading proxy.

5.3 Predicting small and large stock returns

We hypothesize that institutional investors may have shifted their preferences toward smaller capitalization stocks because such securities provide greater opportunities to exploit any informational advantages. To test this hypothesis, small and large securities (as defined previously) are partitioned into two groups: "buy-herding securities" (i.e., the term within absolute values is positive in Equation (11)) and "sell-herding securities" (i.e., the term within absolute value is negative in Equation (11)). Within both the small- and large-capitalization groups, both buy-herding and sell-herding securities are then sorted into five groups by the level of institutional herding, each quarter. This process results in a total of 10 portfolios each quarter within both the small and large capitalization groups.

For each of the 59 quarters, we compute a capitalization-adjusted return for each security (the firm's return less the cross-sectional average return for firms within the same capitalization group) for the two quarters prior to the herding, the quarter of the herding ($t = 0$), and each of the four quarters following the herding. We also compute the compound total capitalization-adjusted return over the subsequent four quarters. Portfolio returns are computed as the equal-weighted average of the member securities' capitalization-adjusted returns. We then compute the difference in returns for the portfolio most heavily purchased by institutional investors (i.e., the top buy-herding quintile) and the portfolio most heavily sold by institutional investors (i.e., the top sell-herding quintile), within both the large- and small-capitalization groups. Table 9 reports the time-series average of these 59 quarterly observations of these portfolio return differences for small and large firms (t-statistics are computed from time-series standard errors).

The positive values in the two quarters prior to the portfolio formation period reveal that institutional investors are positive feedback traders.[17] In addition, there is a significant positive relation between the institutional herding measure and contemporaneous returns. Consistent with the previous section, the results also suggest that institutions are better informed than other investors — securities institutional investors herd to subsequently outperform those they herd away from. Moreover, institutional investors' ability to forecast security returns arises primarily in small-capitalization securities. That is, small stocks appear to offer the most fertile ground for institutions to exploit informational advantages.[18] Wermers (1999) finds similar results for the case of mutual funds.

6. Conclusion

Although institutional investors still exhibit an overall preference for large stocks (i.e., a positive coefficient associated with capitalization), they have

[17] Grinblatt, Titman, and Wermers (1995), Wermers (1999, 2000), Nofsinger and Sias (1999), and Sias, Starks, and Titman (2002) also document evidence of institutional positive feedback trading.

[18] In unreported tests, we find that institutional investors' ability to forecast small-firm returns and inability to forecast large-firm returns exists in both the early and late periods. Contrary to our increased competition hypothesis, however, we find little evidence that institutional investors' ability to forecast small stock returns declines over time.

Table 9
Average abnormal returns for top buy-herding portfolio less top sell-herding portfolio

	Quarter –2	Quarter –1	Portfolio formation quarter	Quarter +1	Quarter +2	Quarter +3	Quarter +4	Quarters +1 to +4
	Average return from top-buy herding portfolio less average return on top sell-herding portfolio							
Small firms	8.83	11.80	13.55	2.16	1.99	0.83	−0.52	5.09
	(16.52)**	(13.33)**	(16.29)**	(2.71)**	(2.31)*	(1.00)	(−0.52)	(6.46)**
Large firms	2.99	2.53	7.17	0.80	0.12	−0.02	−0.04	1.17
	(6.88)**	(5.17)**	(11.39)**	(1.44)	(0.21)	(−0.04)	(−0.08)	(0.99)

Each quarter between March 1983 and December 1997 we compute the Lakonishok, Shleifer, and Vishny (1992) "herding measure" for each security with at least five institutional traders. Each security is then classified as either a buy herding security (the ratio of the number of institutions buying the security to the number trading the security that quarter is greater than the cross-sectional average ratio that quarter) or a sell herding security (the ratio of the number of institutions buying the security to the number trading the security that quarter is less than the cross-sectional average ratio that quarter). We then compute the average capitalization-adjusted return difference between those securities most heavily purchased by institutional investors (top buy-herding quintile) and those securities most heavily sold by institutional investors (top sell-herding quintile) for small stocks (bottom third of NYSE capitalization) and large stocks (top third of NYSE capitalization). The time-series average of these differences (and associated *t*-statistics computed from time-series standard errors) in the two quarters prior to the herding quarter, the herding quarter, and the four quarters following the herding quarter are reported above. Capitalization-adjusted returns are calculated as the difference between the firm's return and the average return for firms within the same capitalization group. **indicates statistical significance at the 1% level; *indicates statistical significance at the 5% level.

become much more willing to hold smaller, riskier stocks over the past decade. We find that the shift in aggregate preferences is primarily (93%) attributed to changes in the preferences of each group of institutional investor, with the remainder explained by changes in the relative importance of different types of institutional investors and interaction effects.

Our analysis also suggests that the growing role of institutional investors and their shifting preferences has impacted financial markets — the growth in institutional ownership helps explain why markets have become more liquid and why firm-specific risk has increased over time. Our results also suggest that the shift in institutional preferences has led to relative increases in small stocks' liquidity and firm-specific risk vis-à-vis large stocks.

Last, we consider two potential explanations for the institutional migration toward smaller securities. First, we hypothesize that institutional demand shocks combined with institutional investors' historical preference for larger-capitalization securities have driven the relative valuations of large stocks higher over time. As a result, institutional investors have moved toward "less expensive" smaller stocks. Supporting this hypothesis, we find evidence of institutional demand shocks [consistent with Gompers and Metrick (2001)] and that large stocks' book-to-market ratios have declined over time. Second, we hypothesize that increased institutionalization in large-capitalization securities and the incentive structure of institutional money management has led at least some institutions to move toward smaller securities because such securities offer greater opportunities for them to exploit informational advantages. Consistent with this hypothesis, we find evidence that institutional investors are able to forecast returns and that postherding returns of smaller securities are larger than postherding returns of larger securities. The results suggest that institutional investors' informational advantages are greatest in smaller-capitalization securities. In sum, our results suggest that the shift in preferences results from institutional investors' belief that smaller stocks offer "greener pastures."

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