

Institutional investors and the limits of arbitrage

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Abstract

This paper studies the performance and equity holdings of institutional investors from 1980–2007, providing a negative assessment of their stock-picking skill. Institutions in aggregate essentially hold the market portfolio: their returns have nearly perfect correlation with the value-weighted index, a market beta of 1.01, and a small, precisely estimated CAPM alpha of 0.08% quarterly. Institutions also show little tendency to bet on any of the main characteristics known to predict stock returns, like B/M, momentum, and accruals. Some groups of institutions have modest stock-picking ability relative to the CAPM, but their performance is almost entirely explained by the B/M and momentum effects in returns. Finally, institutions, overall or grouped by type, do not invest like Shleifer and Vishny's (1997) rational but constrained arbitrageurs.

1. Introduction

Institutional investors play a growing role in U.S. equity markets. The share of common equity held by mutual funds, hedge funds, pensions, bank trust departments, and other institutions has increased from 32% of total market value in the early 1980s to over 68% at the end of 2007, according to quarterly 13F filings compiled by Thomson Financial.

Institutions' performance has been the subject of much research. Recent studies suggest that institutions have stock-picking ability even though their returns, after costs and fees, are known to be poor (the latter result dates to at least Jensen, 1968; see, also, Malkiel, 1995; Gruber, 1996). Daniel, Grinblatt, Titman, and Wermers (1997) find that stocks held by mutual funds outperform various benchmarks, building on the results of Grinblatt and Titman (1989, 1993) and Grinblatt, Titman, and Wermers (1995). More broadly, Gompers and Metrick (2001) find that institutional ownership – the fraction of a firm's shares held by all institutions – predicts returns cross-sectionally after controlling for a variety of firm characteristics, and Cohen, Gompers, and Vuolteenaho (2002) show that institutions, as a group, exploit price momentum at the expense of individuals.¹

This paper offers new perspective on the performance of institutional investors. I provide an updated and comprehensive analysis of institutions' returns, overall and disaggregated by type, and test whether their investment decisions are constrained by the 'limits of arbitrage' discussed by Shleifer and Vishny (1997). The analysis, overall, provides a much more negative assessment of institutions' stock-picking skill than have other recent studies.

My initial tests focus on institutions in aggregate. The results in prior studies can be difficult to evaluate and compare because of the use of different return benchmarks and weighting schemes (equal weights vs. value weights vs. cross-sectional regressions). I argue that the best way to evaluate institutions' overall stock-picking skill, given holdings data, is to sum their holdings and study their aggregate returns. Doing so provides a surprisingly simple view of performance: institutions overall essentially hold the market portfolio. From 1980–2007, the aggregate institutional portfolio had a return correlation of 99.8% with the CRSP value-weighted index and a market beta of 1.01 (see also Cohen, Gompers, and Vuolteenaho, 2002). Given those facts, it should come as little surprise that institutions' abnormal returns are close to zero (before costs and fees): their CAPM and Fama-French (1993) three-factor alphas are 0.08% per

¹ Nofsinger and Sias (1999), Bennett, Sias, and Starks (2003), and Kovtunencko and Sosner (2004) also study institutional stock picking; Wermers (1999, 2000), Chen, Jegadeesh, and Wermers (2000), Chen, Hong, and Stein (2002) and Brunnermeier and Nagel (2004) provide additional evidence for mutual funds and hedge funds.

quarter and their Carhart (1997) four-factor alpha is 0.05% per quarter, all of which are estimated precisely with standard errors of 0.05–0.06%. Moreover, I show that any risk model that includes the market portfolio is likely to produce similar alphas since the residual risk of institutions' returns is so small.

Institutions' stock-picking skill appears weaker here than in prior studies because I focus directly on their returns rather than on the cross-sectional predictive power of institutional ownership (IO). In fact, I confirm that IO predicts returns in cross-sectional regressions. But I also find that institutions' stock-picking ability is reliable only for smaller stocks, which make up a tiny fraction of their holdings. For example, institutions' investment in small stocks (below the NYSE 30th percentile) outperforms a value-weighted index of those stocks by a significant 0.51% quarterly (CAPM alpha) but represents just 2% of their holdings. Institutions' investment in large stocks (above the 70th percentile) outperforms a value-weighted index by 0.02% quarterly and represents 85% of their holdings.

The near-perfect correlation between institutional and market returns is, in some ways, surprising because institutions have been found to tilt toward certain types of stocks, deviating significantly from the market portfolio. For example, Gompers and Metrick (2001) regress IO on stock characteristics and find that institutions prefer larger, older stocks with higher prices, B/M ratios, volatility, and turnover, and, controlling for the other characteristics, lower past returns (see, also, Grinblatt, Titman, and Wermers, 1995; Del Guercio, 1996; Falkenstein, 1996; Bennett, Sias, and Starks, 2003). Again, institutions' aggregate holdings provide a different and, I would argue, clearer picture. Specifically, I sort stocks into quintiles based on a variety of characteristics and compare how much institutions invest in each quintile with the quintile's weight in the market portfolio. From this perspective, institutions show little tendency to bet on any of the most common characteristics considered by the asset-pricing literature. Institutions tilt a bit toward large stocks (77% of the institutional portfolio vs. 73% of market cap) and away from low-turnover (7% institutional vs. 12% market) and low-beta (14% institutional vs. 16% market) stocks. But for sorts based on eight other characteristics – B/M, momentum, long-term returns, volatility, stock issuance, accruals, asset growth, and profitability – not a single quintile has a weight in the institutional portfolio that differs from its value weight by more than 2 percentage points, and most differ by less than one. In short, institutions don't bet, to a significant degree, on any of the main characteristics found to predict stock returns.

These findings have several implications. Most clearly, they show that institutions in aggregate do little more than hold the market portfolio, presumably generating significant costs and fees in the process. The

results also suggest that any herding by institutions (e.g., Sias, 2004) doesn't substantially affect returns, in the sense that an investor who actively mimics institutional trades or passively holds the market portfolio would earn almost identical pre-cost returns. Finally, as I explain in a moment, the results suggest that limits of arbitrage don't explain institutions' investment decisions.

My second set of tests explores the stock-picking ability of different types of institutions. Many of the classifications I consider have parallels in the mutual fund literature but haven't been analyzed in detail for institutions more generally. They are motivated by questions like: Do institutions benefit from economies of scale? Does performance persist? Does money flow to the best institutions? Does active trading help or hurt performance?

Grouping institutions first by legal type, I find that the equity portfolios of banks, insurance companies, and other institutions² have return correlations of 99.3%, 99.7%, and 99.8%, respectively, with the market index. Banks exhibit the best performance with a CAPM alpha of 0.20% and a four-factor alpha of 0.13% quarterly (t-statistics of 2.23 and 1.43, respectively), compared with alphas of 0.03–0.09% quarterly for insurance companies and other institutions.

Ranked by equity under management, the largest institutions (top quartile) have the highest correlation with the market (99.8%) and the smallest alphas (CAPM alpha of 0.09% and four-factor alpha of 0.06% quarterly). Small and medium-sized institutions earn somewhat better returns, yet still hold portfolios with greater than 99% correlation with the market. The middle two quartiles have the highest CAPM alphas of 0.24% and 0.27% quarterly (t-statistics of 2.91 and 3.17), while the smallest quartile has the highest four-factor alpha of 0.23% quarterly (t-statistic of 2.39).

Ranked by past annual returns and growth, the best-performing and fastest-growing institutions have the best CAPM alphas, largely a consequence of momentum in returns (consistent with Carhart's, 1997, results for mutual funds). The top performers hold, in aggregate, a portfolio that has a return correlation of 97.6% with the market, a CAPM alpha of 0.47% quarterly (t-statistic of 2.48), and a four-factor alpha of 0.15% quarterly (t-statistic of 0.87). The fastest-growing institutions hold a portfolio that has a return correlation of 99.2% with the market, a CAPM alpha of 0.19% quarterly (t-statistic of 1.75), and a four-factor alpha of 0.06% quarterly (t-statistic of 0.62).

² Thomson Financial's codes don't permit a finer partition. The 'other' category includes mutual funds, pensions, hedge funds, investment advisors, endowments, and all other institutions.

Ranked by annual turnover, institutions that trade the least seem to do the best, even without accounting for trading costs. Low-turnover institutions have a return correlation of 99.3% with the market portfolio, a CAPM alpha of 0.26% quarterly (t-statistic of 2.89), and a four-factor alpha of 0.18% quarterly (t-statistic of 2.11). High-turnover institutions have a return correlation of 98.5% with the market portfolio, a CAPM alpha of 0.09% quarterly (t-statistic of 0.56), and a four-factor alpha of 0.15% quarterly (t-statistic of 1.13%).

Last, grouping institutions by the types of stocks they hold, I find that institutions that tilt the most toward small, high-B/M, or high-momentum stocks have the highest CAPM alphas, with quarterly estimates of 0.24%, 0.59%, and 0.33%, respectively (only the second of these is significant, with a t-statistic of 2.46). Again, no group has a significant four-factor alpha; the largest point estimate is 0.12% quarterly for these three groups and 0.17% quarterly across all 12 size-, B/M-, and momentum-tilt quartiles.

In sum, several groups of institutions appear to have moderate stock-picking ability relative to the CAPM. The only groups that have a statistically significant four-factor alpha – taking their t-statistics in isolation, but not accounting for the fact we’ve searched across 31 groups – are the smallest and lowest-turnover institutions, with point estimates of 0.23% and 0.18% quarterly.

My final tests explore whether institutions are constrained by the ‘limits of arbitrage’ posited by Shleifer and Vishny (1997). SV argue that professional traders (i.e., institutions) may be reluctant to bet heavily on anomalies because mispricing can widen in the short run, leading to poor returns and withdrawals by their investors. This restraint, suggest SV, allows anomalies to persist in equilibrium. A testable feature of the argument is that, despite such concerns, institutions still have an incentive to hold a portfolio with the best risk-return trade-off available, in particular, one with the highest alpha per unit of idiosyncratic risk. It follows that, if, say, the B/M and momentum effects are truly exploitable, institutions should take advantage of them by holding a portfolio with a high alpha per unit of idiosyncratic risk given the opportunities presented by B/M and momentum portfolios – even if they aren’t willing to bet heavily on mispricing or deviate too much from the market portfolio.

Statistically, the test takes a simple form: I just use the institutional portfolio as an asset-pricing factor in time-series regressions, i.e., I test whether alphas are zero when B/M and momentum portfolios are regressed on the market portfolio and either institutions’ aggregate portfolio or the portfolio held by a particular type of institution. This test basically reverses the earlier tests of performance: it asks whether institutions’ returns explains the B/M and momentum effects, rather than the other way around. The logic

follows from Gibbons, Ross, and Shanken (1989). If institutions hold a portfolio with the highest alpha per unit of idiosyncratic risk, given the opportunities presented by B/M and momentum portfolios, then the institutional and market portfolios will together span the tangency portfolio and drive B/M and momentum alphas to zero. Importantly, this tests only asks whether institutions deviate efficiently from the market portfolio, not whether they deviate a lot.

The answer for institutions taken as a whole, grouped by legal type, turnover, and past annual growth, or grouped by the size and momentum of stocks they hold, is a clear ‘no.’ For each of these classifications, adding the aggregate portfolio held by each group to CAPM regressions has little impact on the B/M and momentum effects. The implication is that none of these groups, or institutions overall, tilt toward the tangency portfolio in the way suggested by SV’s limits-of-arbitrage view.

The same conclusion holds when institutions are grouped by size, past annual returns, or their ownership of value stocks, but the results are more nuanced. Portfolios held by most groups within these classifications explain neither the B/M nor momentum effects. The exceptions are: (i) portfolios held by medium-sized and value-oriented institutions partially explain the B/M effect; and (ii) the portfolio held by top-performing institutions partially explains momentum. No group seems to exploit both anomalies. The strongest results are for institutions that hold value stocks: adding their portfolio to CAPM regressions pushes up the low-B/M alpha (bottom quintile) from -0.32% to 0.06% quarterly and pushes down the high-B/M alpha (top quintile) from 1.32% to 0.54% quarterly. The t-statistic for the difference between the high- and low-B/M alphas drops from 2.61 to 1.12. Put differently, we can’t reject that value-oriented institutions as a group tilt optimally toward the tangency portfolio achievable from B/M quintiles (again, however, they do not exploit momentum).

The paper is organized as follows. Section 2 describes the data. Section 3 explores the performance and portfolio choices of institutions as a whole. Section 4 explores the performance of institutions by type. Section 5 discusses the B/M and momentum tests and relates them to Shleifer and Vishny’s (1997) limits-of-arbitrage arguments. Section 6 concludes.

2. Data

Data for this study come from four sources. Stock returns, market values, trading volume, and one-month Tbill rates come from the Center for Research in Security Prices (CRSP) monthly files. Returns on the Fama–French size, B/M, and momentum factors, SMB, HML, and UMD, come from Ken French’s website at Dartmouth College. Accounting data, including the book value of common equity, operating

accruals, and return on assets (defined precisely later) come from the Compustat annual file, supplemented with Davis, Fama, and French's (2000) hand-collected book equity data from Moody's (available on French's website). Finally, institutional stock holdings come from the CDA/Spectrum files maintained by Thomson Financial.

The CDA/Spectrum database is compiled from institutions' 13F filings with the SEC. The SEC requires large institutional investors – those that 'exercise investment discretion over \$100 million or more' in so-called 13(f) securities, including institutions that aren't SEC-registered investment advisors (such as hedge funds and foreign-based institutions) – to report their quarter-end holdings of U.S. stocks, closed-end funds, and other exchange-traded securities within 45 days after the end of the calendar quarter. The only exceptions are for small holdings below 10,000 shares and \$200,000 or in special circumstances in which the SEC grants a confidentiality waiver. Securities are listed by CUSIP number, allowing an easy merge with CRSP and Compustat.

Institutions in the 13F database can be tracked through time, and Thomson identifies each as being one of five types: (1) bank trust departments, (2) insurance companies, (3) investment companies, (4) investment advisors, and (5) other. The last three types include mutual funds, pensions, brokerage firms, hedge funds, endowments, and all other institutions. Unfortunately, the breakdown into the last three categories is somewhat arbitrary and Thomson mistakenly re-classified many institutions as 'other' beginning in the 4th quarter of 1998 (see Wharton Research Data Services' User Guide for details), a change that seems to affect categories 3, 4, and 5 the most, though not exclusively. As a partial solution to these problems, I merge those categories into a single group for any test that uses Thomson's classification. I also use Thomson's code at the end of 1997 for any institution that is in the database at that time, rather than updating it if the classification changes.

A second problem with the 13F database concerns late filers who miss the SEC's 45-day deadline. The WRDS User Guide explains that share holdings for late filers are (or may be?) adjusted for stock splits that occur after the quarter. Fortunately, fewer than 0.02% of the records in the 13F database seem to be affected after WRDS deletes duplicate entries, i.e., the record's filing and report dates are different, signaling a late filer, and a stock split was recorded on CRSP between the two dates. In these cases, I reverse Thomson's split adjustment using CRSP's share-price adjustment factors.

The nearby charts illustrate a few features of the data. The sample extends from 1980Q1–2007Q4. At the beginning of the sample, just under 500 institutions owned shares in 3,329 common stocks for which I

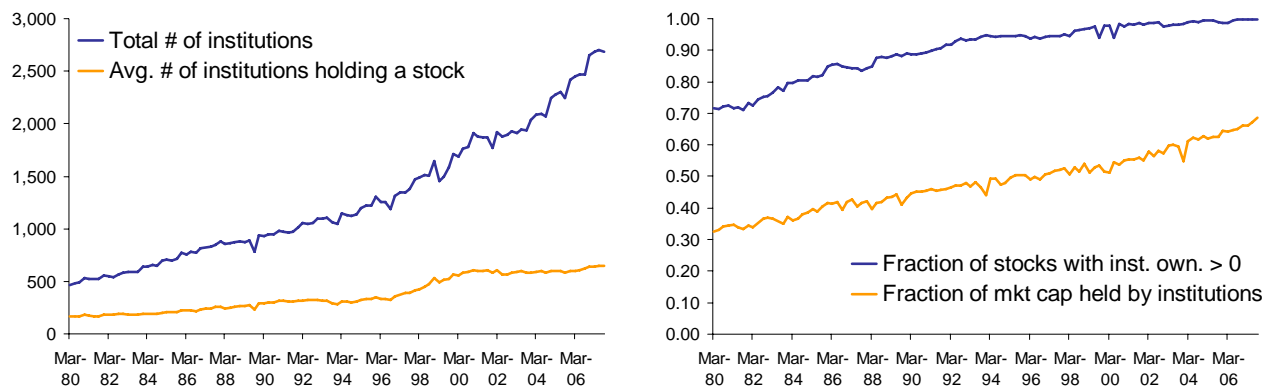


Fig. 1. Institutional ownership, 1980–2007

The figure plots quarterly statistics from the merged CRSP/institutional ownership database. The left panel shows (i) the number of institutions in the CDA/Spectrum files, and (ii) the average number of institutions holding each stock, value-weighting across common stocks on CRSP. The right panel shows (i) the fraction of stocks with positive institutional ownership, and (ii) the share of total market capitalization held, in aggregate, by institutions.

could find returns and market values on CRSP (stocks that represent 72% of firms and 99% of the total market value of common stocks on CRSP). As group, institutions in the 13F database held 32% of total market cap on March 31, 1980. The number of institutions in the database steadily increases to 2,681 by the end of 2007, by which time they hold 68% of the U.S. equity market. Nearly all stocks on CRSP, representing close to 100% of market cap, are held by at least one institution at the end of the sample. The number of institutions holding shares of an average firm (including firms with no institutional ownership) rises from 164 to 649 on a value-weighted basis and from 17 to 110 on an equal-weighted basis during the sample.

As a data check, I flag observations for which institutions, in aggregate, hold more than 100% of the shares outstanding on CRSP. These observations represent less than 1% of firms and less than 0.5% of market cap in an average quarter. In about half of those cases, the number of shares held by institutions exceeds shares outstanding by less than 5%, a scenario that is plausibly attributable to short selling rather than data error (shares owned and lent out are included in an institution’s holdings but shares borrowed and sold short are not). The issue, overall, appears to be minor and my solution is just to set the maximum ownership of institutions at 100%.

3. Institutions’ overall performance

My initial tests focus on the aggregate portfolio held collectively by all institutions. This portfolio simply sums their holdings, treating institutions as one big investor, and provides the best overall measure of

Table 1
Institutions' returns and alphas, quarterly, 1980–2007

Panel A reports average quarterly excess returns, standard deviations, and t-statistics (do expected excess returns differ from zero?) for the aggregate portfolios held by institutions and individuals and for the CRSP value-weighted index, MKT, and the Fama-French factors, SMB, HML, and UMD. Panel B reports quarterly CAPM, three-factor, and four-factor regressions for institutions' and individuals' returns (R): $R = a + b \text{ MKT} + s \text{ SMB} + h \text{ HML} + m \text{ UMD} + e$. $se(a)$ is the standard error of a , $t(a)$ is the OLS t-statistic testing whether a is zero, R^2 is the regression adjusted R^2 , and GRS F is the Gibbons-Ross-Shanken (1989) F-statistic (p-value in parentheses) testing whether the intercepts for institutions and individuals are jointly significant. The columns labeled MKT, SMB, HML, and UMD report the slope estimates on each factor. Returns come from CRSP, institutional ownership comes from Thomson Financial, and SMB, HML, and UMD come from Ken French's website.

Panel A: Excess returns (%)

	Avg	Std	t-stat
Institutions	2.18	8.33	2.76
Individuals	2.02	8.20	2.60
MKT	2.09	8.25	2.66
SMB	0.47	5.21	0.94
HML	1.15	6.35	1.91
UMD	2.44	7.14	3.60

Panel B: Regressions

	a	se(a)	t(a)	MKT	SMB	HML	UMD	R ²	GRS F
Institutions	0.08	0.05	1.56	1.01	.	.	.	1.00	1.24
Individuals	-0.05	0.05	-0.10	0.99	.	.	.	1.00	(0.29)
Institutions	0.08	0.06	1.36	1.01	-0.02	0.00	.	1.00	1.55
Individuals	-0.02	0.05	-0.48	0.99	0.00	-0.01	.	1.00	(0.22)
Institutions	0.05	0.06	0.87	1.02	-0.02	0.00	0.01	1.00	1.05
Individuals	0.00	0.05	-0.05	0.99	0.00	-0.02	-0.01	1.00	(0.35)

performance before costs and fees. Returns on the portfolio are the same as institutions' size-weighted average returns (size, here, being equity under management). I also consider the aggregate portfolio held by everyone else, referred to simply, if not quite accurately, as 'individuals.'

Table 1 reports quarterly excess returns over Tbills for institutions, individuals, the CRSP value-weighted index (MKT), and the Fama-French size, B/M, and momentum factors. Quarterly returns are compounded from monthly data; I compound each side of the strategy and then difference for long-short portfolios. The table also reports CAPM, Fama-French (1993) three-factor, and Carhart (1997) four-factor regressions for institutions and individuals.

The main message from Table 1 is that institutions as a group have returns that are slightly higher than, but almost perfectly correlated with, the value-weighted index. From 1980–2007, institutions outperform the market by 0.10% per quarter and individuals by 0.16% per quarter, without adjusting for risk.

Institutions have a CAPM beta of 1.01 and an adjusted R^2 of 1.00 rounded to two decimals (1.008 and 0.996, respectively, rounded to three). And their alphas, however measured, are economically small: institutions' CAPM and three-factor alphas are both 0.08% quarterly and their four-factor alpha is 0.05% quarterly. Institutions' load a bit negatively on SMB and a bit positively on UMD, but only the three-factor slope on SMB is borderline significant (t-statistic of -1.97).

Statistically, Table 1 provides little evidence of stock-picking skill for institutions. Their highest t-statistic is 1.56 for the CAPM and we can't reject, for any of the three regressions, that institutions and individuals perform the same or that alphas for the two groups are jointly zero (the GRS F-statistics in the table aren't significant, nor are untabulated t-statistics testing for a difference between the groups' alphas, the highest being 1.42 for the CAPM). More importantly, institutions' alphas are economically small and would be wiped out by tiny trading costs, not to mention management fees. The low standard errors also imply that the range of statistically likely true alphas is quite narrow, extending from below zero to a best-case scenario of 0.20% for any of the factor models.³

We can get a rough – almost certainly conservative – sense of institutions' turnover and trading costs from their quarterly holdings, estimating turnover using each institution's split-adjusted change in holdings during the quarter (multiplied by quarter-end share prices). Institutions buy new shares equal to 12.4% of their aggregate portfolio in an average quarter and sell shares equal to 10.5% of their aggregate portfolio, for average round-trip turnover of 11.4%. Thus, one-way trading costs of 0.25% would cut institutions' alphas by 0.06% ($.114 \times 2 \times .0025$), to 0.00–0.03% quarterly, while one-way costs of 0.50% would push all of the estimates below zero.

To be fair, I should point out that the small alphas in Table 1 shouldn't be interpreted to mean that institutions don't have any stock-picking skill. Like Gompers and Metrick (2001), the Appendix shows that institutional ownership (the fraction of a firm's shares held by institutions) has some predictive power in cross-sectional regressions, most reliably in tests that include smaller firms. But the evidence in Table 1 does imply that any skill washes out on an aggregate (or size-weighted) basis, which is the right metric for evaluating institutions' overall performance.

³ The tests in Table 1 use only common stocks to be consistent with most asset-pricing studies (as well as my later tests that use accounting data). Institutions' performance looks incrementally better if I expand the sample to all securities on CRSP: alphas increase by 0.02% quarterly for all three risk models and the CAPM alpha becomes statistically significant (t-statistic of 2.04), though it remains economically small. Also, performance is fairly stable through time but decreases at the end of the sample. From 1980–2007, 10-year rolling estimates of alphas vary from roughly 0.00% to 0.20% quarterly for all three models. They drop during the late 1990s, spike in 2000, and decline again from 2001–2007. The CAPM alpha reaches a low of 0.02% quarterly at the end of 2007 (estimated from 1997Q4–2007Q3), while the four-factor alpha reaches a low of -0.06% quarterly at the end of the 2006 (estimated from 1997Q1–2006Q4).

Table 2
Institutional performance and firm size, 1980–2007

The table reports average institutional- and value-weighted excess returns for firm-size quintiles (based on NYSE breakpoints). Returns are % quarterly. IW is a quintile’s institutional-weighted return (weighting by the institutional holdings of each stock); VW is the quintile’s value-weighted return (weighting by market cap). a_{CAPM} , a_{FF} , and a_{4Fac} are CAPM, three-factor, and four-factor alphas for IW–VW, using MKT, SMB, HML, and UMD as factors, with OLS t-statistics denoted by t(·). Returns come from CRSP, institutional ownership comes from Thomson Financial, and SMB, HML, and UMD come from Ken French’s website.

Size quintile	IW	VW	IW–VW	Alphas for IW–VW					
				a_{CAPM}	t(a_{CAPM})	a_{FF}	t(a_{FF})	a_{4Fac}	t(a_{4Fac})
Q1 (small)	2.81	2.15	0.66	0.57	2.89	0.29	1.48	0.67	3.35
Q2	2.87	2.45	0.42	0.34	2.37	0.14	0.96	0.34	2.26
Q3	2.68	2.40	0.28	0.25	2.15	0.12	1.07	0.18	1.39
Q4	2.65	2.44	0.21	0.18	2.18	0.13	1.52	0.17	1.76
Q5 (big)	2.10	2.05	0.05	0.01	0.17	0.01	0.25	-0.05	-0.94

Table 2 explores the connection between firm size and institutions’ stock-picking skill in more detail; I sort stocks into size quintiles (NYSE breakpoints) and test how well institutions perform within each group. The table shows that institutions beat the value-weighted return of the smallest stocks (Q1) by an impressive 0.66% quarterly but their performance drops steadily for larger stocks, to a low of 0.05% quarterly in quintile 5. Adjusted for risk, institutions significantly beat the value-weighted portfolios of quintiles 1–4 using the CAPM (alphas of 0.18–0.57% with t-statistics of 2.15–2.89) and of quintiles 1 and 2 using the four-factor model (alphas of 0.67% and 0.34% with t-statistics of 3.35 and 2.26). The stock-picking skill for smaller stocks has a modest aggregate effect, however, because quintiles 1 and 2 together represent just 4% of institutions’ overall portfolio. Nearly 80% of institutions’ holdings are in the top size quintile, for which there’s no evidence they can beat the market.

It is useful to note that the near-perfect correlation between institutions’ aggregate returns and the market index suggests that any risk model that includes MKT would give similar results. The impact on alpha of adding a new factor to the CAPM regression is the product of (i) the Sharpe ratio of the portion of the factor that is uncorrelated with the market (an ‘orthogonalized factor’), and (ii) the standard deviation of the part of returns explained by the orthogonalized factor. The second term is bounded above by the residual standard deviation of returns missed by the market, 0.54% quarterly for institutions. Thus, if we add an orthogonalized factor with, say, the same Sharpe ratio as the market, 0.25, institutions’ alpha could go up or down by at most 0.13% quarterly (0.25×0.54). The actual impact seems likely to be much smaller, as illustrated by the three-factor and four-factor regressions.

The near-perfect correlation with the market index also suggests that institutions’ aggregate holdings must

not deviate too much from the value-weighted portfolio – if they do, institutions must bet primarily on idiosyncratic returns. Table 3 provides relevant evidence. I sort stocks into quintiles (NYSE breakpoints) based on a variety of characteristics and compare the fraction of the institutional portfolio invested in each (relative to institutions' investment in all five quintiles) with the quintile's weight in the market portfolio (the quintile's market cap relative to the market cap of all five quintiles). The weights are found each quarter, using all stocks with data for the characteristic, and the table reports the time-series averages from 1980–2007. The 11 characteristics are:

- (a) size – market cap of the stock at the beginning of the quarter,
- (b) B/M – book value of common equity for the prior fiscal year (with a 4-month delay) divided by size,
- (c) momentum – returns for months -12 to -2 relative to the sort date,
- (d) reversals – returns for months -36 to -13 relative to the sort date,
- (e) volatility – daily return volatility from month -12 to -1 relative to the sort date,
- (f) beta – market beta estimated from at least 24 months and up to 60 months of past monthly returns,
- (g) turnover – trading volume divided by shares outstanding over the past 12 months,
- (h) share issuance – percent change in split-adjusted shares outstanding, equal to log growth in market cap minus log capital gains, over the past 12 months,
- (i) accruals – operating accruals, as per Sloan (1996),
- (j) asset growth – percent change in the book value of total assets during the last fiscal year,
- (k) ROA – return on assets, equal to EPS before extraordinary items divided by lagged assets per share.

These characteristics have all been used by prior studies to explain the cross section of expected returns, for the most part successfully. My focus isn't on their predictive power per se but, rather, on whether institutions under- or overweight the various quintiles relative to the market portfolio. That is, do institutions tilt their holdings toward or away from particular types of stocks?

The answer, in Table 3, is almost uniformly negative: institutions' average holdings from 1980–2007 line up very closely with value weights. Institutions tilt somewhat toward large stocks (the top size quintile is 77% of the institutional portfolio vs. 73% of the market) and away from low-turnover and low-beta stocks (institutional weights of 7% and 14% vs. value weights of 12% and 16%, respectively, for the first quintile of each variable). But for the other eight characteristics, not a single quintile has an institutional weight that differs from its value weight by more than two percentage points and most differ by less than one (looking closely, institutions take tiny bets on growth, momentum, and profitability, and against share issuers). These results suggest that, viewed from the perspective of portfolio weights, the institutional preferences found in cross-sectional regressions by Del Guercio (1996), Gompers and Metrick (2001), and Bennett, Sias, and Starks (2003) have little aggregate effect (my appendix reports cross-sectional

Table 3**The institutional portfolio vs. the market portfolio, 1980–2007**

The table compares the weight invested by institutions in each group of stocks with its weight in the market portfolio (weights are relative to the total investment in, or market cap of, stocks included in the five portfolios in each row). The weights are found quarterly, and the table reports their time-series averages. Stock portfolios are based on NYSE quintile breakpoints for each of the 11 variables listed in the table and described more thoroughly in the text. Market values come from CRSP, accounting data come from Compustat (supplemented with Davis, Fama, and French's, 2000, equity data), and institutional holdings come from Thomson Financial.

		Low	2	Portfolio 3	4	High
Size portfolios (market cap)	Institutions	0.01	0.03	0.06	0.14	0.77
	Market	0.03	0.04	0.07	0.13	0.73
	Difference	-0.02	-0.01	-0.01	0.00	0.04
B/M portfolios (book-to-market equity)	Institutions	0.43	0.23	0.16	0.12	0.06
	Market	0.41	0.22	0.17	0.13	0.07
	Difference	0.02	0.00	-0.01	-0.01	-0.01
Momentum portfolios (returns for months -12 to -2)	Institutions	0.11	0.18	0.21	0.25	0.26
	Market	0.12	0.19	0.21	0.24	0.25
	Difference	-0.01	0.00	0.00	0.00	0.01
Reversal portfolios (returns for months -36 to -13)	Institutions	0.11	0.17	0.20	0.24	0.28
	Market	0.11	0.17	0.20	0.24	0.27
	Difference	-0.01	0.00	0.00	0.00	0.00
Volatility portfolios (daily, past 12 months)	Institutions	0.21	0.31	0.23	0.15	0.10
	Market	0.23	0.30	0.22	0.14	0.11
	Difference	-0.02	0.02	0.01	0.00	-0.02
Beta portfolios (past 24- to 60-month estimate)	Institutions	0.14	0.24	0.22	0.21	0.19
	Market	0.16	0.24	0.21	0.20	0.19
	Difference	-0.02	0.00	0.01	0.01	0.01
Turnover portfolios (past 12 months)	Institutions	0.07	0.22	0.25	0.23	0.23
	Market	0.12	0.24	0.23	0.20	0.21
	Difference	-0.05	-0.02	0.02	0.03	0.03
Share issuance (past 12 months)	Institutions	0.25	0.19	0.18	0.19	0.19
	Market	0.24	0.20	0.18	0.18	0.20
	Difference	0.01	-0.01	0.00	0.01	-0.01
Accruals (as per Sloan, 1996)	Institutions	0.17	0.24	0.22	0.20	0.17
	Market	0.18	0.24	0.21	0.20	0.17
	Difference	0.00	0.00	0.00	0.00	0.00
Asset growth (prior year)	Institutions	0.10	0.19	0.23	0.25	0.23
	Market	0.11	0.19	0.23	0.24	0.23
	Difference	0.00	0.00	0.00	0.01	0.00
ROA (prior year)	Institutions	0.11	0.18	0.16	0.22	0.34
	Market	0.11	0.18	0.17	0.22	0.33
	Difference	0.00	0.00	-0.01	0.00	0.02

evidence that is similar to those studies).⁴

The patterns in Table 3 are quite stable during the sample. The key exception is that institutions' tilt toward large stocks declines over time: institutions begin with a 10 percentage point overweight of the largest quintile in the early 1980s, which steadily drops to zero by the end of the sample. (Part of this effect may be due to reporting requirements since the minimum holding that must be disclosed – 10,000 shares or \$200,000 – hasn't changed over time, likely increasing the reported holdings of smaller stocks.) Figure 2 on the next page plots average institutional and market weights for select characteristic portfolios in each of the 1980s, 1990s, and 2000s.

In sum, institutions as a group seem to do little more than hold the market portfolio: they don't bet to a significant degree on any of the most important characteristics known to predict stock returns, and their aggregate returns are almost perfectly correlated with the market index. The close correspondence with market returns and the small, precisely estimated alphas provide strong evidence that institutions don't earn significant abnormal returns, even before costs and fees.

4. The cross section of institutional performance

A natural follow-up question is whether some institutions have stock-picking ability, even if institutions overall do not. I explore the performance of institutions grouped by size, legal type, past performance, turnover, and by the characteristics of stocks they hold. The classifications provide evidence on a number of issues that have been asked in the mutual fund literature: Do organizational or regulatory constraints affect performance? Do institutions benefit from economies of scale? Does performance persist? Does money flow to the best institutions? Does active trading help performance? The text doesn't dwell on these questions, in the interest of brevity, but the answers (such as they are) should be fairly clear from the results.

More specifically, Table 4 reports CAPM, three-factor, and four-factor regressions for institutions grouped in eight different ways: by legal type (banks vs. insurance companies vs. all others), size (equity under management at the beginning of the quarter), past annual returns of their equity portfolios, past annual growth in equity under management, past annual turnover (inferred from quarterly changes in their

⁴ I don't report statistical tests in Table 3 because it isn't clear what the right notion of statistical randomness would be, since the results are essentially population values (i.e., institutions' actual holdings). In return tests, randomness comes from returns themselves – we are interested in expected returns but the tests use realized returns – and there is no corresponding notion of such randomness here. Even if the differences were statistically significant, it wouldn't change conclusions about their economic magnitudes.

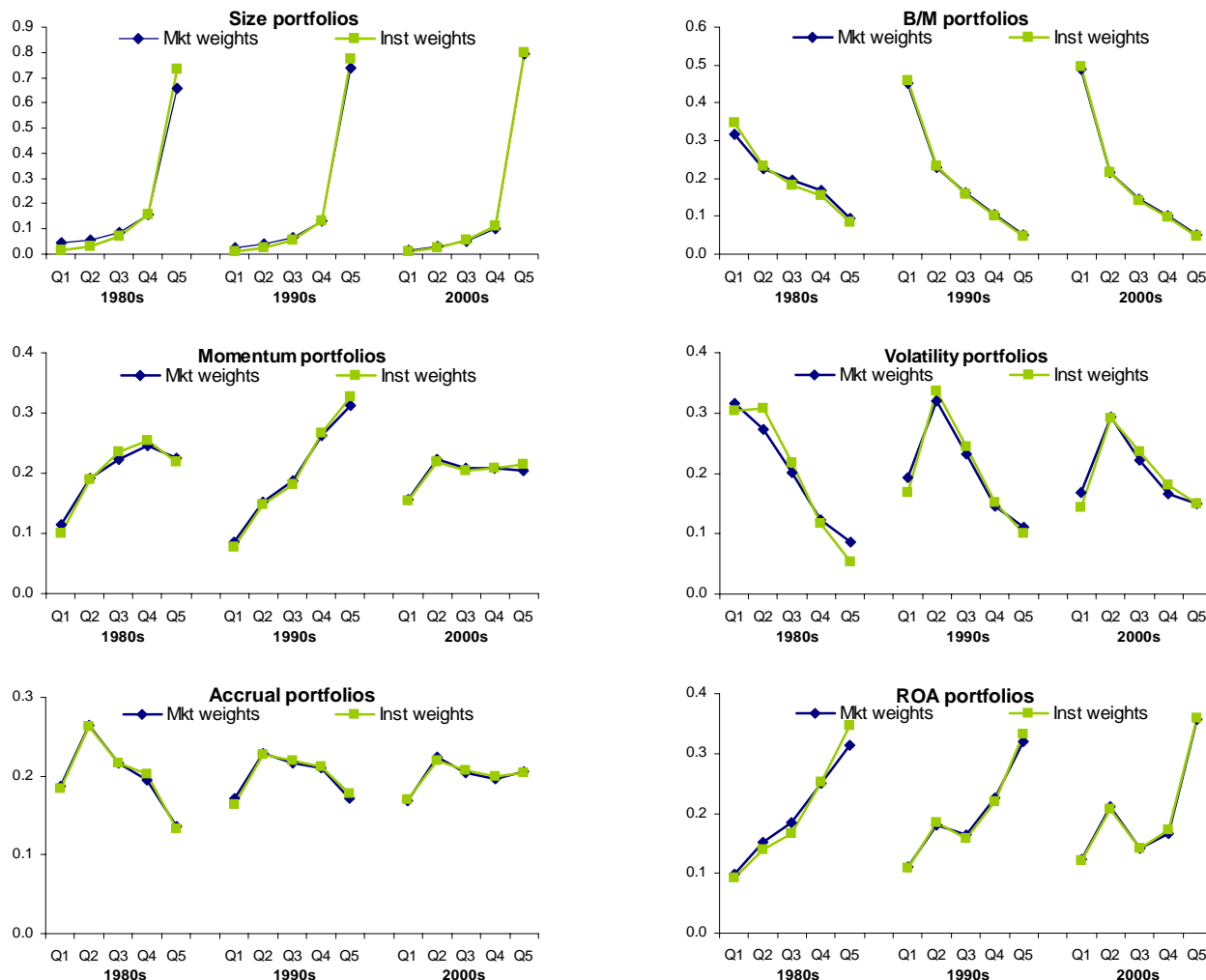


Fig. 2. Institutional vs. value weights, by decade, 1980–2007

Average institutional and value weights during the 1980s, 90s, and 2000s for stock portfolios (quintiles Q1-Q5) sorted by size, B/M, momentum (returns from month -12 to -2), volatility (daily for past 12 months), accruals (per Sloan, 1996), and ROA (EPS before extraordinary items divided by lagged assets per share). Market values come from CRSP, accounting data come from Compustat, and institutional holdings come from Thomson Financial.

holdings), and by the holding-weighted average of the log market cap, log B/M ratio, and 12-month momentum of stocks in the institution’s portfolio. All classifications except legal type sort institutions into quartiles; the last column in the table reports the fraction of total institutional equity held by each group. As before, I focus on the aggregate portfolio held by each group, treating institutions within the group as one big investor.

The basic conclusion from Table 4 is that some groups have stock-picking ability relative to the CAPM and Fama-French three-factor models – typically only a small amount – but there’s little evidence any group does so as measured by the four-factor model. The majority of groups hold portfolios that, in

Table 4
Institutional performance by type, quarterly, 1980–2007

The table reports quarterly CAPM, three-factor, and four-factor regressions for institutional investors grouped by legal type, size (equity under management at the start of the quarter), past annual returns, growth, and turnover, and by the average market cap, B/M ratio, or momentum of stocks in an institution's portfolio (groups are quartiles except for legal type). The latter three are holding-weighted averages of the log market cap, log B/M ratio, or return from month -12 to -2 of stocks held by an institution. The regression is: $R = a + b \text{MKT} + s \text{SMB} + h \text{HML} + m \text{UMD} + e$, where R is the excess return on the aggregate portfolio held by a group, MKT is the excess return on the CRSP value-weighted index, and SMB , HML , and UMD are the Fama-French factors from Ken French's website. $t(a)$ is the OLS t -statistic testing whether a is zero, R^2 is the regression adjusted R^2 , and GRS F is the Gibbons, Ross, and Shanken (1989) F -statistic testing whether alphas are jointly significant. %Assets is the fraction of total institutional assets held by each group. Bold indicates estimates of s , h , or m that are greater than 1.96 standard errors from zero. Returns come from CRSP, accounting data come from Compustat, and institutional holdings come from Thomson Financial.

	CAPM				FF 3-factor						Carhart 4-factor							%Assets
	a	t(a)	b	R ²	a	t(a)	b	s	h	R ²	a	t(a)	b	s	h	m	R ²	
Panel A: Grouped by LEGAL TYPE																		
Banks	0.20	2.23	0.93	0.99	0.11	1.38	0.98	-0.11	0.04	0.99	0.13	1.43	0.98	-0.11	0.04	0.00	0.99	0.27
Insurance	0.05	0.88	0.99	0.99	0.04	0.67	1.00	-0.04	0.00	0.99	0.05	0.66	1.00	-0.04	0.00	0.00	0.99	0.09
All others	0.07	1.12	1.03	0.99	0.09	1.42	1.02	0.02	-0.01	1.00	0.03	0.39	1.03	0.03	0.00	0.02	1.00	0.64
GRS F	1.99				0.98						0.68							
p-value	0.12				0.40						0.57							
Panel B: Grouped by SIZE																		
Smallest	0.17	1.60	1.02	0.98	0.10	1.17	1.00	0.14	0.04	0.99	0.23	2.39	0.99	0.12	0.02	-0.04	0.99	0.01
2	0.24	2.91	1.01	0.99	0.18	2.42	1.00	0.09	0.03	0.99	0.16	1.95	1.00	0.09	0.04	0.01	0.99	0.03
3	0.27	3.17	1.00	0.99	0.19	2.36	1.00	0.08	0.04	0.99	0.15	1.71	1.00	0.08	0.05	0.01	0.99	0.09
Largest	0.09	1.66	1.00	1.00	0.09	1.57	1.01	-0.03	0.00	1.00	0.06	0.93	1.01	-0.03	0.00	0.01	1.00	0.86
GRS F	3.31				1.96						1.75							
p-value	0.01				0.11						0.15							
Panel C: Grouped by PAST RETURNS																		
Lowest	-0.25	-1.22	1.02	0.94	-0.52	-2.43	1.07	0.02	0.12	0.95	0.01	0.06	1.04	-0.03	0.06	-0.16	0.96	0.14
2	0.07	0.71	0.98	0.98	-0.10	-0.98	1.02	-0.02	0.08	0.99	0.04	0.36	1.01	-0.03	0.06	-0.04	0.99	0.33
3	0.22	3.17	0.98	0.99	0.15	2.05	1.00	-0.04	0.03	0.99	0.02	0.33	1.01	-0.03	0.05	0.04	0.99	0.36
Highest	0.47	2.48	1.03	0.95	0.70	3.59	0.97	0.05	-0.10	0.96	0.15	0.87	1.00	0.10	-0.04	0.17	0.97	0.17
GRS F	3.15		a		3.23						0.45							
p-value	0.02				0.02						0.77							
Panel D: Grouped by PAST GROWTH																		
Lowest	0.02	0.13	1.01	0.96	-0.22	-1.35	1.06	0.02	0.11	0.97	0.15	0.94	1.04	-0.01	0.07	-0.12	0.97	0.12
2	0.10	1.11	0.98	0.99	-0.03	-0.36	1.02	-0.03	0.06	0.99	0.08	0.82	1.01	-0.04	0.04	-0.03	0.99	0.28
3	0.14	2.31	1.00	0.99	0.11	1.70	1.01	-0.04	0.01	0.99	0.05	0.68	1.02	-0.03	0.02	0.02	1.00	0.37
Highest	0.19	1.75	1.04	0.98	0.35	3.25	1.00	0.03	-0.07	0.99	0.06	0.62	1.01	0.06	-0.04	0.09	0.99	0.22
GRS F	1.84				2.69						0.52							
p-value	0.13				0.04						0.72							

table continues on next page

	CAPM				FF 3-factor						Carhart 4-factor							% Assets
	a	t(a)	b	R ²	a	t(a)	b	s	h	R ²	a	t(a)	b	s	h	m	R ²	
Panel E: Grouped by TURNOVER																		
Lowest	0.26	2.89	0.93	0.99	0.11	1.35	0.99	-0.10	0.06	0.99	0.18	2.11	0.98	-0.10	0.06	-0.02	0.99	0.32
2	0.12	1.78	0.99	0.99	0.00	0.07	1.02	-0.03	0.05	0.99	0.07	0.91	1.01	-0.03	0.05	-0.02	0.99	0.31
3	-0.01	-0.14	1.07	0.99	0.12	1.62	1.03	0.04	-0.06	0.99	0.01	0.14	1.04	0.05	-0.04	0.03	0.99	0.25
Highest	0.09	0.56	1.14	0.97	0.43	3.12	1.04	0.16	-0.14	0.98	0.15	1.13	1.06	0.18	-0.11	0.08	0.99	0.11
GRS F	6.25				6.33						3.31							
p-value	0.00				0.00						0.01							
Panel F: Grouped by MARKET CAP OF HOLDINGS																		
Small cap	0.24	0.93	1.11	0.92	0.12	0.80	1.01	0.46	0.09	0.98	0.01	0.05	1.02	0.47	0.10	0.03	0.98	0.07
2	0.18	1.61	1.04	0.98	0.07	0.66	1.04	0.11	0.06	0.99	0.02	0.18	1.04	0.11	0.07	0.01	0.99	0.20
3	0.08	1.38	1.00	1.00	0.09	1.64	1.01	-0.05	-0.01	1.00	0.07	1.11	1.01	-0.05	-0.01	0.01	1.00	0.48
Large cap	0.11	0.95	0.94	0.98	0.16	1.85	0.98	-0.17	-0.03	0.99	0.15	1.57	0.98	-0.17	-0.03	0.00	0.99	0.25
GRS F	1.32				1.43						0.72							
p-value	0.27				0.23						0.58							
Panel G: Grouped by B/M RATIO OF HOLDINGS																		
Low B/M	-0.13	-0.59	1.12	0.95	0.53	3.55	1.00	-0.04	-0.32	0.98	0.09	0.68	1.02	-0.01	-0.27	0.13	0.99	0.17
2	0.05	0.72	0.99	0.99	0.09	1.29	1.00	-0.07	-0.02	0.99	0.06	0.81	1.00	-0.07	-0.02	0.01	0.99	0.35
3	0.26	2.51	0.96	0.98	0.03	0.34	1.01	0.00	0.11	0.99	0.14	1.42	1.00	-0.01	0.10	-0.03	0.99	0.31
High B/M	0.59	2.46	0.92	0.90	-0.12	-0.85	1.03	0.14	0.36	0.97	0.07	0.46	1.02	0.13	0.33	-0.06	0.97	0.16
GRS F	2.44				3.34						1.02							
p-value	0.05				0.01						0.40							
Panel H: Grouped by MOMENTUM OF HOLDINGS																		
Low returns	-0.02	-0.08	0.95	0.90	-0.57	-2.42	1.05	0.05	0.27	0.93	0.17	0.85	1.01	-0.02	0.18	-0.22	0.96	0.13
2	0.13	1.14	0.94	0.98	-0.12	-1.20	1.01	-0.05	0.12	0.98	0.03	0.28	1.00	-0.06	0.10	-0.04	0.99	0.31
3	0.16	2.18	0.99	0.99	0.14	1.93	1.00	-0.05	0.00	0.99	0.07	0.90	1.01	-0.05	0.01	0.02	0.99	0.38
High returns	0.33	1.60	1.12	0.95	0.79	4.26	1.01	0.08	-0.22	0.96	0.12	0.84	1.04	0.13	-0.13	0.19	0.98	0.18
GRS F	2.05				5.25						1.00							
p-value	0.09				0.00						0.41							

aggregate, closely mimic the market index: 20 out of 31 have return correlations with the market index of 99% or higher, including 15 of the 19 groups sorted by legal type, size, past returns, past growth, and turnover (the other categories sort by the type of stocks held by the institution, so it's not surprising that they have somewhat lower correlations).

In Panel A, the portfolios held by banks, insurance companies, and other institutions have return correlations with the market index of 99.3%, 99.7%, and 99.8%, respectively. Banks appear, weakly, to have the best performance, with a CAPM alpha of 0.20% quarterly (t-statistic of 2.23) and a four-factor alpha of 0.13% quarterly (t-statistic of 1.43). Insurance companies and other institutions have consistently small alphas across all risk models, with estimates of 0.03–0.09% quarterly. None of the alphas for insurance companies or other institutions is individually significant, nor are any of the GRS F statistics testing whether alphas for the three groups are jointly significant.

In Panel B, different-sized institutions again hold portfolios that are highly correlated with the market index. The portfolio held by large institutions (top quartile) has the strongest correlation with the market (99.8%) and the smallest alphas (0.06–0.09% quarterly, with t-statistics between 0.93 and 1.66). Small and medium-sized institutions also hold portfolios with greater than 99% correlation with the market but with slightly better returns. Medium-sized institutions (quartiles 2 and 3) have the best CAPM and three-factor adjusted performance, with quarterly CAPM alphas of 0.24% and 0.27% and three-factor alphas of 0.18% and 0.19%, all of which are individually statistically significant. Small institutions have insignificant CAPM and three-factor alphas but, interestingly, the highest four-factor alpha of 0.23% quarterly (t-statistic of 2.39). The GRS F statistic, testing the joint significance of the groups' alphas, has a p-value less than 0.05 only for the CAPM. Loadings on the Fama-French factors suggest that the bottom three quartiles all tilt a bit toward small value stocks, and the smallest institutions also tilt toward loser stocks.⁵

In Panels C and D, institutions with the best past annual returns and growth have the highest CAPM and three-factor alphas, largely a consequence of momentum in returns. The spread between the best- and worst-performing institutions is greatest for three-factor alphas: institutions with the highest past returns have a big positive alpha of 0.70% quarterly (t-statistic of 3.59), while institutions with the lowest past returns have a big negative alpha of -0.52% quarterly (t-statistic of -2.43). Likewise, the fastest-growing

⁵ Sorting institutions based on the number of stocks they hold, which is fairly highly correlated with institutional size, gives similar results. Institutions in the middle two quartiles have the best performance, with quarterly CAPM alphas of 0.31% and 0.23% (t-statistics of 3.90 and 3.04) and four-factor alphas of 0.20% and 0.18% (t-statistics of 2.28 and 1.93). Those groups account for 20% of total equity under management.

institutions have an alpha of 0.35% quarterly (t-statistic of 3.25) while the slowest-growing institutions have an alpha of -0.22% quarterly (t-statistic of -1.35). Abnormal performance all but vanishes, however, once we control for momentum via the four-factor model: alphas of the two top quartiles shrink to 0.15% and 0.06%, alphas of the two bottom quartiles jump to 0.01% and 0.15%, and none of the estimates (or GRS F statistics) remains statistically significant.

In Panel E, institutions that trade the least seem to have the best performance. The low-turnover quartile is the only group with significant CAPM and four-factor alphas (0.26% and 0.18%, respectively, with t-statistics of 2.89 and 2.11). Their portfolio has a correlation of 99.3% with the market, tilted somewhat toward large, value stocks (institutions in this group trade 4.8% of their portfolios in an average quarter). In contrast, high-turnover institutions tend to invest in small, low-B/M, high-momentum stocks, turning over 29.0% of their portfolios in an average quarter. Their CAPM and four-factor alphas are small but their Fama-French alpha is a significant 0.43% quarterly (t-statistic of 3.12) because of the three-factor model's adjustment for low-B/M stocks with no control for momentum.

Finally, in Panels F, G, and H, institutions grouped by the characteristics of stocks they hold (small vs. large stocks, growth vs. value stocks, losers vs. winners) also show evidence of stock-picking ability relative to the CAPM and the three-factor model but not relative to the four-factor model. As one might expect, institutions that tilt the most toward small, high-B/M, or high-momentum stocks have the highest CAPM alphas within each panel, with estimates of 0.24%, 0.59%, and 0.33% quarterly for the extreme quartiles, respectively (only the middle number is individually significant, with a t-statistic of 2.46). Those compare with insignificant CAPM alphas of 0.11%, -0.13%, and -0.02% quarterly for institutions at the opposite ends of the spectrum. Again, alphas essentially vanish using the four-factor model: the point estimates all become slightly positive and insignificant, ranging from 0.01–0.17% quarterly across the 12 groups in Panels E, F, and G. Loadings on the Fama-French factors exhibit the expected patterns as institutions invest in progressively smaller, higher-B/M, or higher-momentum stocks. None of the four-factor GRS F statistics is statistically significant.

In sum, a number of institutional groups appear to have stock-picking ability as measured by the CAPM, but abnormal performance is almost fully explained by the groups' modest tilts toward small, value, and high-momentum stocks. Across all 31 groups in Table 4, only two – small and low-turnover institutions – have four-factor alphas greater than 0.18% quarterly and t-statistics that, taken in isolation, are significant (not accounting for the implicit data-mining we do by searching across groups). Returns earned by most groups closely mimic market returns.

5. Limits of arbitrage

The tests above ask whether institutions have stock-picking ability, i.e., do their equity holdings have positive alphas? Evidence that some groups do when performance is measured by the CAPM implies that those groups' portfolios, when combined appropriately with the market index, would achieve a higher Sharpe ratio than the market portfolio alone.

My final tests ask a stronger question: does any group of institutions hold a portfolio that is either mean-variance efficient or, somewhat less strongly, tilts optimally away from the market portfolio toward the mean-variance frontier? These tests are stronger because, as I explain below, they ask whether institutions hold portfolios with the highest alphas per unit of idiosyncratic risk, not just portfolios with positive alphas.

One motivation for the tests is to explore the 'limits of arbitrage' view of Shleifer and Vishny (1997). Shleifer and Vishny argue that mispricing may exist in equilibrium, rather than being arbitrated away, because most arbitrage is undertaken by professional traders – i.e., institutions – who may be reluctant to bet heavily on anomalies, fearing short-term losses and withdrawals by their investors. A testable feature of the argument is that, despite such concerns, professional traders should still hold portfolios with the best risk-return trade-off, either the tangency portfolio, if absolute performance is important, or a portfolio with the highest alpha per unit of idiosyncratic risk, if relative performance is important. The latter type of portfolio produces the tangency portfolio when combined with the market (assuming that 'relative performance' means relative to the CAPM or market index). Thus, asking whether institutions hold portfolios that are mean-variance efficient when combined with the market portfolio provides a basic test of the limits-of-arbitrage view.⁶

Statistically, the test takes a simple form: I just use the institutional portfolio, along with the market portfolio, as an asset-pricing factor in time-series regressions, i.e., I test whether alphas are zero when B/M and momentum portfolios are regressed on the market portfolio and either the aggregate institutional portfolio or the portfolio held by a particular type of institution. The logic here follows from Gibbons, Ross, and Shanken's (1989) general analysis of mean-variance tests: alphas for B/M and momentum portfolios will be zero if and only if the market and institutional portfolios combine to form the tangency portfolio that is achievable from each set of assets – or, equivalently, only if institutions optimally exploit

⁶ I use the phrase 'limits of arbitrage' to refer exclusively to the issue above, which focuses on problems caused by delegated portfolio management. The literature sometimes uses the phrase more generally to refer to any trading friction, including, for example, trading costs and segmented markets (see, e.g., Pontiff, 1996). My tests don't address whether anomalies might persist because of these other frictions.

Table 5
B/M and momentum portfolios, quarterly, 1980–2007

The table reports average quarterly excess returns (%), standard deviations, t-statistics, and CAPM regressions for B/M and momentum quintiles, labelled Q1–Q5, as well as for portfolios long Q5 and short Q1. $t(\text{Avg})$ is the t-statistic testing whether expected excess returns are zero; a_{CAPM} is the CAPM alpha with OLS t-statistic $t(a_{\text{CAPM}})$; beta is the slope on the market portfolio; R^2 is the regression adjusted R^2 ; GRS F is the Gibbons, Ross, and Shanken (1989) F-statistic (with p-values immediately below) testing whether intercepts for the five quintiles are jointly significant. B/M quintiles come from Ken French’s website and other returns come from CRSP. Momentum quintiles (NYSE breakpoints) are re-formed monthly based on returns from months -12 to -2 relative to the sort date.

Portfolio		Avg	Std	t(Avg)	a_{CAPM}	$t(a_{\text{CAPM}})$	Beta	R^2	GRS F
B/M quintiles	Q1 (G)	2.00	9.54	2.21	-0.32	-1.21	1.11	0.92	1.96
	Q2	2.40	8.46	3.00	0.37	1.43	0.97	0.90	0.09
	Q3	2.25	7.69	3.08	0.48	1.53	0.85	0.83	
	Q4	2.55	7.40	3.62	0.94	2.51	0.77	0.73	
	Q5 (V)	2.98	7.92	3.96	1.32	3.01	0.79	0.68	
	V–G	0.97	6.89	1.49	1.64	2.61	-0.32	0.14	
Momentum quintiles	Q1 (L)	0.68	11.30	0.63	-1.75	-3.00	1.17	0.72	4.87
	Q2	1.85	8.08	2.42	0.05	0.13	0.87	0.78	0.00
	Q3	1.45	7.25	2.11	-0.26	-1.04	0.82	0.87	
	Q4	2.33	7.41	3.32	0.57	2.33	0.85	0.89	
	Q5 (W)	3.20	9.66	3.49	0.91	2.72	1.10	0.87	
	W–L	2.52	8.55	3.11	2.67	3.18	-0.07	0.00	

the B/M and momentum effects by holding a portfolio with the highest CAPM alpha per unit of idiosyncratic risk. I focus on B/M and momentum portfolios because the value and momentum anomalies are significant during the sample, while the size effect is not.

Table 5 reports time-series statistics for the B/M and momentum portfolios. Both sets of portfolios are value-weighted quintiles and include all common stocks on CRSP, with breakpoints determined by NYSE percentiles. The B/M quintiles come from Ken French’s website; they are formed each year in June using stocks with positive B/M ratios as of the prior December (to allow for a lag in reporting). The momentum quintiles, used earlier for comparing institutional vs. market weights, are formed monthly based on returns from months -12 to -2 relative to the sort date. (I use French’s data for the B/M quintiles because their returns exhibit a more consistent pattern across portfolios than my own and should be closer to the Fama-French HML factor.)

The table shows that the B/M and momentum effects are significant during the sample. Focusing on alphas for the extreme quintiles, high-B/M stocks outperform low-B/M stocks by 1.64% per quarter (t-statistic of 2.61), while high-momentum stocks outperform low-momentum stocks by 2.67% per quarter (t-statistic of 3.18). The GRS F statistic, testing whether alphas are jointly significant, is marginal for the

B/M quintiles, with a p-value of 0.09, but strong for the momentum quintiles, with a p-value of 0.00. These results provide a benchmark for my subsequent tests.

Table 6 explores the mean-variance efficiency of institutions' portfolios. Panel A repeats, for ease of reference, the CAPM regressions for B/M and momentum portfolios. The remaining panels report two-factor regressions that add either the aggregate institutional portfolio (Panel B) or the portfolio held by a particular group of institutions (Panels C–J) as a second factor:

$$R_i = a_i + b_i \text{MKT} + g_i \text{INST} + e_i, \quad (1)$$

where R_i is the excess return on a B/M or momentum portfolio and INST is the excess return on the institutional portfolio. Again, testing whether the B/M and momentum portfolios' alphas are zero in this regression is equivalent to testing whether the institutional portfolio has the highest alpha per unit of idiosyncratic risk. For brevity, I report only estimates of a_i and g_i for the long-short portfolios, quintiles 5 minus quintiles 1, along with the GRS F statistics for all five quintiles. Rows that are shaded indicate institutional groups that were found to have statistically significant stock-picking ability relative to the CAPM (see Tables 1 and 4).

The overall conclusion from Table 6 is that no group of institutions tilts optimally toward the tangency portfolio achievable from B/M and momentum portfolios. The portfolios held by a few groups help explain either the B/M or momentum effects – never both – but the improvements are generally modest, with a couple of exceptions.

Specifically, Panel B shows that the aggregate return for all institutions explains almost none of the B/M and momentum effects, as measured by alphas for the long-short B/M and momentum portfolios (labeled V-G and W-L, respectively). The B/M effect increases slightly, from 1.64% to 1.70% quarterly, and the momentum effect decreases slightly, from 2.67% to 2.56% quarterly, when the aggregate institutional portfolio is added as a factor. Both alphas remain significant, and we can't reject that the aggregate institutional portfolio has no explanatory power. (The conclusions are the same if we use the aggregate portfolio held by individuals as a factor.) These results are consistent with my finding that institutions add little beyond the market index.

Portfolios held by most groups of institutions also explain only a small part of the B/M and momentum effects. For classifications based on legal type (Panel C), turnover (Panel G), and the market cap of an institution's holdings (Panel H), no group of institutions has a meaningful effect on the alphas of V-G and

Table 6**Testing the efficiency of institutional portfolios, quarterly, 1980–2007**

The table reports quarterly CAPM and two-factor regressions for B/M and momentum quintiles. Intercepts are in percent. V-G is B/M quintile 5 minus B/M quintile 1. W-L is momentum quintile 5 minus momentum quintile 1. Panel A reports CAPM regressions: $R = a + b \text{MKT} + e$, where R is either V-G's or W-L's excess return and MKT is the excess return on CRSP value-weighted index. Panels B–I report regressions that include the portfolio held by the specified group of institutions (or, in the second row of Panel B, individuals) as a second factor: $R = a + b \text{MKT} + g \text{INST} + e$. MKT is included in the regressions but its slope isn't reported. t(a) is the OLS t-statistic testing whether a is zero; INST is the slope on INST, with t-statistic t(INST); R^2 is the regression adjusted R^2 ; GRS F is the Gibbons, Ross, and Shanken (1989) F-statistic testing whether intercepts for all five B/M or momentum quintiles (not just V-G and W-L) are jointly significant; F pval is the p-value for the GRS F. B/M quintiles come from Ken French's website, other returns come from CRSP, and institutional ownership comes from Thomson Financial. Momentum portfolios are re-formed monthly based on returns from months -12 to -2 relative to the sort date. Shaded rows indicate institutional groups that have statistically significant CAPM alphas in Tables 1 or 4.

Portfolio	Institutional group used as INST	a	t(a)	INST	t(INST)	R^2	GRS F	F pval
Panel A: CAPM benchmark								
V-G	--	1.64	2.61	.	.	0.14	1.96	0.09
W-L	--	2.67	3.18	.	.	0.00	4.87	0.00
Panel B: All institutions and individuals								
V-G	All institutions	1.70	2.68	-0.83	-0.73	0.13	1.64	0.16
	Individuals	1.61	2.54	-0.57	-0.43	0.13	1.72	0.14
W-L	All institutions	2.56	3.02	1.25	0.82	-0.01	4.29	0.00
	Individuals	2.69	3.17	0.40	0.23	-0.01	4.56	0.00
Panel C: Institutions grouped by LEGAL TYPE								
V-G	Banks	1.65	2.55	-0.05	-0.07	0.13	1.46	0.21
	Insurance	1.68	2.66	-0.84	-0.84	0.13	1.83	0.11
	All others	1.69	2.67	-0.76	-0.75	0.13	1.79	0.12
W-L	Banks	2.62	3.04	0.21	0.23	-0.01	4.25	0.00
	Insurance	2.64	3.12	0.48	0.36	-0.01	4.73	0.00
	All others	2.56	3.04	1.55	1.14	0.00	4.53	0.00
Panel D: Institutions grouped by SIZE								
V-G	Smallest	1.34	2.20	1.72	3.15	0.20	1.45	0.21
	2	1.14	1.81	2.07	2.91	0.19	0.91	0.48
	3	1.06	1.68	2.13	3.17	0.20	0.85	0.52
	Largest	1.75	2.75	-1.25	-1.11	0.14	1.73	0.13
W-L	Smallest	3.25	4.24	-3.48	-5.06	0.18	6.24	0.00
	2	3.16	3.68	-2.06	-2.13	0.03	4.47	0.00
	3	3.08	3.54	-1.51	-1.63	0.01	4.28	0.00
	Largest	2.48	2.93	2.13	1.41	0.00	4.23	0.00
Panel E: Institutions grouped by PAST RETURNS								
V-G	Low returns	1.97	3.26	0.85	2.96	0.19	3.88	0.00
	2	1.64	2.72	1.70	2.95	0.19	2.31	0.05
	3	1.66	2.54	0.46	0.52	0.12	1.81	0.12
	High returns	2.17	3.48	-0.87	-2.77	0.18	3.46	0.01
W-L	Low returns	1.88	2.82	-2.58	-8.20	0.38	4.14	0.00
	2	2.76	3.53	-3.29	-4.42	0.15	4.57	0.00
	3	1.61	1.92	4.14	3.73	0.11	2.54	0.03
	High returns	1.21	1.78	2.82	8.27	0.39	3.23	0.01

table continues on next page

Portfolio	Institutional group used as INST	a	t(a)	INST	t(INST)	R ²	GRS F	F pval
Panel F: Institutions grouped by PAST GROWTH								
V-G	Low growth	1.74	2.92	1.21	3.45	0.21	2.82	0.02
	2	1.64	2.64	1.27	1.88	0.15	1.91	0.10
	3	1.84	2.87	-0.56	-0.55	0.12	1.89	0.10
	High growth	2.07	3.40	-1.66	-3.04	0.19	3.21	0.01
W-L	Low growth	2.58	3.68	-2.90	-6.98	0.31	5.14	0.00
	2	2.82	3.49	-3.03	-3.44	0.09	4.62	0.00
	3	2.09	2.47	3.09	2.31	0.04	3.37	0.01
	High growth	1.71	2.38	4.31	6.68	0.29	3.77	0.00
Panel G: Institutions grouped by TURNOVER								
V-G	Low turnover	1.53	2.37	0.90	1.35	0.14	1.36	0.25
	2	1.47	2.39	2.40	2.82	0.18	1.53	0.19
	3	1.74	2.89	-2.37	-3.07	0.19	2.24	0.06
	High turnover	1.86	3.07	-1.02	-2.80	0.18	2.62	0.03
W-L	Low turnover	2.86	3.28	-1.28	-1.43	0.01	4.39	0.00
	2	2.91	3.49	-3.13	-2.71	0.05	4.55	0.00
	3	2.56	3.14	3.13	2.98	0.07	4.64	0.00
	High turnover	2.37	2.94	1.67	3.44	0.09	4.39	0.00
Panel H: Institutions grouped by the MARKET CAP OF HOLDINGS								
V-G	Small stocks	1.44	2.42	0.82	3.70	0.23	1.76	0.13
	2	1.26	2.13	2.13	4.13	0.25	1.43	0.22
	3	1.80	2.88	-2.06	-1.98	0.16	1.87	0.11
	Large stocks	1.86	3.15	-2.05	-4.11	0.25	2.28	0.05
W-L	Small stocks	2.84	3.44	-0.72	-2.35	0.04	4.96	0.00
	2	2.91	3.48	-1.42	-1.94	0.02	4.68	0.00
	3	2.45	2.93	2.72	1.95	0.02	4.42	0.00
	Large stocks	2.47	3.01	1.82	2.62	0.05	4.62	0.00
Panel I: Institutions grouped by the B/M RATIO OF HOLDINGS								
V-G	Low B/M stocks	1.35	3.31	-2.19	-12.22	0.63	2.77	0.02
	2	1.77	2.94	-2.53	-3.25	0.21	1.98	0.09
	3	0.86	1.53	2.96	5.84	0.34	0.80	0.55
	High B/M stocks	0.49	1.12	1.95	11.63	0.61	0.75	0.59
W-L	Low B/M stocks	2.95	4.29	2.22	7.38	0.33	6.07	0.00
	2	2.52	3.07	2.70	2.54	0.04	4.88	0.00
	3	3.45	4.28	-2.99	-4.16	0.13	5.84	0.00
	High B/M stocks	3.66	4.83	-1.69	-5.73	0.22	6.55	0.00
Panel J: Institutions grouped by the MOMENTUM OF HOLDINGS								
V-G	Low ret stocks	1.66	3.07	1.23	6.24	0.36	3.92	0.00
	2	1.35	2.32	2.18	4.58	0.27	1.90	0.10
	3	1.82	2.84	-1.13	-1.38	0.14	1.81	0.12
	High ret stocks	2.13	3.83	-1.47	-5.85	0.34	3.92	0.00
W-L	Low ret stocks	2.62	4.38	-2.26	-10.29	0.49	5.78	0.00
	2	3.03	3.86	-2.73	-4.24	0.13	5.27	0.00
	3	2.22	2.66	2.81	2.62	0.05	3.79	0.00
	High ret stocks	1.76	2.79	2.69	9.43	0.44	4.31	0.00

W-L when the group's portfolio is added to the regression. Among those groups, the largest effect is for institutions that hold moderately small stocks (group 2 in Panel H); adding their portfolio to the regressions decreases the B/M effect from 1.64% to 1.26% quarterly but increases the momentum effect from 2.67% to 2.91% quarterly. Both alphas remain significant.

Institutions grouped by past growth (Panel F) and the momentum of their stock holdings (Panel J) have a somewhat larger impact on alphas, but still no group within those classifications explains either the B/M or momentum effect. Portfolios held by the fastest-growing institutions and by institutions that invest the most in past winners substantially decrease W-L's alpha, to 1.71% quarterly in the first case and 1.76% quarterly in the second (down from a CAPM alpha of 2.67%), but t-statistics for both remain greater than 2.37. Thus, even institutions that invest most strongly in winners don't tilt optimally toward the tangency portfolio that is achievable from momentum portfolios (let alone from B/M portfolios). And short-sale constraints don't seem to be the cause: when that groups' portfolio is included as a factor, both the long and short sides of the W-L portfolio continue to have significant alphas (not shown in the table): quintile 1 has an alpha of -1.28% quarterly, with a t-statistic of -2.50, and quintile 5 has an alpha of 0.49% quarterly, with a t-statistic of 2.34.

The groups that best take advantage of the B/M or momentum effects (no group exploits both) are medium-sized institutions (in Panel D), the best-performing institutions (in Panel E), and institutions that invest most in value stocks (in Panel I). In particular, portfolios held by medium-sized (quartile 3) and the most value-oriented institutions, when used as factors, accentuate the momentum effect but decrease V-G's alpha to 1.06% and 0.49% quarterly, respectively, down from the CAPM alpha of 1.64%. Neither estimate is statistically different from zero (t-statistics of 1.68 and 1.12), though the first remains economically large. In contrast, the portfolio held by the top-performing institutions accentuates the B/M effect but decreases W-L's alpha to 1.21% quarterly (t-statistic of 1.78), down from the CAPM alpha of 2.67%. These results imply that, on a statistical basis, we can't reject that medium-sized, value-oriented, or top-performing institutions optimally exploit the opportunities available from either B/M portfolios or momentum portfolios, though not from both.⁷

Overall, the results provide little support for the limits-of-arbitrage view that (a) the B/M and momentum effects reflect mispricing and (b) the anomalies persist because professional traders are reluctant to bet too

⁷ For top-performing institutions, it's more accurate to say that they exploit the opportunities available from momentum quintiles 1 and 5, not from all five quintiles, since the GRS F statistic in Table 6 is significant. Also, none of the groups explains the returns on HML or UMD, which give greater weight to small stocks than the long-short portfolios considered in Table 6. Thus, none of the groups really takes full advantage of the B/M or momentum effects.

heavily on them. In practice, institutions overall or grouped by type often don't exploit the anomalies at all and certainly not in a way that maximizes alpha (per unit of idiosyncratic risk). Remarkably, no group that I considered simultaneously takes advantage of both the B/M and momentum effects: when we use groups' portfolios as factors, *not once* do the alphas of V-G and W-L both decrease.⁸ The results suggest that the anomalies persist either because institutions don't take advantage of them for reasons other than Shleifer and Vishny's (1997) limited-arbitrage arguments or because institutions themselves have the same biases that create the anomalies in the first place.

6. Conclusions

The performance and trading decisions of institutional investors have become more important in recent years as their assets have grown. The literature suggests that institutions have stock-picking skill even though they deliver mediocre returns, at best, to their investors. That view has important effects on how we think about institutions' role in capital markets, the economics of the money management industry, and market efficiency more generally. For example, it supports Berk and Green's (2004) contention that many stylized facts about mutual fund performance and flows are consistent with a rational, competitive mutual fund industry.

This study provides a more pessimistic view of the value added by institutional investors. Quite simply, institutions overall seem to do little more than hold the market portfolio, at least from the standpoint of their pre-cost and pre-fee returns. Their aggregate portfolio almost perfectly mimics the value-weighted index, with a market beta of 1.01 and an economically small, precisely estimated CAPM alpha of 0.08% quarterly. Institutions overall take essentially no bet on any of the most important stock characteristics known to predict returns, like B/M, momentum, or accruals. The implication is that, to the extent that institutions' holdings deviate from the market portfolio, they seem to bet primarily on idiosyncratic returns – bets that aren't particularly successful. Another implication is that institutions, in aggregate, don't exploit anomalies in the way they should if they rationally tried to maximize the (pre-cost) mean-variance trade-off of their portfolios, either relative or absolute.

The same conclusions apply, for the most part, to different types of institutions. I find modest stock-picking ability relative to the CAPM for banks, medium-sized and low-turnover institutions, institutions

⁸ The point estimates for V-G and W-L simultaneously drop in a single case, when the portfolio held by above-average performing institutions (group 3 in Panel E) is used as a factor, but the decline in V-G's alpha isn't statistically significant. The drop isn't obvious in the table because the time period used for Panels E, F, and G differs from the other panels, beginning in 1981 instead of 1980, a result of requiring one year of past data for the sorts in those panels. The quarterly CAPM alphas of V-G and W-L are 1.76% and 2.52%, respectively, for the matching time period.

with strong past performance, and institutions that invest in high-B/M or high-momentum stocks, but their performance is almost entirely explained by the B/M and momentum effects in returns. Only two groups out of 31 total have a four-factor alpha that is greater than 0.18% quarterly. And, like institutions overall, even groups that have some stock-picking ability (relative to the CAPM) don't take advantage of the risk-return opportunities presented by B/M and momentum portfolios. Put differently, the B/M and momentum effects can explain the groups' returns, but the groups' returns do not explain, in a statistical sense, the B/M and momentum effects.

Appendix

Section 3 shows that institutions, in aggregate, seem to have little stock-picking skill and place almost no bet on the main characteristics known to predict returns. For comparison with prior studies, this appendix explores the same issues via cross-sectional regressions. In particular, the regressions ask whether institutional ownership, equal to the fraction of a firm's shares owned by institutions, is correlated either with a firm's future returns or with the characteristics considered in Section 3.

Table A1 reports Fama-MacBeth regressions of quarterly stock returns on institutional ownership (IO) and other characteristics (t-statistics are reported below slope estimates). The regressors, defined in the table, are measured at the end of the prior quarter and winsorized at the 1st and 99th percentiles. Regressions in the left-hand columns use all stocks, while regressions in the right-hand columns use only stocks larger than the NYSE median value.

IO has little direct correlation with future returns (t-statistic of -0.21 for all stocks and 1.40 for large stocks when used alone in the regressions) but becomes statistically significant after controlling for size, B/M, and momentum (t-statistic of 2.58 for all stocks and 1.77 for large stocks). The point estimates imply that a 25 percentage point increase in IO (roughly one standard deviation) predicts an increase in next quarter's return of 0.46% in the regression with all stocks and 0.30% in the regression with large stocks, assuming no change in size, B/M, and momentum. The slope on IO remains significant when the other characteristics are added to the full-sample regression but the t-statistic drops to 1.05 in the large-stock regression. In short, IO seems to have reliable predictive power in the full sample but relatively weak predictive power for larger stocks. The weak effect for large stocks helps explain why institutions' aggregate returns only slightly beat the market index.

Figure A1 explores the correlation between IO and firm characteristics. In lieu of regressions, the figure simply plots how IO varies across the characteristic-sorted portfolios considered in Section 3. Focusing on the value-weighted results, IO varies substantially across size, volatility, beta, and turnover portfolios and shows some correlation with all of the other variables (excepts perhaps with accruals). The patterns are almost always more pronounced for equal-weighted IO. The bottom line is that institutions clearly display a preference for certain types of stocks but, as emphasized in Section 3, the aggregate effect of these preferences appears to be quite small (the tests there essentially weight each quintile by its importance in the market portfolio while the plots here treat each quintile equally).

Table A1**Cross-sectional regressions, quarterly, 1980–2007**

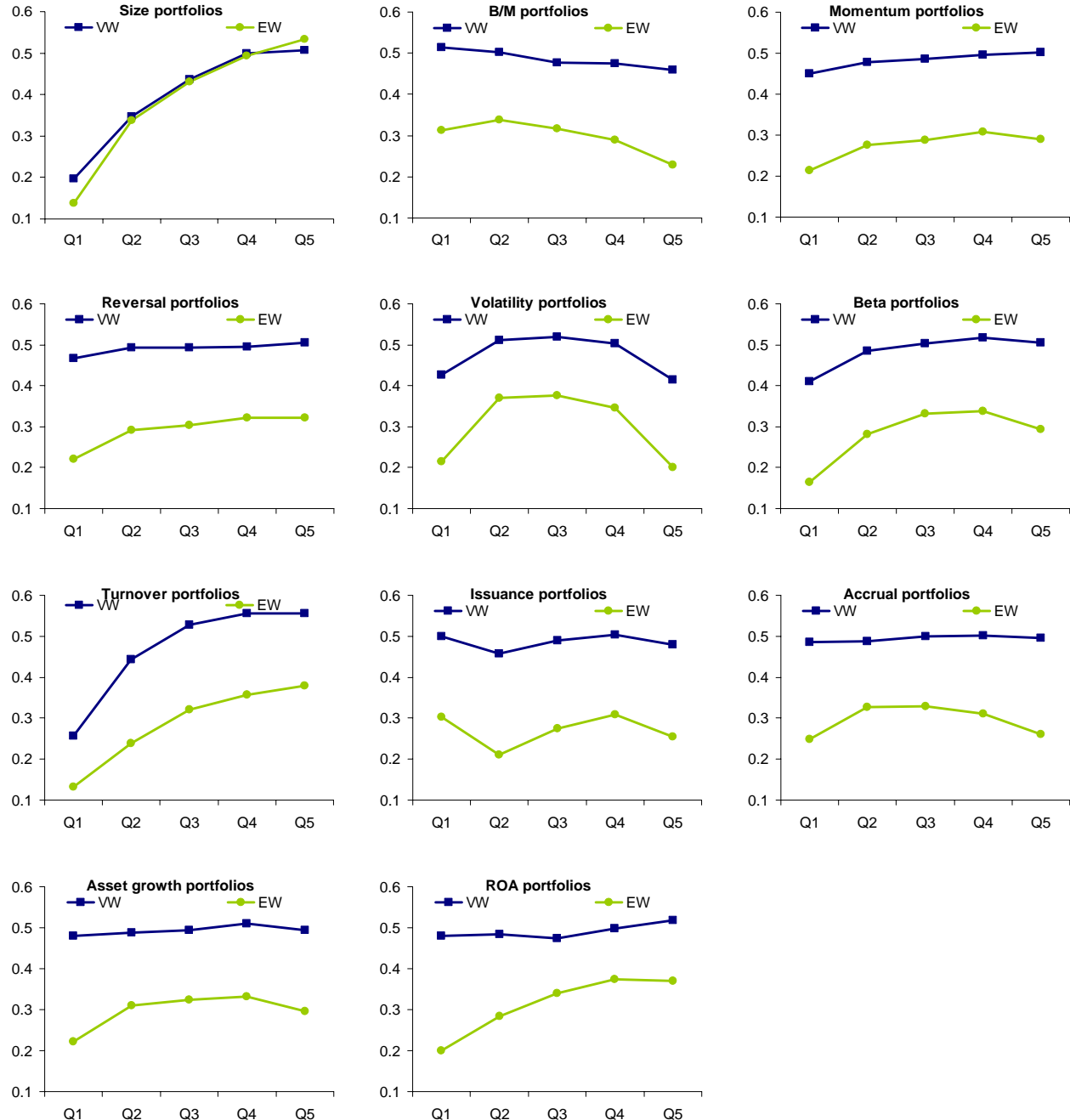
The table reports Fama-MacBeth cross-sectional regressions (t-statistics below slope estimates) of quarterly stock returns (in %) on institutional ownership (IO) and other firm characteristics. The left-hand columns use all firms while the right-hand columns use only firms with market cap above the NYSE median. Regressors are measured at the end of the prior quarter and winsorized at the 1st and 99th percentiles. IO is the fraction of a firm's shares held by institutions; LogSize is log market cap; LogB/M is log book equity for the most recent fiscal of year (with a 4-month delay) minus LogSize; Returns_{-12to-2} are returns from month -12 to -2; Returns_{-36to-13} are returns from month -36 to -13; Volatility_{-12to-1} is the daily standard deviation of returns during the prior 12 months; Beta is the market beta estimated from at least 24 and up to 60 months of past monthly returns; Turnover_{-12to-1} equals shares traded divided by shares outstanding for the prior 12 months; Issuance_{-12to-1} is the log growth in split-adjusted shares outstanding during the prior 12 months; Accruals₋₁ are operating accruals, as per Sloan (1996); Asset growth₋₁ is the log growth in the book value of total assets during the prior fiscal year; and ROA₋₁ is earnings per share before extraordinary items divided by lagged assets per share. N is the average number of firms in the sample. All regressions require firms to have data for LogSize, LogB/M, Returns_{-12to-2}, and IO. Returns, market cap, shares outstanding, and turnover come from CRSP, accounting data come from Compustat, and institutional holdings come from Thomson Financial.

	All stocks				Large stocks			
LogSize	-0.24	-0.37	-0.35	-0.11	-0.18	-0.24		
	-1.25	-2.11	-3.52	-0.71	-1.09	-1.82		
LogB/M	1.57	1.50	0.67	0.68	0.68	0.52		
	5.29	5.11	3.10	2.09	2.11	2.04		
Returns _{-12to-2}	3.19	3.19	2.80	2.70	2.71	2.73		
	5.79	5.71	7.28	3.87	3.88	4.78		
Inst. ownership	-0.27	1.82	1.95	0.93	1.20	0.62		
	-0.21	2.58	3.24	1.40	1.77	1.05		
Returns _{-36to-13}			-0.13			0.09		
			-0.53			0.29		
Volatility _{-12to-1}			-1.61			-11.71		
			-0.42			-1.77		
Beta			0.56			0.20		
			1.58			0.42		
Turnover _{-12to-1}			-9.84			1.68		
			-3.66			0.64		
Issuance _{-12to-1}			-2.84			-2.54		
			-5.20			-3.66		
Accruals ₋₁			-2.68			-2.47		
			-3.04			-1.92		
Asset growth ₋₁			-2.77			-1.36		
			-8.14			-3.24		
ROA ₋₁			3.48			4.53		
			3.20			2.74		
N	4,661	4,661	4,661	3,633	1,090	1,090	1,090	906

Figure A1

Institutional ownership across characteristic-sorted portfolios, 1980–2007

The figure shows equal- and value-weighted institutional ownership for stock portfolios (quintiles, Q1-Q5, based on NYSE breakpoints) sorted by size (market cap), B/M (book equity for the most recent fiscal of year divided by size), momentum (returns from month -12 to -2), reversals (returns from month -36 to -13), volatility (daily standard deviation during the prior 12 months), beta (estimated from at least 24 and up to 60 months of past monthly returns), turnover (shared traded divided by shares outstanding for the prior 12 months), issuance (growth in split-adjusted shares outstanding during the prior 12 months), accruals (as per Sloan, 1996), asset growth (growth in the book value of total assets during the prior fiscal year), and ROA (earnings per share before extraordinary items divided by lagged assets per share). Returns, market cap, shares outstanding, and turnover come from CRSP, accounting data come from Compustat, and institutional holdings come from Thomson Financial.



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