Institutional Investors and Stock Return Anomalies

Abstract

We examine institutional investor demand for stocks that are categorized as mispriced according to twelve well-known pricing anomalies. We find that institutional demand prior to anomaly portfolio formation is typically on the wrong side of the anomalies' implied mispricing. That is, we find increases in institutional ownership for overvalued stocks and decreases in institutional ownership for undervalued stocks. Moreover, abnormal returns for all twelve anomalies are concentrated almost entirely in stocks with institutional demand on the wrong side. We consider several competing explanations for these puzzling results.

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1. Introduction

A longstanding debate in finance concerns the extent to which institutional investors are sophisticated in their investment decisions. One of the recent entries in this literature, Lewellen (2011), examines the aggregate holdings of institutional investors and finds little evidence of stock-picking skill. In particular, he finds that institutions as a whole essentially hold the market portfolio and fail to tilt their portfolios to take advantage of well-known stock return anomalies. This analysis of how institutional holdings relate to stock return anomalies puts aside the general question of whether institutional investors are informed and focuses on a simpler question: do they exploit well-known sources of predictability in returns? The fact that institutions fail to use such information raises serious questions about their sophistication and potential role as arbitrageurs in the stock market

We expand on this line of inquiry. Lewellen's (2011) analysis is based on the level of institutional holdings – which likely reflect portfolio decisions made long before the anomaly portfolio formation period whereas stock characteristics associated with return predictability (e.g., past returns, earnings, equity issuance, investment) are transient. Thus, the level of holdings may not yield particularly sharp inferences regarding institutions' participation in anomalies. We examine changes in institutional holdings during the anomaly portfolio formation period (prior to anomaly returns) to provide insights into how institutional investors modify their portfolios as stocks take on their anomaly defining characteristics. We also focus on initiations and terminations of positions, which are more likely to reflect informed trades than adjustments to ongoing positions that often reflect operational trades to accommodate investor flows or portfolio rebalancing.

We find that not only do institutional investors fail to tilt their portfolios to take advantage of anomalies, they trade contrary to anomaly prescriptions and contribute to mispricing. Most notably, they have a strong propensity to buy stocks classified as 'overvalued' (i.e., short leg of anomaly portfolio). For example, there is a net *increase* in both the number of institutional investors and fraction of shares held by institutional investors in short-leg stocks for all twelve anomalies considered.[1] Notably, in nine out of the twelve anomalies there is greater institutional buying in short-leg stocks than in long-leg stocks – despite the fact that anomaly returns are largely driven by the negative returns of the short-leg portfolios [Stambaugh, Yu, and Yuan (2012)]. Moreover, pre-anomaly changes in institutional ownership are maintained throughout the subsequent performance evaluation period. In particular, institutional ownership of the short-leg stocks continues to increase while they earn abnormally low returns.

Importantly, institutions' contrary trading does not translate into successful stock picking -- anomaly returns are significantly greater when institutions defy the anomaly prescriptions than when they follow them. Across the twelve anomalies we examine, the monthly three-factor alpha for long-short portfolios formed using stocks where the change in institutional investors is on the wrong side of the anomalies is 84 bps (t-stat=5.7), versus 22 bps (t-stat=1.6) for portfolios formed using stocks where the change in institutional investors is on the right side.[2] Thus, the long-leg stocks with the greatest decrease in institutions and short-leg stocks with the greatest increase in institutions are the primary drivers of anomaly returns.

The fact that anomaly returns are concentrated primarily in stocks where institutions trade contrary to the anomaly prescriptions has important implications regarding the role of

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[1] Our list of anomalies include ten of the eleven anomalies in Stambaugh, Yu, and Yuan (2012) plus the book-to-market anomaly and the undervalued minus overvalued anomaly of Hirshleifer and Jiang (2010). We exclude failure probability from the list of eleven anomalies in Stambaugh et al. (2012) due to its high degree of overlap with Ohlson's (1980) O-score measure of financial distress.

[2] We characterize each stock in an anomaly portfolio according to whether changes in institutional investors during the pre-anomaly trading window were on the 'right side' or 'wrong side' of the anomaly's implied mispricing. Stocks in the long-leg of an anomaly portfolio with an increase (decrease) in institutional investors during the pre-anomaly trading window are labeled right side (wrong side). Likewise, stocks in the short-leg of an anomaly portfolio with a decrease (increase) in institutional investors are labeled right side (wrong side).

institutional investors and limits-of-arbitrage in stock return anomalies. Lewellen's (2011) evidence that the aggregate institutional portfolio does not deviate efficiently from the market portfolio vis-à-vis anomalies suggests that institutions' failure to capitalize on anomalies is not due to their unwillingness to take on idiosyncratic risk [Shleifer and Vishny (1997)]. Our evidence that institutions actively trade these stocks (but in the wrong direction) lends further support to this conclusion but also casts doubt on friction-based limits-of-arbitrage (e.g., transaction costs and short-sale constraints) as explanations for why institutions fail to exploit these opportunities.

Stambaugh, Yu, and Yuan (2013) argue that short-sale constraints contribute to persistent overpricing. Our evidence suggests that short-sale constraints faced by institutional investors are not of first-order importance in explaining anomalies. First, to the extent that institutional investors use overvaluation signals but are constrained from exploiting them fully due to short-sale restrictions, we would expect to see poor returns concentrated in the short-leg stocks with institutional selling – yet we find just the opposite as they are concentrated in stocks with substantial institutional buying. Second, to the extent that short-sale constraints are relevant, their effect should be most pronounced at mutual funds where short-sale restrictions are greatest [Chen, Hong, and Stein (2002); Hong and Sraer (2012)] -- yet we find that the relations are notably weaker for the mutual fund sample. And third, short-leg stocks with institutional buying earn the lowest returns despite the fact that they do not exhibit the stock characteristics typically associated with significant short-sale constraints (e.g., low institutional ownership, high idiosyncratic volatility, low liquidity etc.).

More generally, the negative relation between changes in institutional holdings and future returns we document is in sharp contrast to the positive relation between changes in institutional holdings and future stock returns found in other studies [see e.g., Grinblatt, Titman, Wermers (1995), Wermers (1999), Chen, Hong, Stein (2002), Chen, Jagadeesh, Wermers (2002), Bennet, Sias, Starks (2003), Sias (2004), and Sias, Starks, Titman (2006)]. However, the horizons we examine (12-18 months) are generally longer than that of the above studies (3-6 months).[3] As noted in Jain (2009), the relation between institutional trading and future returns depends critically on the horizon over which institutional trading and future returns are measured. For example, the literature indicates that institutional trading is negatively related to future returns for horizons longer than one year [see e.g., Gutierrez and Kelly (2009), and Dasgupta, Prat, and Verardo (2011)].[4]

We find the same horizon-dependent pattern in the relation between changes in institutional holdings and future returns in the context of our study. In particular, we find a significant positive relation between quarterly changes in institutional holdings and next-quarter returns that turns negative as the horizon extends to a year or longer. The fact that the negative long-horizon relation subsumes the positive short-horizon relation suggests that the short-horizon relation likely reflects temporary price pressure as opposed to informed trading by institutions. Whatever the case may be, the longer horizon is more relevant to our inquiry for two reasons. First, our central hypothesis concerns how institutional investors modify their portfolios as stocks take on their anomaly defining characteristics. Both the standard anomaly portfolio formation period and the standard anomaly return interval span a year (or longer for three of the twelve anomalies). Second, the changes in institutional holdings we document persist beyond the portfolio formation

[3] Studies also differ in their choice of measure for institutional demand (number vs. % held), scaling of changes in demand, and type of institution (all institutions vs. mutual funds) – these differences appear less important to inferences than length of horizon.

[4] In those cases in the above studies where the horizon extends beyond 6 months the relation tends to be insignificant (or even negative). See i.e., Grinblatt Titman and Wermers (1995), Wermers (1999), Chen Hong and Stein (2002), Sias (2004) and Chen Jagadeesh and Wermers (2002)].

through the entire anomaly return interval, and thus, the longer horizon is more relevant to their holding period.

A growing literature finds that the trades of institutions are often driven by the flows from beneficial shareholders [Edelen (1999)]. Evidence from this literature suggests that the effects from correlated flow can be relatively protracted [see, for instance, Coval and Stafford (2007), Frazzini and Lamont (2008), and Khan, Kogan, and Serafeim (2012)]. Thus, the negative relation between changes in institutional holdings and future anomaly returns we document is potentially consistent with price reversals from investor flow. Several robustness checks and alternative methodologies to control for flow reveal that our results are not due to investor flow. For example, we find nearly identical results when we exclude mutual funds from our sample – where flow effects are likely to be most severe. Alternatively, when we restrict our sample to only mutual funds and directly control for flow using the methodology in Coval and Stafford (2007), we again find nearly identical results.

A large body of literature portrays institutions as relatively sophisticated investors who, in the absence of frictions, correct mispricing. However, our evidence seems more consistent with a causal role for institutions as opposed to an arbitrager role. Indeed, perhaps the real limits-of-arbitrage is the prospect of having to go against the widespread actions of institutional investors. This notion that institutions may contribute to mispricing is consistent with studies that suggest that institutional herding can be destabilizing [see i.e., Coval and Stafford (2007), Frazzini and Lamont (2008), Gutierrez and Kelly (2009) and Dasgupta, Prat, and Verardo (2011)]. Our results have implications for alternative motives behind institutional herding proposed in earlier studies. The fact that institutions trade contrary to widely known ex-ante valuation signals casts doubt on herding motives related to private information acquisition. Moreover, the fact that our results are not related to persistence in institutional demand [Dasgupta et al (2011)], which we directly control for using their metric, casts doubt on reputational herding. To the extent that the institutional behavior we document reflects herding, the likely explanation is common tracking of firm characteristics perhaps in response to prudent-man investing constraints [Lakonishok, Shleifer, and Vishny (1994), Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001), Barberis and Shleifer (2003), Bennett, Sias, and Starks (2003)].

In what follows, Section 2 describes the data and variables used in our analysis. Section 3 documents changes in institutional investors prior to anomaly portfolio formation. Section 4 examines the returns to anomalies conditioning on changes in institutional investors. Section 5 discusses possible explanations and Section 6 concludes the study.

2. Sample, data, and variable definitions

2.1. Stock return anomalies

Data on the defining anomaly characteristics and stock returns is obtained from CRSP, Compustat, and SDC Global New Issues databases. Our initial sample includes US common stocks (CRSP share codes of 10 or 11) traded on the NYSE, AMEX, and Nasdaq from January 1977 through June 2012. We exclude utilities, financials, and stocks priced under $5—results are nearly identical if we include them. To avoid survivorship bias, we adjust monthly stock returns for stock delistings using the CRSP monthly delisting file following Shumway (1997). Quarterly data on institutional holdings is obtained from Thomson-Reuters Institutional Holdings (13F) starting in March 1981; quarterly data on mutual fund holdings are from Thomson-Reuters Mutual Fund Holdings database; and annual data on shareholders of record is from Compustat.

Table 1 presents a detailed description of the twelve stock return anomalies we examine along with a primary literature reference. The list includes ten of the eleven anomalies in

Stambaugh, Yu, and Yuan (2012) plus the book-to-market anomaly and the undervalued minus overvalued anomaly of Hirshleifer and Jiang (2010).[5] From Table 1, the anomalies reflect sorts on various measures of financing, investment, profitability, stock returns, and financial distress.

[Table 1 around here]

We follow standard conventions in the literature for constructing anomaly portfolios, except for the case of momentum where we deviate somewhat to accommodate our analysis of changes in institutional holdings. For each anomaly except momentum, we rank stocks on June 30th of year *t* using data observed either at calendar year-end *t*-1 or the fiscal year-end in year *t*-1, and hold the stocks for twelve months from July *t* through June *t*+1.[6] In the case of momentum, we rank stocks on a quarterly basis using stock returns from the previous four calendar quarters and hold them for three months after skipping one month.[7] For each anomaly, we sort stocks into three groups: the bottom 30%, middle 40%, and the top 30% and further partition stocks in the bottom and top groups according to whether they are above or below the median market capitalization of stocks on the NYSE at the end of year *t*-1. Anomaly returns are calculated as the difference between the value-weighted returns of the two top portfolios and two bottom portfolios. We start constructing the anomaly portfolios in June of 1982 since institutional holdings data for is available starting in 1981. As a result, the sample period for anomaly portfolio returns extends from July 1982 though June 2012.

Table 2 documents the magnitude and statistical significance of returns for each of the twelve anomalies, confirming the presence of each during our sample period. In particular, the

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[5] We exclude failure probability from the eleven anomalies in Stambaugh, Yu, and Yuan (2012) due to its high degree of overlap with Ohlson's (1980) O-score measure of financial distress.

[6] Two of the anomalies (composite equity issuance and undervalued minus overvalued) use more than one year of historical data (five and two years, respectively).

[7] The results are robust to using more conventional specifications of momentum strategies that sort stocks on returns over the prior three to twelve months and hold stocks for three to twelve months with monthly rebalancing.

Fama-French (1993) three-factor abnormal returns for the long-short portfolio are economically and statistically significant in all cases. The monthly abnormal returns range between 25 basis points per month (t-stat=3.0) for the accruals anomaly and 76 basis points (t-stat=6.8) for the gross profitability anomaly. The combination anomaly portfolio ("COMB") that takes equal positions across the twelve anomalies each month earns a three-factor alpha of 53 basis points with a t-statistic of 8.4. Table 2 also shows that the anomalies derive most of their abnormal returns from the short leg ('overvalued' stocks). Several studies attribute this long-short asymmetry to Miller's (1977) argument that differences of opinion with short-sale constraints can cause overpricing [see also Diether, Malloy, Scherbina (2002), and Stambaugh, Yu, and Yuan (2012)].

[Table 2 around here]

2.2. Changes in institutional investors

Institutional investor demand is measured in various ways in the literature depending on the hypothesis being tested. The primary differences in these measures lie in their choice between the level of holdings vs changes in holdings and the number of institutions vs shares held by institutions (see table 1). Our central hypothesis centers around how institutional investors modify their portfolios as stocks take on anomaly characteristics. Thus, we examine changes in holdings which reflect trades over a given interval of time rather than the level of holdings which reflect the accumulation of trades since portfolio inception. We also focus primarily on the number of institutions rather than shares held by institutions for several reasons. First we are interested in an assessment of institutional investors' actions – not how they influence prices [as in Gompers and Metrick (2001)]. An equal weighted account of their actions (number of institutions) seems more appropriate than value weighting (shares held). Second, changes in the number of institutions is more likely to reflect information-motivated trades (i.e. anomalies) because it tracks initiated and terminated positions whereas changes in shares held includes adjustments to ongoing positions, and thus, often reflects operational motives such as investor flow and portfolio rebalancing (cite papers in literature).[8] Nevertheless it is worth noting that the results are always qualitatively similar (though sometimes only marginally significant) when we use changes in the percentage of shares held as our measure of institutional demand.

Figure 1 depicts the time line for anomaly portfolio construction, institutional trading, and returns for the twelve anomalies. Our aim is to measure changes in institutional ownership during a fixed period that roughly corresponds to the realization of anomaly ranking variables, plus a one-quarter extension to insure that they (e.g., annual 10-k filings) are observable during the pre-anomaly trading window. Thus, we measure changes in institutional ownership over calendar year *t*-1 through March of year *t*. We stop in March (rather than June, when the anomaly return measurement begins) to insure that anomaly returns are not influenced by price pressure from serially correlated institutional trades [see, e.g., Sias et al. (2006)] or disclosure of portfolio holdings (they are reported within 45 days of calendar quarter end).[9]

As previously noted, an exception to this timing occurs in the case of the momentum, where we form portfolios each January, April, July, and October using stock returns from the previous 12 months and institutional holdings from the previous five calendar quarters, and hold the portfolios for the following three months. Here we refrain from leaving a larger gap due to the momentum strategy's sensitivity to time horizons [Jegadeesh and Titman (1993)].

[Figure 1 around here]

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[8] Several studies argue/provide evidence that count-based measures are better in capturing the information content of institutional investor demand (see e.g. Jones, Kaul and Lipson (1994), Sias, Starks and Titman (2006) Alti and Suleman (2011)).

[9] Brown and Schwarz (2013) document positive announcement returns and abnormal trading volume around the disclosure of institutional investors' portfolio holdings.

To differentiate between competing hypotheses, we employ alternative measures of investor demand, including the change in fraction of shares held by institutional investors (Δ%Inst); the change in fraction of shares held by mutual funds (Δ%MF); and the percentage change in number of shareholders of record, i.e., 'individual' shareholders (Δ#Shrs).[10] We compute Δ%Inst and Δ%MF over the same time interval as our primary measure, Δ#Inst. Data on shareholders of record are available only on an annual basis so Δ#Shrs is computed over the fiscal years ending in calendar year *t-2* and year *t-1*. Each of these measures are winsorized at the 1% level in both tails in order to minimize the effect of outliers.

3. Institutional investor demand prior to anomalies

Table 3 documents changes in the number of institutional investors during the pre-anomaly trading window, along with the alternative measures of investor demand. For purposes of comparison, neutral stocks (middle 40% of anomaly ranking) show an average Δ#Inst of 26% and an average Δ%Inst of 3%, reflecting a general increase in both the number and ownership of institutional investors during the sample period. Long leg stocks show a slightly higher average Δ#Inst of 30% and short leg stocks show a much higher average Δ#Inst of 43%. Under the sophisticated institutions hypothesis, one would expect to observe the opposite – a relatively large Δ#Inst for stocks in the long leg of the anomalies and a relatively small Δ#Inst for stocks in the short leg of the anomalies. This contrary trading pattern of institutions holds in nine of the twelve anomalies.[11]

[10] Due to the way institutional holdings are reported by Thomson-Reuters, an absence of holdings can indicate either zero institutional ownership, an inactive company, or missing data. We exclude missing observations instead of setting them to zero to avoid data errors. The results are somewhat stronger if we set missing observations to zero.

[11] To address concerns of outliers, we also examine the percent change in the aggregate number of institutional investors. The same pattern emerges: changes in aggregate number of institutional investors are much greater in short-leg stocks compared to long-leg stocks.

[Table 3 around here]

The exceptions are the three anomalies based on past operating and stock return performance. In these cases the change in institutional investors is in line with the anomaly's prescription. For gross profitability (GP), return on assets (ROA), and stock return momentum (MOM), Δ#Inst for stocks in the short leg is smaller than Δ#Inst for stocks in the long leg. One potential explanation for the difference in institutional demand for these three anomalies is that institutions' well-known tendency to chase past performance places them on the right side of these anomalies [see, e.g., Falkenstein (1996)]. Additionally, in the case of stock return momentum, the trading pattern might be an artifact of a mechanical (positive) relation between the momentum ranking variable (past returns) and contemporaneous changes in institutional investors via price pressures [see, e.g., Sias, Starks, and Titman (2006)].

Table 3 Panel B replicates the analysis of Panel A using changes in the fraction of stock held by institutional investors. The results are similar to those for changes in number of institutions. In eight out of the twelve anomalies the increase in the fraction of stock held is greater for stocks in the short leg of the anomaly than for stocks in the long leg of the anomaly (statistically significantly different for seven anomalies). Thus, the tendency for institutions to trade contrary to the implied mispricing of the anomalies is evident from both the fractional change in the number of institutional investors holding the stocks and the change in the fraction of shares held by institutional investors. Three of the four exceptions are the anomalies discussed above (Panel A).

Table 3 Panel C replicates the analysis of Panel B, using data on just mutual funds. With mutual funds the magnitudes are smaller and the contrary trading pattern is statistically significant for only four anomalies. Thus, the evidence in Panels A and B that institutions tend to trade on the wrong side of most anomalies is not driven by mutual funds. Finally, Panel D uses changes in the number of shareholders of record (i.e., total number of shareholders) during the fiscal year ending in calendar year *t-1*. From Panel D, eight out of the twelve anomalies exhibit a larger increase in number of shareholders in the short leg. Collectively, the evidence in Table 3 indicates an expansion in the investor base of short-leg stocks' and a contraction in the investor base of long-leg stocks. We investigate the marginal explanatory power of these alternative measures of changes in firms' investor base for future stock return performance in Table 7 of Section 5.1.

4. Anomaly returns and changes in institutional investors

4.1. Anomalies and stock-picking skill

The fact that institutions take positions contrary to anomaly prescriptions does not necessarily imply that these positions underperform. Although long-leg (short-leg) stocks generally yield positive (negative) abnormal returns, it may be that the subset of long-leg stocks sold by institutions, and short-leg stocks bought by institutions, do not exhibit anomalous returns.[12] We refer to this as the stock-picking hypothesis. This section seeks to more precisely link pre-anomaly changes in institutional investors to anomaly returns.

Table 4 reports monthly Fama-French (1993) three-factor alphas for the long and short legs of each of the twelve anomalies using sub-portfolios that condition on whether changes in institutional investors during the pre-anomaly trading window are on the right or wrong side of the anomaly's implied mispricing. The right-side conditional portfolio contains long-leg anomaly stocks with the largest increase in institutional investors and short-leg anomaly stocks with the

[12] For example, Gibson, Safieddine, and Sonti (2004) find that SEOs experiencing the greatest increase in institutional investors outperform over the 3 months following the offering.

smallest increase (or largest decrease) in institutional investors. The wrong-side conditional portfolio contains long-leg anomaly stocks with the smallest increase (or largest decrease) in institutional investors and short-leg anomaly stocks with the largest increase. More precisely, for each anomaly we conduct an independent double sort of all stocks on the basis of Δ#Inst and the anomaly ranking variable. We then assign the intersection of the long and short leg of each anomaly with the top and bottom quintiles of changes in institutional investors as right-side or wrong-side conditional portfolios as defined above.[13]

[Table 4 around here]

The stock-picking hypothesis follows the mutual fund literature's use of the Grinblatt and Titman (1989) holdings-based approach to evaluate fund managers' portfolio selection by relating changes in holdings in period *t-1* to abnormal returns in period *t*. In many cases these studies show that changes in mutual fund holdings are positively related to future abnormal returns. Applied to our anomalies setting, this literature implies that the right-side conditional arbitrage portfolios should yield relatively large positive abnormal returns and wrong-side portfolios should yield at worst negligible abnormal returns.

We find exactly the opposite: anomaly returns are particularly large for stocks with institutions on the wrong side and significantly smaller for stocks with institutions on the right side of the anomalies. From Table 4 Panel A, neither long-leg stocks with large institutional buying nor short-leg stocks with large institutional selling earn significant abnormal returns. When institutional trading is on the right side of the anomalies, the long-minus-short combination portfolio ('COMB') earns an average monthly abnormal return of only 22 basis

[13] We sort stocks into Δ#Inst quintiles to ensure that all stocks in the lowest Δ#Inst group exhibit a decrease in the number of institutional investors to allow us to frame the discussion of changes in terms of buys and sells. The results are very similar if we use the top and bottom 30% sorts.

points with a t-statistic of 1.6. In contrast, the long-minus-short combination portfolio with institutional trading on the wrong side of the anomalies yields an average monthly abnormal return of 84 basis points with a t-statistic of 5.7. Furthermore, all twelve anomalies exhibit statistically significant wrong-side long-minus-short abnormal returns, whereas only four anomalies are significant at the 5% level when institutions trade on the right side. The difference in the right versus wrong-side conditional anomaly returns is 62 basis points (t-stat=2.4).

The predictive power of institutional trades for anomaly returns comes primarily from the short legs of the anomalies. The short-leg stocks with the largest increase in the number of institutions earn an average monthly three-factor alpha of -69 basis points (t-stat=-5.0) versus -20 basis points (t-stat=-1.5) for short-leg stocks with the largest decline in institutions. The difference is statistically significant with a t-statistic of 3.6. All twelve short legs exhibit statistically and economically very significant negative abnormal returns following large institutional buying. The monthly three-factor alphas for 'Short Leg/Inst. Buy' conditional sub-portfolios range between -47 and -132 basis points and the t-statistics range between -3.1 and -5.1. The evidence that the short-leg stocks with the greatest increase in the number of institutions subsequently earn the lowest returns is inconsistent with the idea that institutions exhibit sophistication and stock-picking skill in their trading of anomaly stocks.

In Panel B, we use changes in the fraction of shares held by institutions, rather than number of institutions, to construct right-side and wrong-side anomaly portfolios. Once again, anomaly returns are larger when institutions trade on the wrong side of anomalies compared to the right side; the difference in abnormal returns for the combined long-short portfolio is 41 bp per month (t-stat = -2.5).

Our results indicate that anomaly returns are concentrated in stocks where the change in institutional investors during the pre-anomaly trading window is on the wrong side of the anomaly, even in the case of gross profitability, return on assets, and momentum. Recall that these were the three cases where institutions tend to trade on the right side of the anomaly. Thus, ironically, for the three cases where institutions follow the anomalies' prescription, they still end up on the wrong side of ex-post anomaly returns. In summary, for all twelve anomalies under consideration, trading against institutional investors maximizes expected anomaly returns.

4.2. Future changes in institutional holdings

An important consideration for evaluating the stock-picking hypothesis is the alignment of institutional holding periods and anomaly returns. While the three-month gap we impose between changes in institutional investors and anomaly returns mitigates potential price pressure from serially correlated institutional trades [see, e.g., Sias, Starks, and Titman (2006)], it also raises the possibility that institutions trading on the wrong side might reverse their positions prior to the realization of the long-horizon anomalous returns that we document. This possibility is particularly relevant given the positive relation between changes in institutional holdings and short-horizon (quarterly) returns documented in Wermers (1999), Sias (2004), and several other studies.[14] If institutions reverse their positions during the three-month gap, they might capture shorter-horizon positive abnormal returns while avoiding the longer horizon negative abnormal returns – leaving little to puzzle over regarding their behavior.

Figure 2 examines potential reversals in changes in number of institutional investors. Specifically, we track Δ#Inst cumulatively from the beginning of the pre-anomaly trading

[14] See Grinblatt, Titman, and Wermers (1995), Nofsinger and Sias (1999), Chen, Hong, and Stein (2002), Gibson, Safieddine, and Sonti (2004), Chemmanur, He, and Hu (2009), Alti and Sulaeman (2012), and Gutierrez and Kelly (2009).

window (calendar quarter -5) to the end of the anomaly return performance evaluation window (quarter 4) separately for both the wrong and right sides of long and short-leg anomaly portfolios. Panel A tracks the highest Δ#Inst portfolios (right-side long-leg and wrong-side short-leg) while Panel B tracks the lowest Δ#Inst portfolios (wrong-side long-leg and right-side short-leg). We aggregate the number of institutions for each portfolio each quarter and report the cumulative change over time. Quarters -5 through -1 reflect the pre-anomaly trading window; quarter 0 reflects the three-month gap before performance evaluation; and quarters 1 through 4 reflect the anomaly return performance evaluation window.[15]

[Figure 2 around here]

From Panel A in Figure 2 stocks in the highest Δ#Inst quintile do not experience a reversal in the number of institutional investors regardless of their alignment with the anomaly prescription. Indeed, for both of the highest Δ#Inst portfolios the number of institutional investors continues to increase over the performance evaluation window. Most importantly, for the wrong-side short-leg portfolios the average cumulative change in number of institutional investors is 94% at of the end of the portfolio formation period rising to 113% by the end of the performance evaluation window. Note that, the cumulative Δ#Inst remains higher for wrong-side short-leg stocks compared to right-side long-leg stocks during all ten quarters. This evidence is inconsistent with the notion that institutional demand on the wrong side of anomalies reverses prior to the realization of long horizon anomaly returns, at least on the short-leg side.

Panel B conducts a similar analysis for stocks in the lowest Δ#Inst quintile (i.e., wrong-side long-leg and right-side short-leg). Here we see a small reversal tendency in both portfolios,

[15] Since momentum portfolios are constructed quarterly with a three-month holding period, the cumulative change in number of institutional investors for momentum is measured and included in Figure 2 only until the end of quarter 1.

likely reflecting the upward drift in institutional holdings over the sample period. Note that the number of institutions remains substantially below the initial level in both cases. Collectively, the evidence of Figure 2 shows that, on average, institutional investors do not reverse their pre-anomaly trades over the three-month gap between the pre-anomaly window or –for the most part – during the anomaly performance evaluation window. Thus, it seems reasonable to conclude that institutions' pre-anomaly trades are on the wrong side of both ex-ante anomaly prescriptions (Table 3) and ex-post realized abnormal returns (Table 4).

4.3. Institutional trading and anomaly return horizon

The negative relation between changes in institutional holdings and future returns we document in Section 4.1 stands in stark contrast to the positive relation between changes in institutional holdings and future stock returns found in other studies [see e.g., Grinblatt, Titman, Wermers (1995), Wermers (1999), Chen, Hong, Stein (2002), Chen, Jagadeesh, Wermers (2002), Bennet, Sias, Starks (2003), Sias (2004), and Sias, Starks, Titman (2006)]. However, the horizons we examine (12-18 months) are generally longer than that of the above studies (3-6 months). As noted in Jain (2009), the relation between institutional trading and future returns depends critically on the horizon over which institutional trading and future returns are measured. For example, the literature indicates that institutional trading is negatively related to future returns for horizons longer than one year [see e.g., Gutierrez and Kelly (2009), and Dasgupta, Prat, and Verardo (2011)].[16]

Table 5 examines the relation between institutional trades and subsequent stock returns using alternative time horizons. To facilitate comparison with earlier studies, we explore the

[16]In those cases in the above studies where the horizon extends beyond 6 months the relation tends to be insignificant (or even negative). See i.e., Grinblatt Titman and Wermers (1995), Wermers (1999), Chen Hong and Stein (2002), Sias (2004) and Chen Jagadeesh and Wermers (2002)].

performance of stocks bought against those sold by institutions (as opposed to a comparison of right- versus wrong-side stocks as in Table 4). We estimate the monthly three factor alphas of institutions' buy-minus-sell portfolios separately for the long and short anomaly legs and report the average alphas across the twelve anomalies. Columns 1 through 4 report the average alphas during quarters 1 through 4 after portfolio formation and the last column reports the cumulative alpha over the entire year after portfolio formation. Panel A reports the average alpha of the buy-minus-sell portfolio conditional on the change in the number of institutional investors (Δ#Inst) measured over the five quarters between December of year *t-2* and March of *t* (the original horizon used in Tables 3 and 4). Panel B sorts anomaly stocks by Δ#Inst measured during the one quarter immediately prior to portfolio formation (between April and June of year *t*), and Panel C sorts anomaly stocks by Δ#Inst measured during the entire six quarters prior to portfolio formation.

[Table 5 around here]

Table 5 reveals a significantly positive relation between short-term changes in institutional holdings and next-quarter returns that turns significantly negative when both horizons are extended. In Panel A, we observe that long-horizon changes in the number of institutions are significantly negatively related to the returns of the short-leg stocks during the second, third, and fourth quarters after portfolio formation. In contrast, Panel B shows a relatively short-lived positive and significant relation between the prior quarter's change in the number of institutions and stock returns during the next two quarters. The cumulative Δ#Inst measured over six quarters is significantly negatively related to subsequent returns during the following year.

The fact that the negative long-horizon relation subsumes the positive short-horizon relation suggests that the short-horizon relation likely reflects temporary price pressure as opposed to informed trading by institutions. Whatever the case may be, the longer horizon is more relevant to our inquiry for two reasons. First, our central hypothesis concerns how institutional investors modify their portfolios as stocks take on their anomaly defining characteristics. Both the standard anomaly portfolio formation period and the standard anomaly return interval span a year (or longer for three of the anomalies). Second, as shown in Figure 2, the changes in institutional holdings we document persist beyond the portfolio formation through the entire anomaly return interval, and thus, the longer horizon is more relevant for the performance of institutions' holdings.

4.4. Limits to arbitrage

Our results cast doubt on the conventional characterization of institutions as rational but constrained arbitrageurs. Generally, the limits to arbitrage arguments hold that frictions deter institutions from taking large enough bets to fully eliminate mispricings. The most direct prediction of this argument is that the stocks with the largest anomaly returns should be those with low institutional trading activity. However, Panel A of Table 6 reveals that the average increase in the number of institutions for wrong-side short-leg stocks is 135% as compared to 116% for right-side long-leg stocks. Likewise, the average decrease in number of institutions for wrong-side long-leg stocks is -23%, versus -24% for right-side short-leg stocks. Thus, institutions seem to be very active in trading the wrong-side stocks. Our evidence that institutions actively trade these stocks (but in the wrong direction) lends further support to Lewellen's (2011) conclusion that institutions' failure capitalize on anomalies is not due to their unwillingness to take sufficiently large bets [Shleifer and Vishny (1997)]. Furthermore, the fact that anomaly stocks experience substantial active trading by institutions casts doubt on transaction costs as a key impediment to arbitrage. From Panel B in Table 6, stocks with institutional trading on the wrong side are neither particularly small nor illiquid compared to stocks with institutional trading on the right side.

[Table 6 around here]

Stambaugh, Yu, and Yuan (2013) argue that short-sale constraints contribute to persistent overpricing. Our evidence suggests that short-sale constraints faced by institutional investors are not of first-order importance in anomalies. First, to the extent that institutional investors use overvaluation signals but are constrained from exploiting them fully due to short-sale restrictions, we would expect to see poor returns concentrated in the short-leg stocks with institutional selling – yet we find just the opposite as they are concentrated in stocks with substantial institutional buying.[17] Second, to the extent that short-sale constraints are relevant, their effect should be most pronounced at mutual funds where short-sale restrictions are greatest [Chen, Hong, and Stein (2002); Hong and Sraer (2012)] -- yet we find that the relations are notably weaker for the mutual fund sample. And third, short-leg stocks with institutional buying earn the lowest returns despite the fact that they do not exhibit the stock characteristics typically associated with significant short-sale constraints. From Panel B in Table 6, the short-leg stocks institutions buy have similar institutional ownership and idiosyncratic volatility as compared to the long-leg stocks they buy.

5. Potential explanations

5.1. Institutional trading and investor flow

An important consideration when interpreting institutional trading activity is the potential effects of investor flow. Edelen (1999) finds that roughly 30% of all mutual fund trades are in

[17] Chen, Hong, and Stein (2002) also predict a positive relation between changes in institutional investor breadth and future stock returns arising from short-sale constraints in a model of heterogeneous expectations.

response to investor flow. Moreover, trading in response to flow can cause price-pressure in the underlying stocks of institutional portfolios. For example, Khan, Kogan, and Serafeim (2012) argue that mispricing prior to SEOs is related to price pressures by mutual funds experiencing large investor inflows. Likewise, Frazzini and Lamont (2008) argue that the value effect is due, in part, to mispricing from investor flows into mutual funds holding growth stocks. More generally, Coval and Stafford (2007) show that correlated investor flows into institutional portfolios with common investment objects (particularly highly specialized) can cause relatively protracted price-pressures and subsequent reversals. Thus, the puzzling institutional trading that we find conceivably originates with beneficial investors rather than the portfolio managers.

In what follows, our methodology includes several elements to distinguish between flow-driven and discretionary trades. First, following Sias, Starks, and Titman (2006), we compare two different measures of institutional trading: the change in the number of institutions and the change in the fraction of shares held by institutions. As Khan et al. (2012) show, mutual fund inflows typically go towards expansion of existing positions rather than new positions. Hence, flow-induced price pressure should be more closely related to the change in fraction of shares held (which reflects both expansions/contractions and new/closed positions) than the change in number of institutions holding the stock (which reflects only new/closed positions). Preliminary evidence that the institutional trading activity is not driven by flow is presented in Table 4. Note that the change in number of institutions produces a larger spread between the right-side and wrong-side anomaly portfolio returns (-62 bps from Panel B) than the change in the fraction of shares held by institutions (-41 bps from Panel C). This suggests that initiations and terminations of positions rather than adjustments to ongoing positions are the primary driver of our results.

Table 7 provides Fama-MacBeth regressions to more directly address the relevance of initiations and terminations versus adjustments to ongoing positions. The regressions use monthly raw returns from July of year *t* through June of year *t+1*, on Δ#Inst, Δ%Inst, and a variety of untabulated controls.[18] Focusing first on Δ#Inst, note that anomaly returns are strongest where institutions trade contrary to the anomaly prescription. In Panel A (short leg), the coefficients on Δ#Inst are negative and statistically significant for all twelve anomalies (p-value of less than 5%) with an average t-statistic of -3.3. Likewise, from Panel B (long leg) the coefficients on Δ#Inst are negative across the board, with a p-value of 5% or less for seven of the twelve anomalies, and an average t-statistic of -2.4. By contrast, the coefficient on Δ%Inst, the measure most relevant for flow, is insignificant for eleven anomalies on the short legs and all twelve anomalies on the long legs. Thus, initiations and terminations appear far more relevant to anomaly returns than adjustments, casting doubt on flow as a source of the results.

[Table 7 around here]

Table 8 uses Fama-MacBeth regressions similar to Table 7 to provides further evidence regarding the possibility that the negative relation between Δ#Inst and anomaly returns is caused by flow by focusing on mutual funds – where flow-induced trading is likely most severe. Model 1 relates anomaly returns to the change in the number of mutual funds holding the stock (Δ#MF) and the change in the fraction of a stock held by mutual funds (Δ%MF) during the pre-anomaly trading window. We find that the coefficients on the two mutual fund measures are insignificant in both panels A (short leg) and B (long leg). In model 2, we add Δ#Inst to the regressions and

[18] Controls are: log market capitalization; log book to market ratio; cumulative stock returns during the pre-anomaly trading window; the fraction of the firm held by institutional investors; the number of institutional investors; and the Amihud illiquidity ratio.

split the total change in the fraction of shares held by institutional investors into its mutual fund (Δ%MF) and non-mutual-fund (Δ%nonMF = Δ%Inst - Δ%MF) components.[19] The coefficient on Δ%MF is insignificant while Δ#Inst is significantly negative in both panels. Thus, are results are not driven by mutual funds, where flow effects are likely most severe.

[Table 8 around here]

In models 3 and 4 of Table 8, we directly control for mutual fund flow using the methodology developed in Coval and Stafford (2007) to identify stocks with flow-induced buying and selling pressure. Due to the incompleteness of the mutual fund flow data prior to 1990, we limit the sample in the last two models to 1991-2012 (see Coval and Stafford (2007)). Model 3 splits Δ%MF into its Δ%MF(Flow-induced) and Δ%MF(Non-flow) components. Δ%MF (Flow-induced) is the change in fraction of stock held by mutual funds under in-flow or out-flow pressure.[20] Δ%MF(Non-flow) is the change in the fraction of the stock held by mutual funds that are not under flow pressure. Model 3 confirms that flow-induced changes in the fraction of shares held by mutual funds are insignificantly related to future stock returns irrespective of the anomaly leg, while Δ#Inst remains significantly negative in both legs. Finally, in model 4 we exclude stocks under flow-induced buying or selling pressure and re-estimate our main specification of Table 7. Following Khan et al. (2012), we classify a stock as under flow-driven buying (selling) pressure if it is in the top (bottom) decile of Δ%MF(Flow-

[19] It is not possible to conduct a similar decomposition to the change in the number of institutional investors since 13F filings report mutual funds at the family level. As a result, Δ#non-MF cannot be calculated as the difference between Δ#Inst and Δ#MF.

[20] Following Coval and Stafford (2007), a mutual fund is classified as under in-flow driven buying pressure (out-flow driven selling pressure) during the year if the fund was subject to capital flows in the top (bottom) 10% of all mutual funds in at least one quarter during that year.

induced) and in the middle three deciles of Δ%MF(Non-flow).[21] The coefficients on Δ#Inst remain significantly negative on both legs after excluding stocks bought and sold by mutual funds under flow-induced pressure. Thus, by all counts, the relation between changes in institutional investors and long-horizon returns does not appear to be driven by investor flow.

5.2. Micro-cap stocks

A natural question concerns the extent to which our results are driven by micro-cap stocks. Our empirical methodology minimizes the effect of micro-cap stocks in several ways. First, we restrict our sample to firms with a stock price of at least $5 at the time of portfolio formation. Second, our data requirements exclude stocks with zero institutional ownership during the pre-anomaly trading window -- which excludes many micro-cap stocks especially early on in the sample period. Third, following standard convention in the anomalies literature, we construct portfolios by sorting both on the anomaly variable and on market capitalization using the median NYSE size (see Fama and French (1993)). Fourth, the anomaly portfolio returns reported in Table 4 are value-weighted using the market capitalization of stocks prior to portfolio formation. Fifth, our Fama-MacBeth regressions in Tables 7 and 8 include the natural logarithm of market capitalization as of June of year *t* as a control variable. Sixth, in untabulated results, we repeated the analysis in Table 4 excluding stocks with less than five institutional investors. The results are again nearly identical to those of Table 4. We conclude that micro-cap stocks do not overly influence our results.

[21] In untabulated results, we find that stocks under flow-induced pressure constitute between 2% and 4% of the portfolio depending on the anomaly.

5.3. Mispricing: Evidence from earnings announcements

Several studies attempt to distinguish between mispricing and risk-based explanations of financial anomalies by examining returns around earnings announcements (see, e.g., Bernard and Thomas, 1990; Chopra et al., 1992; La Porta et al. 1997). The basic idea is that valuation errors caused by biased expectations about future cash flows should be corrected, in part, during subsequent earnings announcements (Lewellen, 2010). We use this methodology to directly test the hypothesis that our results stem from institutions holding faulty cash flow expectations – i.e., that institutions show relatively high interest in overvalued stocks and relatively low interest in undervalued stocks (perhaps due to causality). Under this hypothesis, we should observe negative announcement period returns for wrong-side short-leg stocks (overvalued stocks they buy) and positive announcement returns for wrong-side long-leg stocks (undervalued stocks they sell). In contrast, right side stocks should exhibit little or no abnormal earnings announcement returns because they have little remaining anomaly returns.

Table 9 reports the average announcement period abnormal return for the four quarterly earnings announcements during the performance evaluation window. Following standard convention for this literature, we compute abnormal returns as the average daily return during the three-day earnings announcement window (event days -1 and +1) minus the average daily return of the same stock outside the earnings announcement window. For robustness we also report market-adjusted abnormal returns and abnormal returns over a longer window (days -3 to 3). From Panel A, wrong-side long-leg stocks (sold by institutions) appear to experience significant positive cash-flow surprises during earnings announcements for all 12 anomalies (average t-stat of 3.1). Likewise, wrong-side short-leg stocks (bought by institutions) appear to experience significant negative cash-flow surprises for all 12 anomalies (average t-stat of -3.5). Together, a strategy that buys long-leg stocks sold by institutions and sells short-leg stocks bought by institutions generates on average 19 basis points (t-stat of 7.2) daily abnormal return during the three days around earnings announcements. By comparison, earnings announcement returns for right-side stocks are, for the most part, statistically insignificant. From Panel B, these results are robust to using a seven-day event window as well as market-adjusted announcement returns. This evidence suggests that at least some of the anomalous returns associated with institutions taking the wrong side of anomalies are due to errors in cash-flow expectations.

[Table 9 around here]

Curiously, this bias in cash flow expectations seems to apply to long-horizon earnings (i.e., the next 6-18 months) but not short-horizon (i.e., the next quarter) earnings. In unreported results we find a positive relation between changes in institutional holdings and earnings announcement returns in the following quarter. This is consistent with earlier evidence by Baker, Litov, Wachter, and Wurgler (2010) that stocks bought by mutual funds' outperform those sold by mutual funds during the next quarter. This difference in the relation between changes in institutional holdings and earnings announcement period returns might be just another manifestation of the more general difference in the relation between changes in institutional holdings and short versus long-horizon returns discussed in Section 4.2.

5.4. Institutional herding

The mispricing explanation and evidence in section 5.3 contradicts the conventional wisdom that institutional investors are relatively informed.[22] However, it is consistent with a growing body of research that suggests institutional herding can be destabilizing, resulting in

[22] See i.e., Coval and Moskowitz (2001), Badrinath and Wahal (2002), Cohen, Gompers, and Vuolteenaho (2002), Parrino, Sias, and Starks (2003), Gibson, Safieddine, and Sonti (2004), Alti and Sulaeman (2012).

long-horizon return reversals [Coval and Stafford (2007), Gutierrez and Kelly (2009) and Dasgupta, Prat, and Verardo (2011)]. This literature examines a number alternative motives for herding, including managerial reputation [Scharfstein and Stein (1990)], information acquisition [Banerjee (1992), Bikhchandani, Hirshleifer and Welch (1992)], and tracking of common firm characteristics [Lakonishok, Shleifer, and Vishny (1994), Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001), Barberis and Shleifer (2003), Bennett, Sias, and Starks (2003)]. Our evidence casts doubt on herding explanations based on information acquisition, at least in the context of stock return anomalies. Such an explanation is hard to reconcile with our evidence that institutions trade contrary to widely known ex-ante valuation signals, confirmed by ex-post poor returns. It is more consistent with agency conflicts and/or behavioral biases relating to managerial reputation or tracking common firm characteristics.

A particularly relevant paper in this literature is Dasgupta et al. (2011), which documents that stocks that are persistently bought or sold by institutions over three to five consecutive quarters experience subsequent long-term stock return reversals. Following Dasgupta et al. (2011), we place stock-years with an increase or decrease in institutional ownership over three or more adjacent quarters during the pre-anomaly period in a "persistent changes" subsample, and all other stock-years in a "non-persistent" subsample. We then repeat the analysis of Table 4 separately for the two samples, focusing only on the combined anomaly portfolio. From Panel A of Table 10, using the persistent change sample, right-side long-short anomaly portfolios earn an average three factor alpha of 21 basis points per month (t-statistic of 1.3), versus 73 basis points per month (t-statistic of 4.4) for wrong-side anomaly portfolios (difference t-statistic of 1.8). Using the non-persistent sample, institutions trading on the right-side earn an average three factor alpha of 18 basis points per month (t-statistic of 1.1) versus 92 basis points (t-statistic of

5.8) for wrong-side portfolios (difference t-statistic of 2.7). Thus, abnormal returns appear to be slightly smaller when the change in institutional ownership is more persistent over adjacent quarters.

[Table 10 around here]

In Panel B of Table 10, we repeat the Fama-MacBeth analysis of Table 7 including a variable that measures the maximum number of consecutive quarters during year t-1 with an increase (decrease) in the percent of shares held by institutions for short-leg (long-leg) stocks. We refer to this variable as *Buy* (*Sell*) *Persistence*. Neither the coefficient on *Buy Persistence* in the short-leg regression in column 1, nor *Sell Persistence* in the long-leg regression in column 2 is significantly negative. In the next two columns we repeat the baseline regressions from Table 7 using only stocks from the non-persistent change sample. Again, we find that the coefficients on Δ#Inst are significantly negative. Both findings confirm that our results are not driven by persistence in institutional trades over adjacent quarters.

The insignificant role of persistence in Table 10 casts doubt on reputational herding by institutions as a potential explanation for our findings.[23] Thus, to the extent that institutional investors are making poor portfolio decisions, our evidence points to common tracking of firm characteristics as a likely cause. We leave the identification of firm characteristics that trigger correlated trading among institutions to future research, although the defining characteristics of anomalies is an obvious first place to look.

5.5. Institutional awareness of the anomalies

In this section we consider the possibility that growing awareness of the anomalies over

[23] The implicit assumption here is that reputational herding is likely to take place over multiple adjacent quarters as institutions observe and replicate other institutions' past trades. This assumption might be violated if institutions can observe each other's trades contemporaneously and replicate them within the same calendar quarter.

time might have affected institutional investors' demand for stock characteristics associated with predictable stock returns. While it is difficult to precisely date the origin of anomaly-based trading strategies – particularly in practitioner settings – it is likely that some of the anomalies we consider were not widely known during the early part of the sample period. As a result, our results might be weaker in the later part of the sample period especially after academic studies document the profitability of anomaly trading strategies. In Table 11, we compare our main results across sub-periods. First, we split our sample into an early (1982-1996) and late (1997-2011) period. Second, we split the sample by pre- and post-publication dates for each anomaly. Surprisingly, our results are stronger during later years using both approaches.

Panel A of Table 11 reports the average monthly three-factor alpha of the combination ('COMB') right-side minus wrong-side portfolio from Panel B of Table 4 separately for the sub-periods. When the sample is split equally into two for all twelve anomalies, the difference in the monthly alpha for wrong-side versus right-side combination portfolio is -21 bp (t-stat=-0.9) during 1982-1996 versus -93 bp (t-stat=-2.2) during 1997-2011. When the sample is split into pre- and post-publication periods individually for each anomaly category, the monthly alpha for the difference portfolio is -20 bp (t-stat=-0.7) before publication and -0.83 bp (t-stat=-2.3) after publication.[24]

[Table 11 around here]

Panel B repeats the Fama-MacBeth cross-sectional regression analysis from Table 7 in sub-periods and reports the coefficient and t-statistic on the change in the number of institutional

[24] We use the following publication years to split the sample: 1996 for accruals anomalies (ACC and NOA), 2006 for profitability anomalies (GP and ROA), 1993 for corporate investment anomalies (IVA and AG), 1998 for the distress anomaly (O-SC), 1992 for the book-to-market anomaly (B/M), 1993 for the momentum anomaly (MOM), and 1995 for financing anomalies (UMO, CEI, and NSI). We exclude GP and ROA from the pre- versus post-publication analysis in order to allow a meaningful post-period for performance evaluation. Academic studies on each anomaly with the earliest publication dates are listed in Table 1.

investors (Δ#Inst) averaged across the anomalies separately for the short and the long legs of the anomalies and sub-periods. The coefficients are significant only in the later periods using both 1982-1996/1997-2011 and pre/post-publication splits and for both short and long legs of the anomalies. Altogether, the evidence in Table 11 suggests that our results are actually stronger during the later parts of our sample period when anomalies were more widely known, which presents an even bigger challenge to the sophisticated institutions hypothesis.

6. Conclusion

Our findings have implications for the growing debate on the causes of stock return predictability. From a behavioral perspective, our results cast institutional investors as the key culprits in an exhaustive list of asset-pricing anomalies. From an efficient markets perspective, our results raise the possibility that institutional demand is negatively correlated with stochastic discount rates in a way that eludes conventional asset pricing models.

A behavioral interpretation of our results is both odd but at the same time plausible. It is odd because institutions are generally thought of as 'smart' and that should subsume knowledge of the widely cited decades old anomalies literature. But it is plausible because institutional investing entails known agency conflicts such as excessive turnover [Chalmers, Edelen, and Kadlec (1999)], risk taking [Brown, Harlow, and Starks (1996) and Chevalier and Ellison (1997)] and herding for reputational reasons [see studies cited above]. Moreover, if anomalous returns are a consequence of mispricing, then the most obvious place to look for an impact big enough to distort asset prices is the beast with the largest footprint – institutions.

An asset pricing interpretation of our results points to the need for refinements to benchmarks to capture time-varying discount rates that arise from time-varying risk and/or the effects of market segmentation and liquidity. While it is difficult to settle this debate conclusively lacking a correctly specified asset-pricing model, our findings establish institutional demand as a unifying link between seemingly independent anomalies that needs to be accounted for by competing explanations.

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Table 1, *continued on next page*

Anomalies considered

Anomaly	Label	Description
Panel A. Accounting & Operating Anomalies		
Operating Accruals	ACC	The change in current assets (ACT) minus the changes in cash (CH) and current liabilities (LCT), plus the sum of changes in short-term debt (DLC) and taxes payable (TXP), minus depreciation and amortization expense (DP), deflated by the lagged total assets (AT).
Net Operating Assets	NOA	The sum of short-term debt (DLC), long-term debt (DLTT), minority interest (MIB), preferred stock (PSTK), and common equity (CEQ) minus cash and short-term investment (CHE), deflated by the lagged total assets (AT).
Gross Profitability	GP	Total revenues (REVT) minus cost of goods sold (COGS), divided by total assets (AT).
Return on Assets	ROA	Income before extraordinary items (IB) deflated by the lagged total assets (AT).
Investment to Assets	IVA	The change in gross property, plant, and equipment (PPEGT) plus the change in inventories (INVT), deflated by the lagged total assets (AT).
Asset Growth	AG	The change in total assets deflated by the lagged total assets.
O-Score	O-SC	The probability of bankruptcy calculated using accounting variables such as total liabilities divided by assets, working capital divided by assets, current liabilities divided by current assets, net income, and inflation-adjusted total assets applied to coefficients estimated using a logit regression of bankruptcies.
Panel B. Return & Valuation Anomalies		
Book to market	B/M	Book value of common equity (SEQ or AT-LT) plus net deferred tax assets (TXDB), investment tax credit (ITCB), and postretirement benefit liabilities (PRBA), divided by equity market capitalization end of calendar year t.
Momentum	MOM	Cumulative stock return between months j-1 and j-12, where j+1 to j+3 are the months of performance evaluation.
Panel C. Financing Anomalies		
Undervalued minus overvalued	UMO	The portfolio "U" (undervalued) contains firms with equity or debt repurchases and without any equity or debt issuances during the two most recent fiscal years. The portfolio "O" (overvalued) contains firms with equity or debt issuances and without any equity or debt repurchases during the two most recent fiscal years.
Net Composite Equity Issuance	CEI	The natural log of the ratio of the market value of equity at the end of December of year t to the market value of equity at the end of December of year t-5, minus the past 5-year natural log stock return.
Net Stock Issuance	NSI	The natural log of the ratio of the split-adjusted shares outstanding at fiscal year end in t and in t-1. Following Fama and French (2008), the split-adjusted shares outstanding is shares outstanding (CSHO) times the cumulative adjustment factor (ADJEX_C) from Compustat.

Table 1, *continued*
Anomalies considered

Label	Citation	Ranking Variable
Panel A. Accounting & Operating Anomalies		
ACC	Sloan (1996); Hirshleifer, Hou, Teoh, and Zhang (2004)	$ACC_t = \frac{\Delta ACT_t - \Delta CH_t - \Delta LCT_t + \Delta DLC_t + \Delta TXP_t - DP_t}{AT_{t-1}}$
NOA	Sloan (1996); Hirshleifer, Hou, Teoh, and Zhang (2004)	$NOA_t = \frac{DLC_t + DLTT_t + MIB_t + PSTK_t + CEQ_t - CHE_t}{AT_{t-1}}$
GP	Novy-Marx (2012)	$GP_t = \frac{REVT_t - COGS_t}{AT_t}$
ROA	Fama and French (2006)	$ROA_t = \frac{IB_t}{AT_{t-1}}$
IVA	Lev and Thiagarajan (1993); Titman, Wei, and Xie (2004); Lyandres, Sun, and Zhang (2008)	$IVA_t = \frac{\Delta PPEGT_t + \Delta INVT_t}{AT_{t-1}}$
AG	Cooper, Gulen, and Schill (2008)	$AG_t = \frac{AT_t - AT_{t-1}}{AT_{t-1}}$
O-SC	Ohlson (1980); Dichev (1998)	Model 1 in Ohlson (1980)
Panel B. Return & Valuation Anomalies		
B/M	Fama and French (1992)	$B/M_t = \frac{(SEQ_t \text{ or } AT_t - LT_t) + TXDB_t + ITCB_t + PRBA_t}{ME_t}$
MOM	Jegadeesh and Titman (1993)	$MOM_j = r\,(j\text{-}1 : j\text{-}12)$
Panel C. Financing Anomalies		
UMO	Hirshleifer and Jiang (2010)	U: Only Equity and debt repurchases prior 2 years O: Only Equity and debt issues prior 2 fiscal years
CEI	Loughran and Ritter (1995); Daniel and Titman (2006)	$CEI_t = \log\left(\frac{ME_t}{ME_{t-5}}\right) - r(t\text{-}5,t)$
NSI	Loughran and Ritter (1995); Pontiff and Woodgate (2008)	$NSI_t = \log\left(\frac{CSHO_t * ADJEX\_C_t}{CSHO_{t-1} * ADJEX\_C_{t-1}}\right)$

Table 2
Anomaly returns

The table presents monthly returns in units of percent between July of 1982 and June of 2012. Anomaly portfolios consist of a long position in Long leg stocks (highest-performing 30% for the ranking variable as reported by previous studies, as of June year t) plus a short position in Short leg stocks (lowest-performing 30%). The anomaly portfolio return is listed as Long - Short. For all anomalies except momentum (see Table 1 for acronyms), anomaly portfolios are constructed in June of year *t* and held from July of year *t* through June of year *t*+1. The momentum anomaly portfolios are constructed quarterly using stock returns during the prior 12 months and held during the next three months (12-month/3-month momentum strategy). Panel A presents monthly value-weighted excess returns and Sharpe ratios, and Panel B presents monthly three-factor alphas. Excess returns refer to the stock return less the one month US Treasury bill rate. The Sharpe ratio refers to the mean monthly excess return of the Long-Short portfolio divided by its standard deviation. Three-factor alphas refer to the intercept from a time-series regression of monthly value-weighted excess returns on the MKT, SMB, and HML factors, excluding HML for the B/M anomaly. The last column ('COMB') reports the returns of the combination portfolio that takes equal positions across the twelve anomalies each month. Heteroskedasticity-adjusted t-statistics are in parentheses.

	Accounting & Operating							Valuation		Financing			COMB
	ACC	NOA	GP	ROA	IVA	AG	O-SC	B/M	MOM	UMO	CEI	NSI	
	Panel A: Monthly excess returns (%) and Sharpe ratios												
Long leg	0.74	0.86	0.96	0.71	0.89	0.93	0.76	0.94	0.90	0.97	0.99	0.90	0.88
Short leg	0.46	0.32	0.35	0.47	0.37	0.29	0.56	0.35	0.43	0.40	0.55	0.38	0.41
Long - short	0.28	0.53	0.61	0.24	0.52	0.63	0.20	0.59	0.47	0.57	0.44	0.52	0.47
	(2.9)	(4.7)	(5.2)	(1.6)	(5.0)	(4.4)	(1.8)	(3.3)	(1.9)	(5.1)	(2.7)	(3.2)	(5.2)
Sharpe ratio	0.15	0.25	0.27	0.08	0.26	0.23	0.09	0.18	0.10	0.27	0.14	0.17	0.28
	Panel B: Monthly three-factor alphas												
Long leg	-0.01	0.17	0.28	0.03	0.12	0.12	0.10	0.26	0.20	0.25	0.24	0.16	0.14
	(-0.1)	(1.9)	(3.5)	(0.4)	(1.8)	(1.7)	(1.5)	(2.2)	(2.1)	(3.7)	(3.3)	(2.4)	(2.5)
Short leg	-0.26	-0.50	-0.49	-0.39	-0.41	-0.45	-0.30	-0.46	-0.50	-0.38	-0.23	-0.42	-0.39
	(-2.7)	(-5.2)	(-5.0)	(-3.3)	(-4.4)	(-4.2)	(-3.0)	(-4.3)	(-2.6)	(-3.9)	(-2.6)	(-4.2)	(-4.1)
Long - short	0.25	0.67	0.76	0.42	0.53	0.57	0.40	0.72	0.70	0.63	0.48	0.58	0.53
	(3.0)	(6.5)	(6.8)	(3.4)	(6.0)	(5.8)	(4.5)	(4.0)	(3.2)	(6.8)	(5.0)	(5.7)	(8.4)

Table 3

Pre-anomaly changes in investor base

The table presents changes in investor base during five quarters preceding anomaly portfolio formation, 1982 - 2012 (see Table 1 for acronyms and Figure 1 for precise dating). Panel A reports the average change in the number of institutional shareholders (end of period divided by beginning minus one) for stocks in each subsample. Panels B and C report the change in percentage of shares outstanding held by institutions and by mutual funds, respectively (end of period percentage minus beginning). Panel D reports the change in number of shareholders (end of period divided by beginning minus one). All change measures are winsorized at the 1% level in both tails. All statistics are calculated at portfolio formation (annually for all anomalies except momentum and quarterly for momentum) and the time-series mean and t-statistics are reported. The last column ('COMB') reports the pre-anomaly changes of the combination portfolio that takes equal positions across the twelve anomalies.

	Accounting & Operating							Valuation		Financing			COMB
	ACC	NOA	GP	ROA	IVA	AG	O-SC	B/M	MOM	UMO	CEI	NSI	
Panel A: Average change in number of institutional shareholders (end / beginning of period minus one)													
Long leg	28%	33%	37%	46%	23%	18%	32%	13%	65%	26%	15%	19%	30%
Neutral	24%	26%	30%	26%	29%	25%	29%	29%	22%	28%	22%	24%	26%
Short leg	49%	47%	32%	27%	47%	60%	36%	59%	9%	52%	36%	60%	43%
Long-short	-21%	-14%	5%	19%	-24%	-43%	-4%	-47%	56%	-26%	-21%	-41%	-13%
	(-5.1)	(-3.5)	(1.4)	(4.8)	(-6.2)	(-10.4)	(-1.0)	(-9.9)	(12.5)	(-6.3)	(-5.8)	(-9.5)	(-3.7)
Panel B: Average change in % shares held by institutional shareholders (end minus beginning of period)													
Long leg	3.1%	3.8%	3.8%	4.7%	2.7%	2.2%	3.9%	1.3%	6.5%	2.6%	1.9%	2.0%	3.2%
Neutral	2.8%	2.8%	3.2%	3.1%	3.3%	2.8%	3.4%	3.4%	3.1%	2.9%	2.4%	3.0%	3.0%
Short leg	4.8%	4.3%	3.4%	2.7%	4.5%	5.9%	3.1%	6.0%	0.7%	6.2%	3.6%	5.8%	4.3%
Long-short	-1.7%	-0.6%	0.4%	2.0%	-1.8%	-3.7%	0.8%	-4.7%	5.8%	-3.6%	-1.7%	-3.8%	-1.0%
	(-2.3)	(-0.8)	(0.7)	(2.7)	(-2.5)	(-4.9)	(1.0)	(-6.2)	(9.2)	(-4.4)	(-2.2)	(-5.0)	(-1.5)
Panel C: Average change in % shares held by mutual funds (end minus beginning of period)													
Long leg	0.8%	0.9%	1.0%	1.2%	0.6%	0.6%	1.0%	0.4%	1.4%	0.6%	0.5%	0.6%	0.8%
Neutral	0.7%	0.7%	0.9%	0.8%	0.9%	0.7%	0.8%	0.9%	0.8%	0.7%	0.5%	0.6%	0.8%
Short leg	1.2%	1.1%	0.8%	0.7%	1.2%	1.5%	0.8%	1.5%	0.3%	1.7%	0.6%	1.4%	1.1%
Long-short	-0.4%	-0.2%	0.2%	0.5%	-0.6%	-0.9%	0.2%	-1.1%	1.1%	-1.1%	-0.1%	-0.8%	-0.3%
	(-1.1)	(-0.5)	(0.3)	(1.4)	(-1.4)	(-2.4)	(0.7)	(-2.8)	(3.1)	(-2.4)	(-0.1)	(-2.0)	(-0.7)
Panel D: Change in number of shareholders of record (end / beginning of period minus one)													
Long leg	31%	31%	33%	49%	18%	16%	37%	18%	34%	12%	2%	12%	24%
Neutral	22%	23%	28%	22%	27%	21%	27%	32%	25%	28%	8%	18%	23%
Short leg	53%	56%	40%	34%	58%	72%	37%	53%	41%	66%	20%	69%	50%
Long-short	-23%	-25%	-7%	15%	-40%	-56%	0%	-35%	-7%	-54%	-18%	-57%	-25%
	(-3.4)	(-3.9)	(-1.4)	(2.2)	(-7.2)	(-7.8)	(0.0)	(-6.0)	(-1.4)	(-7.9)	(-6.5)	(-8.0)	(-4.9)

Table 4
Abnormal returns of anomaly portfolios conditional on institutional demand

Panel A presents the intercept from a time-series regression of value-weighted portfolio returns on the MKT, SMB, and HML factors (B/M anomaly portfolio excludes HML). Portfolios are formed using independent sorts of the anomaly variable (see Table 1 for acronyms) and the change in number of institutional investors. For all anomalies except momentum, portfolios are constructed annually in June of year *t* and held for twelve months. Momentum portfolio are constructed quarterly and held for three months. The dependent variable is the vaue-weighted monthly excess portfolio return during the holding period. 'Right side' refers to short-leg stocks with Δ#Inst in the lowest quintile and long-leg stocks with Δ#Inst in the highest quintile. 'Wrong side' refers to short-leg stocks with Δ#Inst in the highest quintile and long-leg stocks with Δ#Inst in the lowest quintile. Panel B reports three-factor alphas conditioning on Δ%Inst. The last column ('COMB') reports the returns of the combination portfolio that takes equal positions across the twelve anomalies each month. Heteroskedasticity-adjusted t-statistics are in parentheses.

	Accounting & Operating							Valuation		Financing			COMB
	ACC	NOA	GP	ROA	IVA	AG	O-SC	B/M	MOM	UMO	CEI	NSI	
Panel A. Three-factor alphas conditional on anomaly ranking and change in # of institutions													
Δ#Inst on the right side:													
Long Leg/Buy	-0.29	0.15	0.03	-0.25	-0.02	0.12	-0.14	0.09	0.25	0.18	0.25	0.01	0.02
[Portfolio L/B]	(-1.9)	(1.0)	(0.2)	(-1.8)	(-0.2)	(0.8)	(-1.1)	(0.5)	(2.0)	(1.4)	(1.7)	(0.1)	(0.2)
Short Leg/Sell	-0.15	-0.28	-0.23	-0.01	-0.24	-0.40	-0.10	-0.27	-0.41	-0.23	0.01	-0.21	-0.20
[Portfolio S/S]	(-0.9)	(-1.8)	(-1.6)	(-0.1)	(-1.6)	(-2.2)	(-0.7)	(-1.5)	(-1.9)	(-1.3)	(0.1)	(-1.3)	(-1.5)
Right Side L-S	-0.14	0.43	0.26	-0.24	0.22	0.52	-0.04	0.36	0.66	0.41	0.24	0.22	0.22
[L/B - S/S]	(-0.7)	(2.2)	(1.5)	(-1.3)	(1.2)	(2.4)	(-0.2)	(1.4)	(2.6)	(2.0)	(1.0)	(1.0)	(1.6)
Δ#Inst on the wrong side:													
Long Leg/Sell	0.12	0.26	0.28	0.01	0.14	0.11	0.16	0.31	0.31	0.08	0.14	0.12	0.15
[Portfolio L-S]	(0.8)	(1.8)	(2.1)	(0.1)	(1.1)	(0.9)	(1.3)	(2.0)	(1.6)	(0.6)	(1.1)	(1.0)	(1.5)
Short Leg/Buy	-0.59	-0.78	-0.74	-0.62	-0.79	-0.72	-0.47	-0.76	-1.32	-0.60	-0.48	-0.62	-0.69
[Portfolio S/B]	(-4.0)	(-4.7)	(-4.8)	(-3.7)	(-5.1)	(-5.1)	(-3.2)	(-4.7)	(-4.8)	(-4.1)	(-3.1)	(-4.5)	(-5.0)
Wrong Side L-S	0.71	1.04	1.02	0.63	0.93	0.83	0.63	1.07	1.63	0.68	0.62	0.74	0.84
[L/S - S/B]	(4.0)	(5.3)	(5.1)	(3.0)	(5.1)	(4.9)	(3.5)	(4.3)	(4.7)	(3.6)	(3.4)	(4.4)	(5.7)
Right-minus-Wrong:													
Difference	-0.85	-0.61	-0.76	-0.87	-0.71	-0.31	-0.67	-0.71	-0.97	-0.27	-0.38	-0.52	-0.62
	(-3.0)	(-2.1)	(-2.6)	(-3.0)	(-2.5)	(-1.1)	(-2.3)	(-2.3)	(-3.0)	(-0.9)	(-1.1)	(-1.8)	(-2.4)
Panel B. Three-factor alphas conditional on change in % of institutions													
Right-Side L-S	-0.31	0.52	0.66	0.08	0.34	0.24	0.03	0.36	0.55	0.68	0.35	0.49	0.30
[B/L - S/S]	(-1.9)	(3.1)	(4.7)	(0.5)	(2.2)	(1.5)	(0.2)	(1.4)	(2.2)	(3.7)	(1.9)	(3.0)	(2.9)
Wrong-Side L-S	0.48	0.87	1.01	0.65	0.74	0.82	0.58	0.99	1.29	0.59	0.36	0.60	0.71
[S/L - B/S]	(3.3)	(4.8)	(6.0)	(3.8)	(4.5)	(5.4)	(3.7)	(4.4)	(4.9)	(3.6)	(2.2)	(4.2)	(6.3)
Difference	-0.79	-0.35	-0.35	-0.57	-0.40	-0.58	-0.55	-0.64	-0.73	0.08	-0.02	-0.11	-0.41
	(-3.7)	(-1.7)	(-1.7)	(-2.8)	(-1.9)	(-2.9)	(-2.7)	(-2.8)	(-3.3)	(0.4)	(-0.1)	(-0.6)	(-2.5)

Table 5. Quarterly abnormal returns of anomaly portfolios

Quarterly 3-factor alphas of the combination Buy-minus-Sell portfolios categorized by the Long and Short legs of 12 anomalies during the four quarters between July t to June t+1 (q+1 to q+4), sorted independently by anomalies and Δ#Inst. Δ#Inst is the change in the number of institutions holding a stock divided by the average number of beginning-of-period institutions holding the stocks in the same market capitalization decile. The institutional trading period is January t-1 to March t (quarters q-5 tp q-1) in Panel A, April t to June t (quarter q) in Panel B, and the six quarters prior to performance evaluation (q-5 to q) in Panel C. Heteroskedasticity-adjusted t-statistics are in parentheses.

	q+1	**q+2**	**q+3**	**q+4**	**Cumulative**
		Panel A: Buy-minus-Sell conditional on Δ#Inst (q-5 to q-1)			
Long leg	0.28	-0.27	-0.42	-0.34	-0.21
	(1.1)	(-1.0)	(-1.5)	(-1.7)	(-1.7)
Short leg	-0.10	-0.63	-1.36	-0.54	-0.65
	(-0.4)	(-1.9)	(-4.3)	(-2.5)	(-4.5)
		Panel B: Buy-minus-Sell conditional on Δ#Inst (q)			
Long leg	0.61	0.73	0.01	0.03	0.29
	(3.0)	(3.2)	(0.1)	(0.1)	(2.3)
Short leg	0.74	0.84	-0.06	0.24	0.41
	(3.0)	(2.4)	(-0.2)	(0.9)	(2.6)
		Panel C: Buy-minus-Sell conditional on Δ#Inst (q-5 to q)			
Long leg	0.29	0.00	-0.29	-0.18	-0.08
	(1.1)	(-0.0)	(-1.5)	(-0.9)	(-0.7)
Short leg	-0.05	-0.35	-1.11	-0.34	-0.44
	(-0.2)	(-1.0)	(-4.3)	(-1.5)	(-3.1)

Table 6
Anomaly portfolio characteristics conditional on institutional demand

Panel A presents statistics related to changes in institutional ownership averaged across the twelve anomalies during five quarters preceding anomaly portfolio formation, 1982 - 2012 (see Figure 1 for precise dating). 'Δ#Inst' is the percentage change in the number of institutions; 'Δ#Inst (aggr)' is the total (or aggregate) change in institutional investors for all stocks in the subportfolio divided by the total number of institutional investors at the beginning of year *t*-1; '% w/ incr' is the percentage of stocks in the subportfolio with a net increase ('decr' = decrease) in institutional investors; 'Δ%Inst' is the change in the percentage of shares outstanding held by institutions; and 'Δ%MF' is the change in the percentage of shares held by mutual funds. Change measures are winsorized at 1% on both tails. Panel B presents statistics related to stock characteristics averaged across the twelve anomalies: #Inst(beg) is the number of institutional investors as of the beginning of year t-1; %Inst(beg) is the percentage of shares outstanding held by institutions as of the beginning of year t-1; 'MCap(beg)' is the average market capitalization in 2012 million dollars as of the beginning of year t-1; average annualized idiosyncratic volatility using monthly residuals from the Fama-French three-factor model between July of year *t*-3 and June of year *t*; average monthly Amihud's illiquidity ratio during year *t*-1 winsorized at 1%; and the number of stocks in each subportfolio. p-values are in brackets.

Panel A. Change in institutional ownership, averaged across the 12 anomalies

	Δ#Inst	Δ#Inst (aggr)	% with increase	% with decrease	Δ%Inst	Δ%MF
Long Leg/Inst. Buy (L/B)	116.0%	82.6%	99.1%	0.6%	10.3%	1.5%
Short Leg/Inst. Buy (S/B)	134.9%	90.0%	99.2%	0.4%	12.3%	2.0%
[p-value for difference]	[0.018]	[0.230]	[0.154]	[0.031]	[0.039]	[0.240]
Long Leg/Inst. Sell (L/S)	-23.3%	-20.5%	2.6%	95.1%	-2.5%	-0.1%
Short Leg/Inst. Sell (S/S)	-24.0%	-22.0%	3.4%	94.8%	-3.2%	-0.4%
[p-value for difference]	[0.681]	[0.369]	[0.650]	[0.897]	[0.429]	[0.524]

Panel B. Stocks characteristics, averaged across the 12 anomalies

	#Inst (beg)	%Inst (beg)	Mcap (beg)	Idiosyncratic Volatility	Amihud illiquidity	Number of stocks
Long Leg/Inst. Buy (L/B)	34.1	29.2%	$619	46.9%	0.22	142.5
Short Leg/Inst. Buy (S/B)	34.1	28.2%	$684	52.2%	0.14	175.1
Long Leg/Inst. Sell (L/S)	72.4	42.2%	$1,572	41.0%	0.32	130.0
Short Leg/Inst. Sell (S/S)	74.2	43.8%	$1,588	45.6%	0.17	121.4
Right-Side (L/B & S/S)	54.2	36.5%	$1,104	46.3%	0.20	132.0
Wrong-Side (L/S & S/B)	53.3	35.2%	$1,128	46.6%	0.23	152.6
[p-value for difference]	[0.917]	[0.739]	[0.910]	[0.867]	[0.519]	[0.001]

Table 7

Fama-MacBeth regressions of anomaly stock returns on institutional ownership changes

The table reports average coefficient estimates from Fama-MacBeth regressions run each month, separately for the short and long legs of each of the twelve anomalies (see Table 1 for acronyms). The dependent variable is the raw monthly stock return during the performance evaluation period (see Figure 1 for precise dating). The independent variables are: 'Δ#Inst' is the percentage change in the number of institutions; 'Δ%Inst' is the change in the percentage of shares outstanding held by institutions; and 'Δ#Shr' is the change in number of shareholders (end of period divided by beginning minus one). All change measures are winsorized at the 1% level in both tails. Six control regressors are also included but not reported: the log of market capitalization as of June t, log of book to market as of December t-1, cumulative monthly stock returns during the 15-month institutional trading period, the average monthly Amihud's illiquidity ratio between January and June of year t, % shares held by institutional investors and the number of institutional investors as of the end of institutional trading period. T-statistics in parentheses are estimated using Newey-West serial correlation consistent standard errors with a six-month lag. The last column reports the average coefficient estimates and t-statistics across the twelve anomalies.

	Accounting & Operating							Valuation		Financing			Avg
	ACC	NOA	GP	ROA	IVA	AG	O-SC	B/M	MOM	UMO	CEI	NSI	
							Panel A: Short leg stocks						
Δ#Inst	**-0.27**	**-0.29**	**-0.21**	**-0.38**	**-0.25**	**-0.27**	**-0.26**	**-0.25**	**-0.25**	**-0.25**	**-0.22**	**-0.25**	**-0.26**
	(-3.4)	**(-4.0)**	**(-2.4)**	**(-4.5)**	**(-3.4)**	**(-4.3)**	**(-3.1)**	**(-3.9)**	**(-2.5)**	**(-3.0)**	**(-2.0)**	**(-3.5)**	**(-3.3)**
Δ%Inst	0.06	0.13	0.43	0.78	0.31	-0.01	0.19	0.08	**-1.39**	-0.20	0.15	0.37	0.08
	(0.2)	(0.4)	(1.1)	(1.9)	(1.0)	(-0.0)	(0.5)	(0.3)	**(-3.2)**	(-0.5)	(0.4)	(1.1)	(0.3)
Δ#Shr	-0.01	-0.05	-0.02	-0.01	-0.02	-0.03	-0.01	-0.02	-0.06	-0.01	-0.06	0.01	-0.02
	(-0.1)	(-1.8)	(-0.6)	(-0.1)	(-0.8)	(-1.6)	(-0.1)	(-1.0)	(-1.6)	(-0.1)	(-1.0)	(0.4)	(-0.7)
							Panel B: Long leg stocks						
Δ#Inst	**-0.25**	-0.09	-0.12	**-0.26**	**-0.38**	-0.12	**-0.28**	**-0.27**	**-0.17**	-0.13	**-0.34**	-0.10	**-0.21**
	(-3.1)	(-1.0)	(-1.8)	**(-3.8)**	**(-4.0)**	(-1.4)	**(-4.0)**	**(-2.6)**	**(-2.0)**	(-1.3)	**(-2.9)**	(-1.1)	**(-2.4)**
Δ%Inst	0.59	-0.48	-0.12	-0.49	0.06	-0.07	-0.51	-0.09	-0.10	-0.12	0.01	0.01	-0.11
	(1.6)	(-1.1)	(-0.3)	(-1.4)	(0.2)	(-0.2)	(-1.4)	(-0.2)	(-0.2)	(-0.3)	(0.1)	(0.0)	(-0.3)
Δ#Shr	-0.06	-0.03	-0.01	0.01	0.05	0.03	-0.03	-0.03	-0.03	-0.25	-0.15	-0.11	-0.05
	(-0.9)	(-0.8)	(-0.2)	(0.4)	(0.7)	(0.4)	(-0.5)	(-0.4)	(-0.7)	(-1.6)	(-1.3)	(-1.6)	(-0.5)

Table 8

Fama-MacBeth regressions of anomaly stock returns controlling for mutual fund flow

The table reports average coefficient estimates from Fama-MacBeth regressions run each month, separately for the short and long legs of each of the twelve anomalies (see Table 1 for acronyms). The dependent variable is the raw monthly stock return during the performance evaluation period (see Figure 1 for precise dating). The independent variables are: 'Δ#Inst' is the percentage change in the number of institutions; 'Δ%Inst' is the change in the percentage of shares outstanding held by institutions; and 'Δ#Shr' is the change in number of shareholders (end of period divided by beginning minus one); 'Δ%MF (Flow)' is the net change in the fraction of a firm's shares outstanding held by mutual funds under in- or out-flow pressure as in Coval and Stafford (2007); Δ%MF(Non-flow) corresponds to complement funds. All change measures are winsorized at the 1% level in both tails. The last model in panel A (B) excludes stocks in the top (bottom) decile of Δ%MF(Flow) and in the middle three deciles of Δ%MF(Non-flow). Seven control regressors are included but not reported: the fractional change in the shareholders of record during the fiscal year ending in calendar year t-1, the log of market capitalization as of June t, log of book to market as of December t-1, cumulative monthly stock returns during the 15-month institutional trading period, the average monthly Amihud's illiquidity ratio between January and June of year t, % shares held by institutional investors and the number of institutional investors holding the stock as of the end of the institutional trading period. T-statistics in parentheses using Newey-West correction for serial correlation (six-month lag).

	Panel A: Short leg stocks				*Panel B: Long leg stocks*			
Sample:	*All*			*No Buy Pressure*	*All*			*No Sell Pressure*
Δ#Inst		-0.28	-0.26	-0.36		-0.19	-0.19	-0.29
		(-3.4)	(-3.3)	(-3.5)		(-2.1)	(-2.1)	(-2.4)
Δ#MF	-0.03	-0.01	0.00		-0.04	-0.02	-0.03	
	(-0.7)	(-0.1)	(0.2)		(-1.0)	(-0.4)	(-0.8)	
Δ%Inst				0.10				-0.20
				(0.3)				(-0.4)
Δ%nonMF		0.21	0.21			0.01	0.06	
		(0.6)	(0.6)			(0.0)	(0.1)	
Δ%MF	-0.43	0.48			-0.76	-0.67		
	(-0.4)	(0.5)			(-0.9)	(-0.7)		
Δ%MF (Flow)			-3.41				-2.75	
			(-1.0)				(-0.9)	
Δ%MF (Non-flow)			-0.63				-0.14	
			(-0.7)				(-0.2)	

Table 9, continued on next page

Abnormal returns around quarterly earnings announcements

Panel A reports average raw returns during a three day earnings announcement window minus the average raw returns of the same stock during non-earnings-announcement days, using the four quarterly earnings announcements during the return observation window. Stocks are sorted independently on anomaly variables and change in number of institutional investors (see Table 1 for acronyms and Figure 1 for dating). 'Right Side' refers to long-leg stocks in the largest Δ-#Inst quintile and short-leg stocks in the smallest Δ-#Inst quintile. 'Wrong Side' refers to short-leg stocks in the largest Δ-#Inst quintile and long-leg stocks in the smallest Δ-#Inst quintile. The last column ('COMB') reports the results for the combination portfolio that takes equal positions across the twelve anomalies. Panel B reports the average abnormal returns across the twelve anomalies using two alternatives: i) market-adjusted and ii) an event window of -3 to +3 days. T-statistics are in parentheses.

	Accounting & Operating							Valuation		Financing			COMB
Anomaly:	ACC	NOA	GP	ROA	IVA	AG	O-SC	B/M	MOM	UMO	CEI	NSI	
	Panel A: Average daily earnings announcement (-1:+1) minus non-earnings-announcement day returns												
Δ#Inst on the right side:													
Long Leg/Buy	-0.05%	-0.07%	0.02%	-0.06%	-0.02%	-0.03%	-0.05%	0.11%	-0.05%	0.02%	0.02%	0.01%	-0.01%
[Portfolio L/B]	(-1.6)	(-2.1)	(0.6)	(-1.7)	(-0.6)	(-0.9)	(-1.3)	(3.5)	(-1.6)	(0.5)	(0.4)	(0.2)	(-0.5)
Short Leg/Sell	0.04%	0.06%	-0.01%	0.06%	0.05%	0.03%	0.08%	-0.01%	-0.10%	0.00%	0.02%	-0.01%	0.03%
[Portfolio S/S]	(0.8)	(1.3)	(-0.0)	(1.6)	(1.0)	(0.6)	(1.8)	(-0.1)	(-0.3)	(0.1)	(0.4)	(-0.1)	(0.7)
Right-Side L-S	-0.09%	-0.13%	0.03%	-0.12%	-0.07%	-0.06%	-0.13%	0.12%	0.05%	0.02%	0.00%	0.02%	-0.04%
[L/B - S/S]	(-1.7)	(-2.9)	(0.5)	(-3.4)	(-1.4)	(-1.1)	(-2.5)	(1.6)	(-1.1)	(0.3)	(0.0)	(0.2)	(-1.1)
Δ#Inst on the wrong side:													
Long Leg/Sell	0.06%	0.05%	0.13%	0.07%	0.10%	0.10%	0.04%	0.10%	0.05%	0.12%	0.11%	0.12%	0.09%
[Portfolio L/S]	(1.4)	(1.1)	(3.2)	(1.3)	(3.5)	(3.5)	(0.9)	(2.7)	(0.9)	(3.5)	(3.9)	(4.3)	(3.1)
Short Leg/Buy	-0.08%	-0.08%	-0.11%	-0.10%	-0.10%	-0.12%	-0.90%	-0.11%	-0.09%	-0.11%	-0.06%	-0.09%	-0.10%
[Portfolio S/B]	(-2.4)	(-2.7)	(-3.1)	(-2.9)	(-3.2)	(-3.8)	(-2.6)	(-3.5)	(-1.8)	(-3.2)	(-1.6)	(-3.1)	(-3.5)
Wrong-Side L-S	0.14%	0.13%	0.24%	0.17%	0.20%	0.22%	0.94%	0.21%	0.14%	0.23%	0.17%	0.21%	0.19%
[L/S - S/B]	(3.4)	(2.7)	(5.6)	(3.0)	(6.4)	(7.2)	(2.2)	(6.5)	(2.1)	(5.2)	(4.4)	(6.1)	(7.2)
Right-minus-Wrong	-0.23%	-0.26%	-0.21%	-0.29%	-0.27%	-0.28%	-1.07%	-0.10%	-0.09%	-0.21%	-0.17%	-0.19%	-0.23%
	(-3.3)	(-4.3)	(-3.5)	(-4.2)	(-4.5)	(-4.0)	(-3.6)	(-1.1)	(-2.2)	(-3.0)	(-2.4)	(-2.5)	(-4.0)

Table 9, continued

Abnormal returns around quarterly earnings announcements

Panel B: Alternative measures for average abnormal returns

Return benchmark:	Non-EA returns		Market-adjusted	
Event window:	-1:+1	-3:+3	-1:+1	-3:+3
Δ#Inst on the right side:				
Long Leg/Buy	-0.01%	-0.02%	0.02%	0.01%
[Portfolio L/B]	(-0.5)	(-0.7)	(0.8)	(1.0)
Short Leg/Sell	0.03%	0.02%	0.05%	0.04%
[Portfolio S/S]	(0.7)	(0.7)	(1.4)	(2.1)
Right-Side L-S	-0.04%	-0.04%	-0.03%	-0.03%
[L/B - S/S]	(-1.1)	(-1.8)	(-0.8)	(-1.6)
Δ#Inst on the wrong side:				
Long Leg/Sell	0.09%	0.05%	0.12%	0.09%
[Portfolio L/S]	(3.1)	(2.1)	(5.3)	(5.2)
Short Leg/Buy	-0.10%	-0.05%	-0.10%	-0.05%
[Portfolio S/B]	(-3.5)	(-2.1)	(-3.7)	(-2.6)
Wrong-Side L-S	0.19%	0.10%	0.22%	0.14%
[L/S - S/B]	(7.2)	(6.6)	(7.1)	(6.7)
Right-minus-Wrong	-0.23%	-0.14%	-0.25%	-0.17%
	(-4.0)	(-4.6)	(-4.2)	(-5.1)

Table 10

Return regressions conditioning on persistence in institutional trading

Panel A presents the intercept from a time series regression as in Table 4, using the return on the 'COMB' portfolio (average of twelve anomalies), except for a further partitioning based on the persistence of changes in institutional ownership. A stock is placed in the 'Persistent changes' portfolio in a given year if its five-quarter institutional trading period contains three or more consecutive quarters with a change in fraction of shares held by institutions in the same direction; otherwise it is placed in the 'Non-persistent changes' portfolio. Heteroskedasticity-adjusted t-statistics are in parentheses. Panel B presents the average coefficient estimates from Fama-MacBeth regressions as in Table 6, except for the inclusion of persistence variables and a sub-sample analysis. Buy (Sell) persistence is the number of consecutive quarters during the five-quarter institutional trading period with a positive (negative) Δ%Inst. Eight control regressors are included but not reported: the change in the percentage of shares held by institutions, the fractional change in the shareholders of record, the log of market capitalization as of June t, log of book to market as of December t-1, cumulative monthly stock returns during the 15-month institutional trading period, the average monthly Amihud's illiquidity ratio between January and June of year t, and % shares held by institutional investors and the number of institutional investors holding the stock as of the end of the institutional trading period. T-statistics in parentheses estimated using Newey-West serial correlation consistent standard errors with a six-month lag.

Panel A. Three-factor alphas from time series regressions

Sample:	Persistent changes	Non-persistent changes
Right-Side Long-Short	0.21	0.18
	(1.3)	(1.1)
Wrong-Side Long-Short	0.73	0.92
	(4.4)	(5.8)
Right-Wrong Difference	-0.52	-0.75
	(-1.8)	(-2.7)

Panel B. Fama-MacBeth regressions

Sample:	All		Non-persistent changes	
Anomaly Leg:	Short-leg	Long-leg	Short-leg	Long-leg
Δ#Inst	-0.27	-0.21	-0.29	-0.25
	(-3.4)	(-2.4)	(-2.6)	(-2.1)
Buy persistence	0.06			
	(1.8)			
Sell persistence		-0.03		
		(-0.6)		

Table 11
Conditional stock returns in subperiods

This table conducts a sub-period analysis for the relation between anomaly returns and institutional demand. Panel A presents three-factor alphas from time-series regressions as in Table 4, using the return on the 'COMB' portfolio (average across anomalies), and Panel B presents the average coefficient estimates from Fama-MacBeth regressions as in Table 6. The sample is split into two using two different approaches. First, the sample is split into two equal halves by portfolio formation year: 1982-1996 and 1997-2011. Second, the sample is split into two for each individual anomaly by the earliest publication date of the anomalous stock performance in finance or accounting journals: 1996 for ACC and NOA; 1993 for IVA and AG; 1998 for O-SC; 1992 for B/M; 1993 for MOM; and 1995 for UMO, CEI, and NSI. Profitability anomalies (GP and ROA) documented by Fama and French (2006) are excluded from the pre/post-publication analysis to allow a meaningful pos-publication period for performance evaluation. In Panel A, heteroskedasticity-adjusted t-statistics are in parentheses. In Panel B eight control regressors are included but not reported: the change in the percentage of shares held by institutions, the fractional change in the shareholders of record, the log of market capitalization as of June t, log of book to market as of December t-1, cumulative monthly stock returns during the 15-month institutional trading period, the average monthly Amihud's illiquidity ratio between January and June of year t, and % shares held by institutional investors and the number of institutional investors holding the stock as of the end of the institutional trading period. T-statistics in parentheses estimated using Newey-West serial correlation consistent standard errors with a six-month lag.

Panel A. Three-factor alphas from time series regressions

Subperiods:	Two equal halves		By publication years	
	1982-1996	1997-2011	Before	After
Right-Wrong Difference	-0.21	-0.93	-0.20	-0.83
	(-0.9)	(-2.2)	(-0.7)	(-2.3)

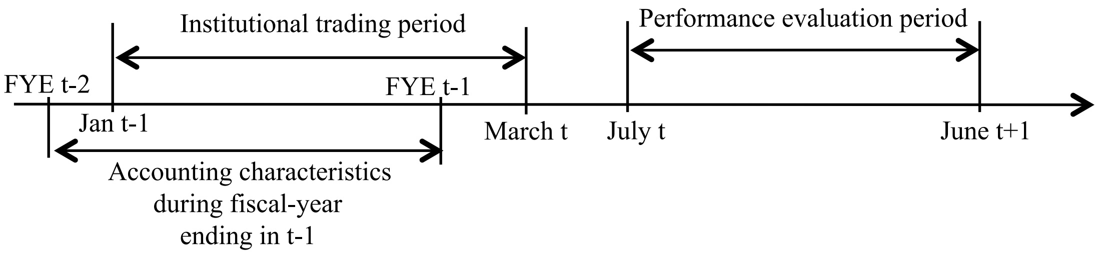
Panel B. Fama-MacBeth regression coefficient on Δ-#Inst

Subperiods:	1982-1996	1997-2011	Before	After
Short-leg	-0.14	-0.39	-0.11	-0.35
	(-1.6)	(-3.1)	(-1.3)	(-3.2)
Long-leg	-0.08	-0.34	-0.07	-0.32
	(-0.9)	(-2.4)	(-0.6)	(-2.4)

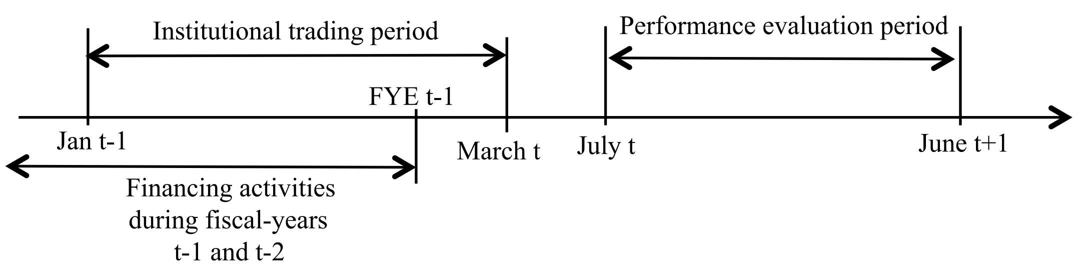
Figure 1. Time line for the construction of anomaly portfolios

Figure 1 depicts the portfolio construction time line for the twelve stock return anomalies of Table 1 (see Table 1 for acronyms). For all anomalies except momentum, portfolios are constructed annually at the end of June of each year *t*, and held for the next twelve months. For momentum, portfolios are constructed quarterly based on stock returns during the previous 12 months and changes in number of institutions during the previous five calendar quarters, and held for the next three months. "FYE *t*-1" indicates the fiscal year-end in calendar year *t*-1. "CQE *j* indicates the end of calendar quarter j.

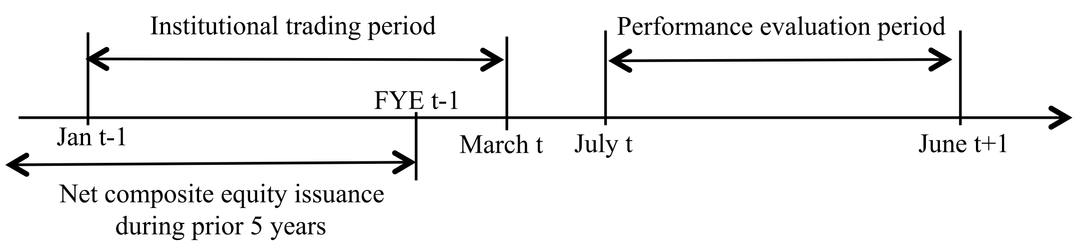
Panel A: Seven Accounting & Operating Anomalies + B/M Anomaly



Panel B: UMO and NSI Anomalies



Panel C: CEI Anomaly



Panel D: Momentum Anomaly

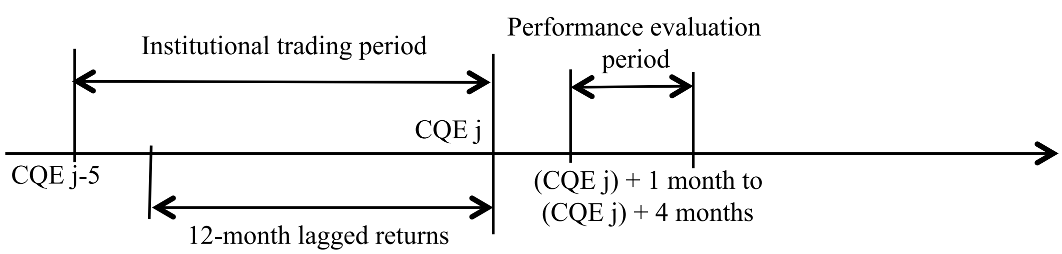
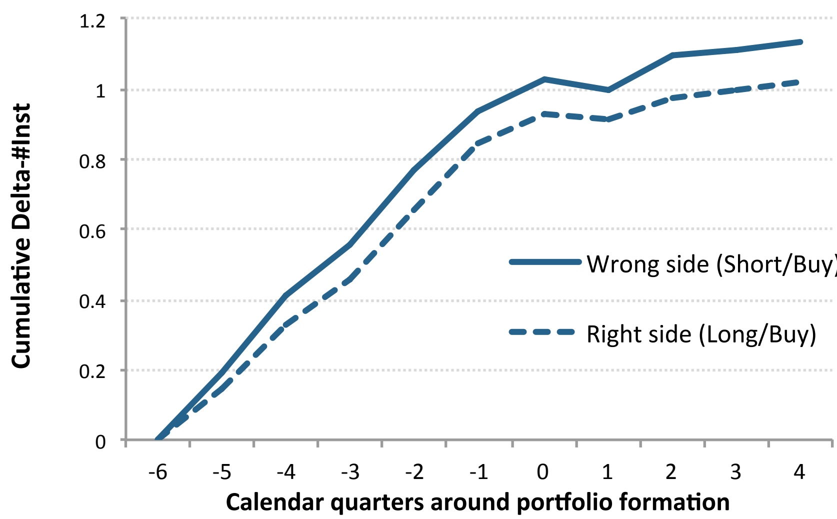


Figure 2. Cumulative changes in number of institutional investors across 12 anomalies

This chart depicts cumulative changes in number of institutional investors from the beginning of the institutional trading period through the end of the performance evaluation period, averaged across 12 anomalies (see Figure 1 for precise dating). Panel A depicts stocks in the highest quintile of Δ#Inst during the institutional trading period, separately for the short and long anomaly legs. Panel B likewise depicts stocks in the lowest Δ#Inst quintile. Cumulative Δ-#Insts is computed by first summing the number of institutions holding any stock in each anomaly subportfolio each quarter; then cumulate changes by anomaly; then averaged across anomalies. 'Wrong side' refers to short-leg stocks with Δ#Inst in the highest quintile (independent sorts) and long-leg stocks with Δ#Inst in the lowest quintile. 'Right side' refers to short-leg stocks with Δ#Inst in the lowest quintile and long-leg stocks with Δ#Inst in the highest quintile. For all anomalies except momentum, quarters 1 through 4 correspond to the performance evaluation period and quarter 0 corresponds to the three-month gap between the institutional trading and performance evaluation periods. For momentum, the three-month performance evaluation period straddles quarters 0 and 1.

Panel A: Stocks in the highest Δ#Inst quintile



Panel B: Stocks in the lowest Δ#Inst quintile