

Institutional Investment Constraints and Stock Prices*

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Abstract

We test the hypothesis that investment constraints in delegated portfolio management may distort demand for stocks, leading to price underreaction to news and stock return predictability. We find that institutions tend not to buy more of a stock with good news that they already overweight; they are reluctant to sell a stock with bad news that they already underweight. Stocks with good news overweighted by institutions subsequently outperform significantly stocks with bad news underweighted by institutions. The impact of institutional investment constraints shed new lights on asset pricing anomalies such as stock price momentum and post earnings announcement drift.

I. Introduction

One of the most significant changes in the financial market has been the surge of delegated portfolio management. An increasing portion of U.S. equities is managed by institutional investors such as pension funds and mutual funds. Different from individual investors, institutional investors face a variety of constraints in their investment decisions. These constraints include restrictions on the market capitalization and the style of stocks in the portfolio, position limits on a stock or an industry, as well as restrictions on tracking errors, portfolio turnover and investment strategies allowed. Such constraints arise as a product of regulation, contract requirements and agency considerations in delegated portfolio management (e.g., Almazan, Brown, Carlson, and Chapman (2004)).

This paper studies the implications of institutional investment constraints for stock demand and valuation. Investment constraints may limit institutional investors' ability to transfer their information into portfolio positions. Institutions could even ignore their own information and "go with the flow" (e.g., Maug and Naik (2011)). This dampened response to information may induce price underreaction for stocks that are affected by institutional investment constraints and generate cross-sectional return predictability as the mispricing subsequently gets corrected.

To empirically measure institutional investment constraints and conduct tests of their impact on institutions' trading and stock prices, we focus on two sets of important institutional investment constraints that are common yet have not been well-researched in the literature. The first is the diversification requirement. The Investment Company Act of 1940 explicitly requires that mutual funds must meet various investment diversification standards to qualify for the "diversified" status and favorable tax treatment. The Employee Retirement Income Security Act of 1974 (ERISA) requires that pension funds "diversify investments ... so as to minimize the risk of large losses, unless under the circumstances it is clearly prudent not to do so".¹ Civil legal penalties can be imposed on fiduciaries in a lawsuit for violation of ERISA's diversification

¹See Section 404 of ERISA. While ERISA established guideline for private pension plan administration and investment practices, the general guideline is widely adopted by public pension funds, bank trusts, and to a large extent, mutual funds (See O'Barr and Conley (1992)).

requirements. In such lawsuits, defendants bear the burden of showing that their decision not to diversify was clearly prudent.

Institutional investors often are subject to both explicit and implicit tracking-error constraints in their investment decisions. The explicit tracking-error constraint as specified in investment contracts restricts the maximal possible deviation of a money manager's portfolio from a given benchmark. Violation of such constraints can result in contract termination and lawsuits.² Even without contractual tracking-error constraint, portfolio managers have increasingly emphasized the risk of underperforming a benchmark index. The risk of being wrong and alone, popularly recognized as the "maverick risk," is viewed as the greatest peril in investment management by many practitioners (Arnott (2003)). The tracking-error restriction is the second type of institutional investment constraints that motivate our study.

The combination of diversification requirement and tracking-error restrictions could lead to institutional investment decisions that are otherwise difficult to explain. Recent studies document that institutions are reluctant to deviate from the market portfolio, or the benchmark they are expected to beat (e.g., Lakonishok, Shleifer, and Vishny (1997), Chan, Chen, and Lakonishok (2002), Cohen, Gompers, and Vuolteenaho (2002), Cremers and Petajisto (2009), Lewellen (2011)). Such "benchmark investing" behavior contradicts predictions of neoclassic models: institutional investors are usually viewed as being better informed than individual investors. Thus, they should overweight stocks that have positive news and underweight stocks with negative news. However, because diversification requirement and tracking-error restrictions, money managers tend to hold large diversified portfolios that mimic closely the market portfolio (or their policy/performance benchmark). Thus, they may not fully take advantage of their information in their investment decisions. For example, Cohen et al. (2002) estimate that institutions only capture about a third of the gains they could if they bought more of the stocks they rated winners and sold more of the ones they rated losers.

This paper provides further evidence that institutional investment constraints affect money

²See, e.g., Pensions & Investments (May 12, 2003) which reports that Merrill Lynch Investment Managers was accused of breaching tracking error limits on its equities mandate and paid 75 million pounds in settlement.

managers' demand for stocks and trading behavior. Because of the diversification requirement and tracking-error constraints, institutions could not or would not keep deviating from their benchmark. We hypothesize that if money managers already overweight a stock, they may not buy more of the stock, even if they receive positive information about the stock. If money managers already underweight a stock, they may be reluctant to sell the stock, even if they receive negative information about the stock. Such investment behavior may affect the valuation of stocks and generate testable return patterns.

Our basic hypothesis on the asset pricing implication of institutional investment constraints can be illustrated with the following example. Suppose institutions receive a positive signal about a stock, but they already overweight this stock. When investment constraints become binding (e.g., the signal or the overweight is large enough), then institutions' demand schedule for the stock will not shift up by as much as it would without the investment constraints. In other words, their demand for the stock at a given price would be lower than the benchmark case without the investment constraints. When demand curve for stock is downward sloping, stock with good news that is already overweighted by the institutions would have a lower market-clearing price than the case without the investment constraints. In this sense, the stock is undervalued because the good news is not fully reflected in the market price, thus setting up a higher future returns. Similarly, institutions may be constrained from selling stocks that they already underweight, even when they have negative information about the stocks. Thus, stocks with bad news but underweighted by the institutions are overvalued (as the bad news is not fully reflected in the market price) and would have abnormally low future returns.

The impact of investment constraints on stock prices generates cross-sectional differences in stock returns that depend on both the direction of institutional investment constraints and the signs of informational signals. For example, when institutions receive good news about a stock, institutions' buying constraints are more likely to be binding if they already overweight the stock than if they underweight it. Thus, among stocks that are having good news, those stocks currently overweighted by institutions would experience more price underreactions and

deliver higher future returns than those stocks currently underweighted by institutions. Similarly, institutions would have more constraints selling a stock with bad news when they already underweight it. Thus, among stocks that are experiencing bad news, those stocks currently underweighted by institutions tend to subsequently underperform those currently overweighted by institutions. Finally, for stocks without significant news, institutional investment constraints should have little impact on stock prices. Thus, no significant differences are expected in the future returns of stocks that institutions currently overweight and those they underweight, when the stocks do not have significant news.

Using quarterly data on institutional equity holdings between 1980 and 2013, we construct two measures of institutional investment constraints for each stock and in each quarter. We compute the fraction of institutions that overweight the stock as well as the abnormal level of aggregate institutional ownership of the stock. The overweight/underweight measures capture the essence of diversification requirement and tracking-error restrictions. We use two proxies for news, one based on stock return over a relatively short horizon (e.g., six months), and the other based on firm's quarterly earning surprises.

We find direct evidence that investment constraints affect institutional trading behavior. Institutions are reluctant to buy stocks they already overweight or sell stocks they already underweight. More importantly, empirical tests strongly support our hypotheses on the asset pricing impact of institutional investment constraints. Among stocks that are having good news, those that institutions already overweight significantly outperform in the future those that institutions underweight. Similarly, for stocks that are having bad news, those that institutions underweight subsequently underperform those that institutions overweight. Our results are consistent across all combinations of constraints measures and information proxies.

Our tests reveal interesting interactions between institutional investment constraints and well-known asset pricing anomalies such as stock price momentum and post-earnings announcement-drift. For example, we find that a refined momentum strategy which buys only the winner stocks that the institutions overweight and shorts the loser stocks that institutions underweight is sig-

nificantly more profitable than the simple momentum strategy that buys all past winners and shorts all past losers. We also find stronger post earnings announcement drifts for stocks experiencing greater institutional investment constraints.

To the extent that momentum and post earnings announcement drifts manifest mispricing caused by behavioral-biased investors and institutional investors are the smart money, our findings are also consistent with the idea that institutional investors' investment constraints limit their ability to arbitrage stock mispricing.³ Our main argument is that when institutional investors already significantly overweight or underweight a stock, their investment constraints prevent them from fully utilizing their information advantage. Such information advantage could be about firm fundamentals, or stock valuations.

Several recent studies rely on details of mutual fund holdings to predict stock return and interpret the findings as evidence of mutual fund managers' information advantage (e.g., Cohen, Polk, and Silli (2010), Wermers, Yao, and Zhao (2012), Jiang, Verbeek, and Wang (2014)). These studies show that certain variables constructed from mutual fund holdings can predict stock return in unconditional tests, while our hypotheses are conditional on information proxies. Our paper complements and extends these studies. Our results are consistent with their conclusion that money managers can possess private information. We take it one step further by showing how money managers' investment constraints can limit their ability to trade on their information and studying the associated pricing implications. Our paper uncovers interesting new findings. For example, these studies could not explain our finding that momentum and post earnings announcement drift are stronger for stocks experiencing greater institutional investment constraints.

Our paper also sheds new lights on whether institutions' trading predict stock returns. At quarterly frequency, we show that in general, stocks recently bought by the institutions do not subsequently outperform stocks sold by the institutions. However, stocks that institutions recently bought and reached an overweight position do significantly outperform in the future

³Lewellen (2011) provides evidence that institutions' investment decisions are constrained by limits of arbitrage considerations.

stocks that institutions recently sold and reached an underweight position. Our results help reconcile the general belief that institutions are more informed and the lack of return predictive power of institutional trades on average.

Our results are related to, but are different from, the implications of short sales constraints. Unlike short sales constraints, we study institutional investors' buying constraints as well as selling constraints. We provide the first empirical test on the asset pricing implications of buy-side constraints. In addition, the selling constraints motivated by diversification and tracking error concerns could be binding even when investors own shares in the stock. In contrast, investors' short sales constraints apply only to stocks they do not own.

II. Data and Methodology

A. Data

This study uses common stocks listed on the NYSE, AMEX or NASDAQ that appear in CRSP and Compustat. We exclude stocks that do not have a CRSP share code of 10 and 11, such as REITs, closed-end funds, and ADRs. We also exclude stocks priced below \$5 and stocks in the lowest market capitalization decile based on NYSE breakpoints as of the end of the previous calendar year. We obtain firm financial information from Compustat. Because of the availability of institutional equity holding data, our sample period is from the first quarter of 1980 through the fourth quarter of 2013.

Institutional equity holding and trading data are obtained from CDA Spectrum 13F Filings, currently distributed by Thomson Reuters. Under the 1978 amendment to the Securities and Exchange Act of 1934, all institutional investors managing a portfolio with an investment value of \$100 million or more are required to file quarterly 13F reports to the SEC, listing their equity positions greater than 10,000 shares or \$200,000 in market value as of the last date of each quarter. The reporting requirements encompass various types of institutional managers such as banks, investment companies, pension funds, insurance companies, and brokerage houses.

Throughout the paper, the terms “institutional investors” and “institutions” are used synonymously to refer to 13F institutions or managers.

We use institutional equity holdings data to construct measures of institutional investment constraints. Before we do that, we check the data for inconsistent records using reported holding and trading, and correct those inconsistencies. For example, stock splits can cause inaccuracies in the data in two ways. One, institutions may fail to report split-adjusted holding and trading records correctly. Two, for the late filings, Spectrum adjusted the holding record that should not be adjusted for the record date. In both cases, we use CRSP reported stock splits to check and adjust the holding data. For the cases where the aggregate institutional ownership of a stock is above 100 percent, we check the records of all institutions who own the stock for potential errors. For those questionable records we could not correct, we use the most recent quarter’s holding for which no errors are found.

B. Identifying Constrained Stocks

Our basic hypothesis is that institutional investment constraints distort institutions’ demand for stocks and delay the incorporation of their information into stock prices. In order to identify the impact of investment constraints, we use the stock holdings of institutions to measure whether institutions overweight or underweight a stock in their portfolios. In the following, we explain two methods we use to identify whether a stock is overweighted (underweighted) by institutional investors. The overweight measures are related to the diversification requirement discussed earlier, and capture well both the explicit and implicit tracking-error constraints relative to the benchmarks.

Our first measure of investment constraint, called “overweight ratio”, is based on individual institution’s equity holdings. At the end of each quarter and for each institution, we first classify whether the institution overweights or underweights a stock in its portfolio. Then, for each stock, the overweight ratio equals the number of institutions who overweight the stock divided by the total number of institutions that hold the stock. By definition, most institutions holding a stock

with a high (low) overweight ratio overweight (underweight) it. Thus, a high (low) overweight ratio indicates that institutional investors on average face buying (selling) constraints for the stock.

An empirical difficulty in determining whether an institution overweights a stock is that its benchmark is unobservable to us. To overcome this difficulty, we take advantage of the observed portfolio composition of institutional investors. The composition of an institution's portfolio contains information about its benchmark. Given the diversification requirement and the tracking error concerns, an institution's portfolio should be close to its benchmark. Thus, it makes sense to compare weights of stocks in an institution's portfolio to those in the value-weighted portfolio of the same stocks. Suppose the institution's portfolio consists of N_i shares of stock i , $i = 1, \dots, K$. Stock i 's price per share is P_i and market capitalization is M_i . We say that the institution overweights a stock i if its weight in the portfolio is higher than the corresponding weight in the value-weighted portfolio consisting of the same K stocks:

$$\frac{P_i N_i}{\sum_{j=1}^K P_j N_j} > \frac{M_i}{\sum_{j=1}^K M_j}. \quad (1)$$

Intuitively, this means that for any two stocks A and B in the institution's portfolio, the institution holds relatively too much of A (overweights stock A relative to stock B) if the ratio of stock A's weight to stock B's weight in the portfolio is higher than the ratio of their market cap.

One main advantage of our approach for measuring investment constraints is that, by focusing on the holdings of the institutions, we can identify a substantial portion of the investment universe of the institutions and consequently identify the investor base of a stock and the potential constraints these investors face. Recent studies provide empirical support for identifying the likely investment targets of the institutional investors based on their holdings. Studying the investment decisions of mutual funds, Alexander, Cici, and Gibson (2007) and Coval and Stafford (2007) both show that institutions are far more likely to continue to add to positions in the existing stocks in their portfolio than initiating positions in new stocks. Based on such evidence, Edmans, Goldstein, and Jiang (2012) and Khan, Kogan, and Serafeim (2012) measure

investor demand pressure at the stock level based on mutual fund holdings. In both papers, the authors hypothesize that if a mutual fund holds a stock, and if the mutual fund experiences large inflow (outflow), then the stock in the mutual funds portfolio experiences positive (negative) demand pressure. For our approach, we further classify, within an institution’s portfolio, whether a stock is over- or under-weighted by the institution. An overweight ratio, defined as the number of institutions that overweight the stock divided by the total number of institutions that own the stock, captures the likelihood that the institutional investors of the stock face investment constraints when deciding whether to change the weight of the stock in their portfolios.⁴

Table 1 studies the cross-sectional determinants of the overweight ratio defined above. The cross-sectional regressions are run for each quarter. The regressors include firm characteristics that are related to institutional investors’ preference and are measured at the end of the previous quarter.⁵ We find that firm characteristics such as size, book-to-market ratio, momentum and S&P 500 index membership are significantly related to a stock’s overweight ratio. Specifically, large stocks and stocks that belong to S&P 500 index tend to have low overweight ratio, while value stocks and past winner stocks tend to have high overweight ratio. In unreported results, we find that institutional ownership for large stocks and S&P 500 index member stocks is more dispersed: a large number of institutions hold these stocks, but many of them only hold a small amount of these stocks, resulting in low overweight ratio. In contrast, the institutional ownership of a typical growth stock or past winner stock tends to be more concentrated: a small number of institutions hold the stock and most of them overweight it. This translates into higher overweight ratio for the growth stocks and past winner stocks.

Since size, book-to-market ratio and momentum are significantly related to both overweight ratio and stock expected returns, these variables may confound the inference in our tests of the asset pricing impact of institutional investment constraints. Therefore, we control for the

⁴In unreported work, we include institutions that used to own the stock during the last year as well as those that currently own it in the denominator of overweight ratio. Results are similar to those reported later in the paper.

⁵See, e.g., Badrinath, Gay, and Kale (1989), Lakonishok, Shleifer, and Vishny (1992), Del Guercio (1996), Falkenstein (1996), Gompers and Metrick (2001), and Bennett, Sias, and Starks (2003).

influence of size, book-to-market and momentum on the overweight ratio. Throughout the rest of the paper, overweight ratio refers to the residual of the overweight-ratio regression as in Model 3 of Table 1. Our results do not change if we use, as the constraint measure, the raw overweight ratio ranked conditional on stock size alone, or the residuals obtained from other models in Table 1, or the residuals from regressing the raw overweight ratio on size, book-to-market ratio, momentum, S&P 500 membership dummy, trading volume, growth option, firm age, volatility, analyst coverage, and analyst dispersion. Note in all these variations, the overweight-ratio measure is by construction uncorrelated with size. Thus, there is no size-bias in the overweight classification. This point will be empirically verified in Table 3.

Our second measure for whether institutional investors overweight a stock starts with level of aggregate institutional ownership (IO) of the stock, defined as the number of shares held by all institutions divided by the total common shares outstanding. If the aggregate institutional portfolio replicates the value-weighted market portfolio, then IO of all stocks should be the same. Relative to the value-weighted market index, institutional investors as a group overweight high IO stocks and underweight low IO stocks. However, it is not appropriate to make cross-sectional comparisons on investment constraints directly based on the raw institutional ownership, because institutional investors display distinct preferences for various stock characteristics.

Our second constraint measure is the abnormal institutional ownership for each stock after adjusting for institutional equity preference. At the end of each quarter, we run a cross-sectional regression for institutional ownership on size, book-to-market ratio, momentum, and a S&P 500 membership dummy.⁶ The residual from the IO-regression, which we call residual institutional ownership (residual-IO), measures the excess amount of institutional holding for a stock relative to the average institutional ownership for stocks with similar characteristics. Institutions in aggregate overweight stocks with high (positive) residual-IO and underweight stocks with low (negative) residual-IO.

⁶In each quarterly cross-sectional regressions, the regressors (e.g., firm size) are measured at the end of the previous quarter. Using the residual of several alternative cross-sectional IO-regressions as our second constraint measure provides similar results.

Since the cross-sectional IO-regressions are run each quarter, our residual-IO measure takes into account the trend of increasing average institutional ownership as well as the dynamic institutional preference (e.g., Gompers and Metrick (2001), Bennett et al. (2003)). In addition, the residual institutional ownership is by construction uncorrelated with variables like size and book-to-market ratio. This makes it easier to interpret results of asset pricing tests. In contrast, portfolios sorted directly on stocks' raw institutional ownership level would overlap heavily with a size-sort, because of the significant positive correlation between size and institutional ownership.

The overweight ratio and residual-IO are complementary measures of institutional investment constraints. The overweight ratio focuses on whether each individual institution overweights a stock in its portfolio and what fraction of institutions holding a stock overweight it. It captures the idea that if a larger proportion of institutions are constrained from buying or selling a stock, the pricing impact of such constraints should be greater. The residual-IO measures complements the overweight ratio measure by taking into consideration of the magnitude of overweight or underweight position at the aggregate level. Empirically, overweight ratio and residual-IO are positively correlated. The time-series average of the cross-sectional correlation between the two measures are 0.6. Because the two measures are derived differently and may capture different aspects of investment constraints, we employ both measures of constraints in our empirical analysis to ensure the robustness of our results.

C. Information Proxies

We propose that investment constraints may prevent institutional investors from fully utilizing the information they possess or reacting properly to public news. Investment constraints are more likely to be binding and affect stock prices for stocks that experience significant news. The impact of investment constraints depends on the combination of investment constraints – whether institutions overweight the stocks (buying constraints) or underweight the stocks (selling constraints), and whether the news are positive or negative.

To identify stocks that are experiencing significant news, and in particular news that have clearly defined signs, we first use recent stock return as a proxy for news. This approach is consistent with both theoretic models (e.g., Barberis, Shleifer, and Vishny (1998), Hong and Stein (1999)) and many previous empirical studies. At the end of each quarter, we sort stocks into quintiles based on their returns over the last six months. Stocks that fall into the top winner quintile generally have significant good news, while stocks that fall into the bottom loser quintile generally have significant bad news. With this news proxy, institutional investment constraints have an interesting implication for the profitability of momentum strategy: momentum profits should be stronger among winners that institutions overweight and among losers that institutions underweight. The idea is that prices of winner stocks that institutions already overweight only partially reflect the positive information that institutions have, because their investment constraints limit their demand, which causes stock price underreaction and leads to subsequent high stock return.

We also examine the impact of institutional investment constraints around a concrete and significant news event, the firm's earning announcement. Baker, Litov, Wachter, and Wurgler (2010) present evidence that institutional investors are better informed about future earnings. Because binding investment constraints could prevent institutional investors from fully exploiting their information, investment constraints can lead to underreaction to their private signals about earnings. Furthermore, even when institutional investors do not possess earning information ahead of the time, investment constraints could still affect price response to public announcement of the earnings. For example, upon the release of surprisingly high earnings, the share price jumps to the point where the stock's weights in the portfolios of those institutions who overweight the stock become excessively high, so that instead of holding or buying more of the stock, they have to sell some shares to satisfy the diversification requirements or tracking error constraints.⁷ In this case, price reaction to significant earnings news exacerbates investment

⁷We thank the referee for pointing out this important channel through which investment constraints affect the institutional investment decisions. Consistent with this idea, our empirical analysis on institutional trading activities around earnings announcements confirms that constrained institutions in aggregate indeed trade in the opposite direction of earnings surprise after earnings announcements.

constraints and leads to trading by constrained institutions in the opposite direction of earnings news. Such trading behavior prevents institutional investors from exploiting the anomalous post-earnings announcement drift, and in fact could directly contribute to the drift.

For the empirical analysis, our proxy for news is firm’s earnings surprise, measured as the un-split-adjusted IBES earnings per share minus the most recent median analyst forecast preceding the announcement date, standardized by the book value of equity per share.⁸ Based on our hypotheses, institutional investment constraints affect the price drift after earnings announcements: the post-earnings-announcement drift should be stronger for stocks with positive earnings surprise that institutions already overweight, and for stocks with negative earnings surprise that institutions already underweight.

III. Investment Constraints and Demand for Stocks

This section examines the impact of investment constraints on institutions’ stock demand. Our hypothesis is that institutions are less likely to buy more of the stocks that they already overweight or sell stocks that they already underweight. We use both overweight ratio and residual-IO to study the relation between investment constraints and the trading activity of institutional investors. Such an analysis not only serves as a direct test for our hypothesis above, but also provides assessment on the effectiveness of our constraint measures.

Table 2 presents the test results. For each quarter, we first sort stocks into three investment-constraint portfolios based on either overweight ratio (Panel A) or residual-IO (Panel B). Then we calculate the change in the level of institutional ownership, change in the overweight ratio and change in the residual-IO for stocks in each of the three portfolios over the six months after as well as the six months prior to the portfolio formation. Panel A reports the time-series average of the changes for portfolios sorted on overweight ratio. Panel B does the same with residual-IO as the sorting variable.

⁸Alternatively, we measure SUE as the most recent standardized unexpected earnings based on a rolling seasonal random walk model. The results are similar.

Institutional trading activities documented in Table 2 are consistent with our hypothesis that institutions face buying (selling) constraints on their high overweight (underweight) positions. In Panel A, we find that over the next six months, institutions buy more of the stocks that they currently underweight, resulting in a 1.48% increase in these stocks' institutional ownership. On the other hand, the institutional ownership of stocks currently overweighted stocks by the institutions is reduced on average by 0.01% over the next six months. Further, we find that stock's (residual) overweight ratio tends to mean-revert toward zero. For example, for stocks currently overweighted by institutions, change in overweight ratio is positive over the more recent six months but negative over the next six months; for stocks currently underweighted by institutions, change in overweight ratio is negative over the more recent six months but positive over the next six months. These results support the hypothesis that institutions could not or would not keep deviating significantly from their benchmark.

In Table 2 Panel A, patterns in the changes of overweight ratio and residual-IO are the same. Further, institutions' trading behavior for portfolios sorted on residual-IO (Table 2 Panel B) are similar to those sorted on the overweight ratio (Table 2 Panel A). These results indicate that both overweight ratio and residual-IO provide similar information as measures of institutional investment constraints.

IV. Investment Constraints and Stock Returns

Section III. presents evidence that investment constraints affect institutions' demand for stocks. This section tests the asset pricing implications of institutional investment constraints. We hypothesize that institutional investment constraints may lead to stock price underreaction to news and stock return predictability. Stocks with good news that are currently overweighted by institutions are undervalued because institutions' buying constraints prevent the good news from getting fully reflected in the stock prices. Stocks with bad news that are currently underweighted by institutions are overvalued because of institutions' selling constraints. Among

stocks that are experiencing good news, those currently overweighted by institutions experience more institutional buying constraints and tend to subsequently outperform those currently underweighted by institutions. Similarly, among stocks that are experiencing bad news, those currently underweighted by institutions experience more institutional selling constraints and tend to subsequently underperform those currently overweighted by institutions.

To test our hypotheses, we form stock portfolios based on measures of investment constraints and proxies of news. Then we compare the average returns of different double-sorted portfolios over several future horizons. We examine whether return patterns of these double-sorted portfolios are consistent with the hypothesized pricing impact of investment constraints. This is our main approach. Later, we complement this portfolio approach using the Fama-MacBeth cross-sectional regressions on individual stock returns.

A. Overweight Ratio and Future Stock Returns

We first present test results using overweight ratio as the measure of institutional investment constraints and recent six-month stock return as the proxy for news. Our hypotheses lead to the following predictions: (1), among the past winner stocks, those that have high overweight ratio (buy-constrained stocks) will subsequently outperform stocks with low overweight ratio; among the past loser stocks, those that currently have low overweight ratio (sell-constrained stocks) will subsequently underperform stocks with high overweight ratio; (2), differences in overweight ratio are not significantly related to future returns for stocks that are neither recent past winners nor losers (stocks without significant news).

At the end of each quarter, we sort all stocks into five quintiles according to their returns over the past six months.⁹ We independently sort stocks into three portfolios of high, medium, and low overweight ratio. Fifteen double-sorted portfolios are obtained by intersecting these two independent sorts. We use fifteen double-sorted portfolios to balance two objectives: (1), to

⁹We refer to stocks in the top (bottom) quintile sorted based on past six-month returns as the winner (loser) stocks. The results are robust to skipping a month between portfolio formation and subsequent performance evaluation.

create enough dispersion in whether stocks are overweighted or underweighted by institutions and whether they are experiencing good news, bad news or no significant news; (2), to make sure that each of the double sorted portfolio contains enough stocks and is reasonably diversified in order to reduce the standard errors in our test statistics.

Table 3 presents summary characteristics for the momentum and overweight ratio double-sorted portfolios. The two independent sorts produce fairly balanced portfolios. For example, each portfolio consists of about 135 stocks; the average size decile ranking is approximately equal across the double-sorted portfolios. In particular, there is no significant difference in size between high overweight ratio stocks and low overweight ratio stocks. There is no obvious size bias in the overweight classification. This is expected since our overweight ratio (as well as residual-IO) already controls for the influence of momentum and other stock characteristics such as size. Stocks in the same overweight ratio tercile have approximately the same level of average institutional ownership and average residual-IO. Stocks with high overweight ratio also tend to have high level of institutional ownership and residual-IO.

Table 4 Panel A reports the average monthly returns for equal-weighted portfolios double sorted on price momentum and overweight ratio, over the K ($K = 3, 6$) months after portfolio formation. Note that our portfolios are formed every three months because the institutional equity holding data (and hence our constraint measures) are available quarterly. For holding period $K > 3$ months, at the end of each quarter and for each double-sorted portfolio, there are other portfolios formed at previous quarters that are still “alive”. Following Jegadeesh and Titman (1993), we first average the monthly returns of these various aged portfolios in one month, and then take the time-series average over the sample period to arrive at the average monthly portfolio returns reported in Table 4 Panel A. In addition to the raw returns, Table 4 Panel A also reports characteristics-adjusted mean portfolio returns where we first subtract from the raw return of each stock the return of the corresponding size and book-to-market matched portfolio, and then take average. Results for holding periods $K = 12, 24$ months are reported in the Online Appendix and are qualitatively similar, although the magnitudes of the differences

in the average return of high versus low overweight ratio stocks decrease as the holding period lengthens. In the following discussions, we focus on the case of $K = 6$.

Table 4 Panel A shows that among past winner and past loser stocks, those with high overweight ratio tend to have higher subsequent returns. For example, the difference between the average monthly return of high overweight ratio winners and low overweight ratio winners is 0.29% and is highly statistically significant. Similarly, high overweight ratio losers on average outperform low overweight ratio losers by about 0.30% per month during the six months after portfolio formation. After controlling for size and book-to-market characteristics portfolio return, high overweight ratio stocks still significantly outperform low overweight ratio stocks by about 0.24% per month among both past winner and past loser stocks. Further, this predictive power of overweight ratio for future stock return is U-shaped. The differences in the returns between stocks with high and low overweight ratio are not significant among stocks that are neither recent winners or losers. This holds for both the raw returns comparisons or size and book-to-market adjusted returns comparisons.

The above results are consistent with the predictions motivated by the pricing impact of institutional investment constraints. They support the idea that institutional investment constraints cause price underreaction to news for stocks affected by the constraints. Note that the forecast power of overweight ratio for stock returns does not come from the momentum effect as we report return differences between stocks within each portfolio sorted by past returns (i.e., we control for the momentum effect).

Table 4 Panel A further shows an interesting interaction between the effects of investment constraints and momentum: the profitability of momentum strategy increases monotonically with the degree of investment constraints. Momentum strategy is most profitable among stocks facing high (or binding) investment constraints (i.e., past winner stocks overweighted by institutions and past loser stocks underweighted by institutions). For example, between 1980 and 2013, and for a holding period of $K = 6$ months, the momentum strategy applied to these highly constrained stocks generates a significant average return of 0.91% per month. In contrast, when

momentum strategy is applied to unconstrained stocks (i.e., buy the low overweight ratio past winners and sell the high overweight ratio past losers), it generates an average monthly return of only 0.32%. This momentum profit is about 0.59% lower than the momentum profits for the constrained stocks. Momentum strategy profit is 0.61% per month among the medium overweight ratio stocks.¹⁰ Controlling for size and book-to-market characteristics does not change patterns of momentum profits across the constraint portfolios.

B. Alternative Measures

In Section A., we use overweight ratio as the measure of institutional investment constraints and recent six-month stock return to proxy for news that institutional investors have. This subsection reports additional test results where we use residual institutional ownership as the constraint measure and quarterly earnings surprises as proxy for news. In addition to providing robustness checks on the results reported in Section A., the analysis offers further insights on the asset pricing implications of institutional investment constraints.

In Table 4 Panel B, we double sort stocks into fifteen portfolios based on residual-IO and past 6-months stock returns. The results are similar across various holding periods. The return patterns are identical to those in Table 4 Panel A. For example, high residual-IO stocks significantly outperform low residual-IO stocks in the next six months, by about 0.45% per month among the past winner stocks, and by about 0.39% per month among the past loser stocks. The predictive power of residual institutional ownership for stock return is also U-shaped. The differences in the average monthly returns between the high residual-IO and the low residual-IO stocks when their past six-month returns rank in the second to fourth quintiles (i.e., neither winners nor losers) are all smaller than 0.1% and statistically insignificant. Further, buying high residual-IO winners (for which institutions face high buying constraints) and selling low

¹⁰The magnitudes of momentum profits in our paper are lower than those reported in Jegadeesh and Titman (1993) because (1) the difference in the sample periods (momentum strategy has performed poorly during the last decade in our sample, see, e.g., Daniel and Moskowitz (2013)), and (2) we use 5 return quintiles, which leads to a smaller difference between the past returns of winners and losers and thus a smaller momentum profit compared to the strategy that sort stocks into 10 deciles based on past returns.

residual-IO losers (for which institutions face high selling constraints) earns a statistically significant 1.02% return per month over the next six months. In contrast, buying low residual-IO winners and selling high residual-IO losers only returns about 0.19% per month which is not significantly different from zero. Hence, results here confirm that momentum profits are higher among stocks experiencing more institutional investment constraints.

Next, we study the asset pricing implications of institutional investment constraints using corporate earnings announcement as the information event. At the end of each quarter, we sort stocks into three portfolios based on either their overweight ratio or residual institutional ownership. Then, we independently sort stocks into five portfolios based on their measured earnings surprises from earnings announcements in the next quarter. Finally, we intersect the two sorts to obtain fifteen double-sorted portfolios. Following existing studies, we use holding period returns over a sixty-trading-days window after earnings announcements and compute the price drift by adjusting for size decile benchmark portfolio returns over the same period.¹¹ The time-series average of the post earning announcement price drift for different portfolios are reported in Table 5.

Consistent with post-earnings-announcement-drift documented in many previous studies, Table 5 shows that stocks with positive (negative) earnings surprises on the announcement date subsequently have positive (negative) returns. More interestingly, we find that stocks with extreme positive earnings surprises have the largest (most positive) post earnings announcement drift when they are already overweighted by the institutions. Controlling for positive earnings surprises, stocks that institutions overweight on average outperform stocks that they underweight by a significant 0.94% over the 60 trading days following the earnings announcement (Table 5 Panel A). Among the stocks having extreme negative earnings surprises, those that institutions already underweight have lower future returns (i.e., more negative drift) than those that institutions overweight. The difference is -0.86% and statistically significant (Table 5 Panel

¹¹We define the earnings announcement date as date 0, and calculate the sixty trading day return from day 2 to day 61. We obtain similar results when using 5x5 size and book-to-market characteristics adjusted stock returns.

A). Results are similar when we use residual-IO as the measure of institutional investment constraints (Table 5 Panel B). Finally, consistent with our prediction and the results in Table 4, the predictive power of constraint measures for post earnings announcement drift is U-shaped.

Results above collaborate those in section A. and provide further support for the hypothesized impact of institutional investment constraints on stock prices. Our results also suggest that institutional investment constraints play an important role in explaining the post-earnings announcement drift. This is consistent with Hirshleifer, Myers, Myers, and Teoh (2008) who conclude that individual investors do not drive post-earnings announcement drift. Recent research on post earnings announcement drift has generally pointed to investors' underreaction induced by investor behavioral bias as the cause of such price drift. Our results show that investment constraints inherent in investor portfolio decisions could also lead to underreaction to earnings news and the subsequent price drift.

One distinctive feature of our investment constraint measures is that they are constructed to capture both buying and selling constraints. Compared with studies that solely focus on short-sale constraints, our approach allows us to consider constraints on both buying and selling decisions and to consider selling constraints that could become binding before holdings reach zero. Given that most of the institutional investors are long-only investors, our results should be stronger when there are negative news and institutions underweight the stocks than when they overweight stocks that have positive news.¹² The results in Table 4 and 5 support the idea that our measures capture better the binding constraints for stocks with news. For example, Table 4 Panel B (holding period $K=3$ months) shows that for stocks experiencing negative news, those that are most underweighted by institutions have an average monthly return of 0.626%, which is significantly lower than the 0.957% monthly average returns for stocks that are not suffering from institutional investment constraints. By comparison, the stocks experiencing positive news that are overweighted by institutions have an average monthly return of 1.639%, which is not significantly different from the 1.591% average monthly return for stocks not facing

¹²We thank the referee for highlighting this implication.

significant institutional investment constraints. In unreported table (available upon request), we find that the same comparisons hold for Fama-French 3-factor model alphas as well as for the size and book-to-market characteristics-adjusted returns. In addition, the magnitudes of the Fama-French 3-factor alphas or characteristics-adjusted returns for the constrained stocks experiencing negative news are about twice the size of those for the constrained stocks experiencing positive news. These results confirm the asymmetric effects of institutional investment constraints.

C. Further Robustness Checks and Alternative Explanations

In this subsection, we first verify the robustness of our main results to variations in the sorting procedures as well as using Fama-MacBeth regressions. We also examine how the effects of the investment constraints vary across different types of institutions. We further evaluate a potential alternative explanation of our results based on informed institutions.

All of the results reported above are robust to variations in the double-sort procedure, such as sorting on past three months or one year return instead of six months return, or using ten past return-sorted portfolios and five constraint-sorted portfolios. Similar results are obtained when we form portfolios each month instead of each quarter using the most recent institutional ownership. Further, our results remain qualitatively the same when we use the previous quarter's institution holdings data when measuring institutions' investment constraints.

When we repeat our analysis separately for the large stocks and for the small stocks, our results hold in both subsamples. In addition, our results hold up in two subperiods (from January 1980 to December 1995, and from January 1996 to December 2013). Our portfolio-sorting results also hold for the Fama-French three-factor alpha, beyond the raw returns and characteristics-adjusted returns reported previously.

We run Fama-MacBeth type cross-sectional regressions to further check the robustness of the predictive power of our institutional investment constraint measures for stock returns obtained using the portfolio approach. The cross-sectional regressions are run each quarter. In quarter t 's regression, the dependent variable is the average monthly return for individual stocks over that

quarter. The key regressor is overweight ratio (or residual-IO) at the end of quarter $t - 1$. The control variables include size (log market cap measured at the end of quarter $t - 1$), momentum (past six-month stock return), book-to-market equity ratio and return on equity (both measured as of the end of the previous year), average monthly turnover ratio over the last two quarters, volatility of stock return, and institutional trading (change in institutional ownership) over the last two quarters. The stock characteristics we include are standard in cross-sectional return regressions.

Table 6 reports the time-series mean of the coefficient estimates (and their t -statistics) for the cross-sectional regressions. Model (1) of Panel A shows that overweight ratio positively predicts future stock returns above and beyond all the control variables above. The same result holds in Model (1) of Panel B using residual institutional ownership as the constraint measure. In particular, the relation between our institutional investment constraint measures and future stock returns is not driven by institutional trading. In fact, at quarterly frequency, institutional trading does not significantly predict subsequent stock returns in our sample.

One of our findings that shows up consistently in Table 4 and 5 is that the U-shaped forecasting power of our constraint measure for stock returns: it is only significant for stocks that are experiencing significant news. To check this result using the Fama-MacBeth regressions, we introduce two additional regressors in Model (2) of Table 6 Panel A, which are the interactions of overweight ratio with a dummy for the past six-month winners and with a dummy for the past six-month losers. Consistent with previous results based on the portfolio approach, these two interaction variables are both significantly positively related to future stock returns in the Fama-MacBeth regressions as well. After controlling for these interaction terms, the overweight ratio variable itself is no longer statistically significant. The same results obtain in Table 6 Panel B with residual-IO as the constraint measure. Thus, the U-shaped pattern in the predictive power of our constraint measures for stock returns is confirmed in the cross-sectional regressions.

The magnitudes of the return spreads generated by the constraint measures as implied by the

Fama-MacBeth regressions are close to those based on the portfolio approach reported earlier. For example, the estimated coefficient for the interaction of overweight ratio with the losers dummy is 1.079. Given the 0.25 average difference in the overweight ratio of between the high and low tercile (see Table 3), this coefficient translates into an expected return difference between the high overweight ratio losers and the low overweight ratio losers of 0.27% per month over the next quarter. For comparison, the return difference (adjusted for size and book-to-market) between the high and low overweight ratio losers (for holding period $K = 3$ in Table 4) based on the portfolio sorting approach is 0.39%.

We next examine how the varying investment constraints faced by different types of institutions affect the strength of our results. We follow Bushee and Noe (2000) to classify institutional investors in the 13F database into three different groups: dedicated, quasi-indexers, and transient institutions. “Dedicated institutions are those institutions who hold a small number of stocks but over a long time period and they only represent a very small portion (5%) of the institutions in the sample. “Quasi-indexers include 70% of the 13F institutions, and these institutions follow but also deviate to certain extent from their benchmarks. The “transient institutions (among 25% of the 13F institutions) are those institutions that trade actively in the stocks and do not have clearly specified benchmarks.

In Table 7, we report the results separately for the two types of institutions, “quasi-indexers and “transient institutions. Based on our hypothesis, the types of institutional investors who are mostly likely to be constrained are the “quasi-indexers, institutions that cannot deviate substantially from their benchmarks even when they possess valuable information. The results in Table 7 confirm this prediction. Using overweight ratio as the constraint measure, we find that the investment constraints faced by the quasi-indexers have a much stronger effects on future stock returns, with a clear U-shape across portfolios sorted by recent stock returns (proxy for news). In comparison, results for the transient institutions are much weaker and sometimes insignificant. In an unreported table, we verify the results remain the same when we use the residual institutional ownership as the constraint measure.

Lastly, we evaluate an alternative explanation of our results that is based on informed institutions. One potential explanation for our finding is that overweight ratio and residual-IO may simply reflect institutions' information which enable them to shift their portfolios in advance of abnormally high or low returns. Under this explanation, stocks that institutions currently overweight (underweight) are just those that they recently bought (sold) based on positive (negative) private information. When the information becomes public later, stocks they have bought (and now overweight) would have high future returns, and stocks they have sold (and now underweight) would have low future return.

We conduct formal tests of the informed trading hypothesis to differentiate the informed institution story and the investment constraint hypothesis. The tests provide further insights on the underlying causes of the return predictability of our constraint measures. In Table 8 Panel A, we report post-formation returns for portfolios double sorted on price momentum and net institutional trading (change in institutional ownership) over the past six-months. The table format is the same as Table 4, except we now sort on institutional trading rather than stocks' overweight ratio. Different from the predictive power of our constraint measures, we do not find any evidence that recent institutional trading positively predict stock returns over the next three or six months.¹³ This finding is also consistent with the cross-sectional regression results in Table 6, which shows insignificant coefficient estimates for the institutional trading variable.

Table 8 Panel B helps us better understand how institutional trading and investment constraints interact to affect stock prices and return. For this table, we double sort stocks into 9 portfolios based on change in institutional ownership over the past six-months and current overweight ratio, and then report the post-formation average monthly portfolio returns for holding period of 3 and 6 months. We find that after controlling for changes in institutional ownership, high overweight ratio stocks still significantly outperform low overweight ratio stocks.

Interestingly, we find that whether institutions' trades predict future stock returns depend on whether they experience investment constraints on these stocks. Stocks that institutions re-

¹³Gompers and Metrick (2001) and Cai and Zheng (2004), employing the same data we use, also find no evidence that institutional trading predict future returns at quarterly frequency.

cently bought but still underweight do not have high future returns, and stocks that institutions recently sold yet still overweight do not have low future returns. On the other hand, stocks that institutions recently bought and now overweight significantly outperform stocks that institutions recently sold and currently underweight. The difference is approximately 0.28% per month and economically significant. As institutions trade and reach binding investment constraints, they could not fully take advantage of their information. Their information only get reflected in stock price with a delay. This delay gives rise to return predictability and profitable opportunity to follow the trades of informed (but constrained) institutions, even with a lag such as one quarter.

V. Conclusions

Institutional investors face constraints due to their restrictive investment policies which are not binding on individuals. These additional restrictions are a mitigation of the legal liability imposed on institutional fiduciaries by laws and regulations such as ERISA and the Prudent Investor Rule.

This study examines the impact of institutional investment constraints on the aggregate demand for stocks and the cross section of stock returns. Using institutional equity holding data between 1980 and 2013, we find that institutional investors are less likely to buy more of the stocks that they already overweight, even when there are good news about the stocks. They are also reluctant to sell the stocks that they already underweight, even when they have bad news about the stocks. This behavior is consistent with institutional investment constraints such as diversification requirements and tracking-error restrictions.

We test hypotheses about the impact of institutional investment constraints on stock prices: stocks which institutions overweight may underreact to good news and become undervalued; stocks which institutions underweight may underreact to bad news and become overvalued. Consistent with the hypotheses, we find that among stocks that are having good news, those that institutions overweight significantly outperform in the future those that institutions underweight.

Similarly, for stocks that are having bad news, those that institutions underweight subsequently underperform those that institutions overweight. Further, we find that the momentum strategy and post earnings announcement drift are both stronger among stocks that experience high institutional investment constraints.

Our results support the argument of Allen (2001) that financial institutions matter for asset pricing. They indicate that asset pricing anomalies may be importantly related to institutional investment constraints. In a similar vein, Alankar, Blaustein, and Scholes (2014) demonstrate that investment managers may not eliminate the observed asset-pricing anomalies because they may contribute to their existence. DeVault, Sias and Starks (2014) argue that institutional investors are the sentiment traders whose demand shocks drive prices from fundamental value. Edelen, Ince, and Kadlec (2014) document that that institutions are on the wrong side of anomalies more often than not. Goldman and Slezak (2003) show that delegated portfolio management may distort managers incentive to trade on long-term information and cause stock mispricing. It seems a fruitful venue for future research to explore further how issues arising from delegated portfolio management affect money managers' portfolio decisions and stock prices in equilibrium, following the lead of Roll (1992), Carpenter (2000), Cornell and Roll (2005), Cuoco and Kaniel (2011) and others.

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TABLE 1
Determinants of Overweight Ratio

Table 1 reports results of regressions that study the determinants of stock's overweight ratio, defined as the number of institutions that overweight a stock divided by the number of institutions that hold the stock. For each quarter between 1980 and 2013, we run cross-sectional regressions of the overweight ratio of stocks on a set of firm characteristics, including the natural logarithm of the market capitalization of the stock at the end of the previous quarter (Size), a dummy that takes value 1 for stocks that belong to the S&P 500 index, book-to-market equity ratio as of the end of the previous year (B/M), and the stock return over the previous 12 months (Mom). We report the time-series averages of the estimated coefficients from the cross-sectional regressions and their t-statistics. The sample includes domestic common stocks traded on NYSE, AMEX, and NASDAQ from 1980 to 2013, excluding REITs, closed-end funds, ADRs, as well as stocks that are priced below \$5 or that rank in the lowest market capitalization decile as of the end of the previous calendar year.

Parameter	(1)		(2)		(3)	
	Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Intercept	0.939	50.27	0.879	43.72	0.888	42.74
Size	-0.066	-22.58	-0.056	-18.02	-0.057	-18.24
S&P			-0.053	-28.27	-0.048	-25.49
B/M					-0.004	-4.84
Mom					0.027	16.25
Adj-R ²	0.348		0.362		0.370	

TABLE 2
Investment Constraints and Institutional Trading

Table 2 reports institutional trading activity for stocks sorted on overweight ratio (OR) and residual institutional ownership (ResIO). OR of a stock is defined as the percentage of overweighting institutions unexplained by the cross-sectional regression reported in Model (3) of Table 1. ResIO for a stock is defined as the level of aggregate institutional ownership unexplained by the cross-sectional IO-regression with the same regressors as Model (3) of Table 1. At the end of each quarter, we sort the stocks into three groups (Low-inst, Med, High-inst) based on their overweight ratio and residual-IO respectively. We then calculate the average change in institutional ownership (IO), average change in OR, and average change of residual-IO during the two quarters prior to, as well as the two quarters following the measurement of investment constraints. Panel A reports the time-series mean of the changes for the three portfolios sorted based on the overweight ratio. Panel B reports the same for the three portfolios sorted based on the residual-IO. The column “D(H,L)” reports the differences of the three trading measures between the High OR (residual-IO) stocks and Low OR (residual-IO) stocks.

Panel A. Sorted on Overweight Ratio

Overweight Ratio	Previous 6 months			Subsequent 6 months		
	Change in IO	Change in OR	Change in ResIO	Change in IO	Change in OR	Change in ResIO
Low	0.42	-2.54	-0.62	1.48	2.73	0.80
Med	1.35	-0.23	0.07	0.80	0.11	0.11
High	2.01	2.60	0.74	-0.01	-3.01	-0.73
D(H,L)	1.60	5.14	1.36	-1.48	-5.75	-1.53
t-stat.	9.32	20.04	11.5	-15.97	-22.06	-15.77

Panel B. Sorted on Residual Institutional Ownership

Residual IO	Previous 6 months			Subsequent 6 months		
	Change in IO	Change in OR	Change in ResIO	Change in IO	Change in OR	Change in ResIO
Low	-0.25	-0.39	-1.30	2.01	0.39	1.42
Med	0.78	-0.06	-0.39	1.36	-0.05	0.69
High	3.25	0.27	1.87	-1.10	-0.51	-1.93
D(H,L)	3.50	0.66	3.17	-3.12	-0.89	-3.35
t-stat.	11.28	5.98	22.44	-24.07	-8.77	-25.80

TABLE 3
Characteristics of Momentum-Overweight Ratio Portfolios

Table 3 reports several characteristics of the portfolios double sorted by price momentum and overweight ratio. At the end of each quarter between 1980 and 2013, we first sort stocks into five quintiles (P1-P5) based on stock returns over the past six months. We then independently sort the stocks into three groups (Low-OR, Med, High-OR) based on their current overweight ratio. P1 refers to the portfolio with the lowest return and P5 the highest. The momentum- overweight ratio portfolios are obtained by intersecting the two independent sorts. For each momentum- overweight ratio portfolio, the table reports its average monthly return (in percent) over the past six months, average size ranking based on market capitalization decile sorted by NYSE breakpoints, average number of stocks it contains, average level of overweight ratio, average level of institutional ownership and average level of residual-IO.

	Low-OR	Med	High-OR	Low-OR	Med	High-OR	Low-OR	Med	High-OR
	Average Monthly Return			Size Ranking			No. of Observations		
P1	-4.03	-3.83	-3.73	3.96	4.45	3.88	147.1	128.2	128.3
P2	-0.41	-0.42	-0.41	4.90	5.48	4.70	135.1	135.9	133.2
P3	1.31	1.31	1.34	5.24	5.82	5.02	134.8	136.6	132.8
P4	3.18	3.15	3.19	5.41	5.90	5.08	127.2	138.4	138.6
P5	8.00	7.27	7.07	5.11	5.46	4.74	128.8	134.6	140.5
	Overweight Ratio			Institutional Ownership			Residual IO		
P1	-0.135	0.016	0.114	0.358	0.543	0.607	-0.137	0.035	0.117
P2	-0.129	0.016	0.113	0.370	0.554	0.620	-0.145	0.024	0.114
P3	-0.126	0.016	0.113	0.372	0.558	0.625	-0.150	0.020	0.112
P4	-0.122	0.016	0.112	0.382	0.562	0.632	-0.144	0.022	0.117
P5	-0.130	0.016	0.113	0.379	0.562	0.630	-0.141	0.034	0.124

TABLE 4**Monthly Returns for Portfolios Based on Price Momentum and Investment Constraints**

Table 4 presents the average monthly returns (in percent) of portfolios double sorted by momentum and investment constraints for the 1980 to 2013 period. In Panel A, investment constraints are measured by overweight ratio. In Panel B, investment constraints are measured by residual-IO. At the end of each quarter, all available stocks are sorted into five momentum quintiles (P1-P5) based on stock returns over the past six months. P1 refers to the portfolio with the lowest return and P5 the highest. The stocks are then independently sorted based on their investment constraints into three groups (Low, Med, High). The momentum-investment constraints portfolios are obtained by intersecting these two sorts. We report average monthly equal-weighted returns of the momentum-investment constraints portfolios over the subsequent 3 to 6 months (holding period $K=3$, 6 months). In addition, we report: (1) difference in average monthly returns between the high investment constraints portfolio and the low investment constraints portfolio for each momentum sort (column D(H-L)); (2) the momentum profits within each investment constraints portfolio (row D(5-1)); and (3) difference in average monthly returns between the high investment constraints /P5 portfolio and the low investment constraints/P1 portfolio, as well as between the low investment constraints/P5 portfolio and the high investment constraints/P1 portfolio (row labeled by “P(H,L)”). We report results based on raw returns as well as results that are adjusted for the 5 by 5 size and book-to-market characteristics portfolio returns.

Panel A. Independent Double Sort on Price Momentum and Overweight Ratio

Momentum	Raw return					Adjusted return				
	K=3					K=3				
	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	0.616	0.947	1.065	0.450	3.71	-0.537	-0.236	-0.147	0.389	3.40
P2	1.225	1.240	1.236	0.012	0.13	-0.043	-0.011	-0.031	0.012	0.14
P3	1.273	1.364	1.342	0.068	0.72	-0.040	0.101	0.020	0.060	0.71
P4	1.194	1.298	1.276	0.082	0.89	-0.079	0.033	-0.023	0.055	0.67
P5	1.273	1.579	1.587	0.315	2.85	0.032	0.338	0.284	0.253	2.50
D(5,1)	0.657	0.632	0.522			0.568	0.574	0.431		
t-stat.	2.56	2.50	2.30			2.51	2.54	2.00		
P(H,L)	0.208		0.972			0.179		0.821		
t-stat.	0.84		3.87			0.790		3.62		

Momentum	K=6					K=6				
	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	0.674	0.975	0.971	0.296	2.70	-0.478	-0.213	-0.239	0.239	2.36
P2	1.156	1.23	1.213	0.057	0.69	-0.111	-0.024	-0.060	0.051	0.68
P3	1.258	1.334	1.373	0.115	1.39	-0.035	0.061	0.070	0.105	1.43
P4	1.294	1.342	1.336	0.042	0.52	0.007	0.071	0.028	0.021	0.30
P5	1.291	1.581	1.583	0.292	2.98	0.042	0.325	0.282	0.241	2.66
D(5,1)	0.617	0.606	0.613			0.520	0.537	0.522		
t-stat.	2.76	2.70	2.97			2.69	2.70	2.71		
P(H,L)	0.320		0.909			0.281		0.760		
t-stat.	1.51		3.88			1.43		3.72		

Panel B. Independent Double Sort on Price Momentum and Residual Institutional Ownership

Momentum	Raw return					Adjusted return				
	K=3					K=3				
	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	0.626	0.957	1.049	0.423	3.00	-0.526	-0.221	-0.178	0.348	2.74
P2	1.209	1.332	1.151	-0.057	-0.50	-0.053	0.074	-0.119	-0.066	-0.63
P3	1.350	1.356	1.258	-0.092	-0.80	0.022	0.090	-0.047	-0.069	-0.68
P4	1.228	1.327	1.231	0.002	0.02	-0.049	0.042	-0.040	0.009	0.09
P5	1.215	1.591	1.639	0.424	3.39	-0.031	0.340	0.355	0.386	3.32
D(5,1)	0.589	0.634	0.590			0.495	0.560	0.532		
t-stat.	2.30	2.55	2.51			2.23	2.48	2.40		
P(H,L)	0.166		1.013			0.147		0.880		
t-stat.	0.64		4.05			0.63		3.90		

Momentum	K=6					K=6				
	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.
P1	0.637	0.965	1.022	0.385	2.96	-0.502	-0.222	-0.207	0.296	2.61
P2	1.138	1.275	1.188	0.050	0.47	-0.126	0.017	-0.085	0.041	0.42
P3	1.295	1.377	1.286	-0.009	-0.09	-0.009	0.102	-0.006	0.003	0.03
P4	1.308	1.373	1.295	-0.013	-0.13	0.022	0.077	0.014	-0.008	-0.08
P5	1.210	1.586	1.655	0.445	3.88	-0.042	0.326	0.364	0.406	3.85
D(5,1)	0.572	0.621	0.633			0.461	0.548	0.571		
t-stat.	2.48	2.85	2.99			2.34	2.83	2.89		
P(H,L)	0.188		1.018			0.165		0.866		
t-stat.	0.82		4.26			0.80		4.14		

TABLE 5**Excess Returns for Portfolios Based on Earnings Surprise and Constraint Measures**

Table 5 presents average excess returns (in percent) during the 60 trading days following quarterly earnings announcements for earnings surprise-investment constraints double-sorted portfolios for the 1980 to 2013 period. The excess returns are raw returns adjusted for size-decile portfolio returns. The two measures for investment constraints are overweight ratio and residual IO. Panel A reports results using overweight ratio as the constraint measure, and Panel B reports results based on the residual-IO. Earnings surprise is defined as the actual earnings per share minus consensus analyst forecast, standardized by per share book value of equity. Each quarter, all available stocks are sorted into quintiles (E1-E5) based on next quarter's earnings surprise. E1 refers to the portfolio with the most negative earnings surprise and E5 the most positive. The stocks are then independently sorted based on their overweight ratio or residual IO into three groups: Low, Med, High. The earnings surprise- overweight ratio (or earnings surprise-residual IO) portfolios are obtained by intersecting the two sorts. We report average excess returns and the difference in the average excess returns between the high overweight ratio (or residual-IO) portfolio and the low overweight ratio (or residual-IO) for each earnings surprise sort (column D(H-L)).

Panel A. Independent Double Sort on Earnings Surprise and Overweight Ratio

Earnings Surprise	Low	Med	High	D(H,L)	t-stat.
E1	-1.226	-0.579	-0.362	0.864	2.62
E2	-1.079	-0.442	-0.959	0.109	0.33
E3	-0.091	0.087	-0.001	0.091	0.29
E4	1.068	1.661	1.800	0.732	2.14
E5	3.673	4.126	4.608	0.936	2.58

Panel B. Independent Double Sort on Earnings Surprise and Residual Institutional Ownership

Earnings Surprise	Low	Med	High	D(H,L)	t-stat.
E1	-1.312	-0.542	-0.431	0.881	2.22
E2	-1.118	-0.620	-0.717	0.392	1.09
E3	-0.209	-0.124	0.229	0.438	1.38
E4	1.066	1.542	1.858	0.793	2.08
E5	3.612	4.245	4.446	0.834	2.66

TABLE 6
Fama-MacBeth Cross-Sectional Regressions

Table 6 reports the results of Fama-MacBeth cross-sectional regressions of individual stock returns on firm characteristics variables and measures of investment constraints. The cross-sectional regressions are run once a quarter. In quarter t 's regression, the dependent variable is the average monthly stock returns over the same quarter. The overweight ratio (OR) and the residual-Institutional Ownership (RIO) are measured at the end of quarter $t-1$. The control variables include firm size measured at the end of last quarter, book-to-market equity ratio (B/M) and return on equity (ROE) measured as of the end of the previous year, standard deviation of monthly returns over the past two years expressed in percent (Volatility), average monthly turnover over the past six months (Turnover), average monthly stock returns over the past six months (Moment(-6)), and the net institutional trading over the past six months (Trading). Panel A reports the results based on the overweight ratio. Model (2) adds as regressors the interaction of OR with a dummy that takes value 1 for stocks whose past 6-month return is in the lowest quintile (loser stocks) as well as the interaction of OR with a winner dummy. Panel B reports the results based on residual-IO. Model (2) adds as regressors the interaction of RIO with a loser dummy and the interaction of RIO with a winner dummy. The table reports the time-series averages of the estimated coefficients from the cross-sectional regressions and their t -statistics. The sample includes domestic common stocks traded on NYSE, AMEX, and NASDAQ from 1980 to 2013, excluding REITs, closed-end funds, ADRs, as well as stocks that are priced below \$5 or that rank in the lowest market capitalization decile as of the end of the previous calendar year.

Panel A. The Impact of Overweight Ratio (OR)

Parameter	Model (1)		Model (2)	
	Estimate	t-stat.	Estimate	t-stat.
Intercept	1.374	7.58	1.374	7.49
Size	-0.012	-1.47	-0.012	-1.41
B/M	0.122	1.43	0.118	1.38
ROE	0.098	0.90	0.077	0.70
Volatility	-0.029	-1.66	-0.028	-1.62
Turnover	-0.021	-2.89	-0.021	-2.97
Moment(-6)	5.116	3.38	5.048	3.34
Trading	-0.129	-0.54	-0.168	-0.71
OR	0.764	2.70	0.415	1.43
Loser*OR			1.079	2.62
Winner*OR			0.958	2.08

Panel B. The Impact of Residual-Institutional Ownership (RIO)

Parameter	Model (1)		Model (2)	
	Estimate	t-stat.	Estimate	t-stat.
Intercept	1.414	7.39	1.411	7.32
Size	-0.009	-1.17	-0.009	-1.18
B/M	0.086	0.88	0.087	0.88
ROE	0.164	1.31	0.152	1.19
Volatility	-0.029	-1.57	-0.028	-1.53
Turnover	-0.021	-3.00	-0.022	-3.06
Moment(-6)	5.527	3.61	5.389	3.54
Trading	-0.261	-0.95	-0.310	-1.13
ResIO	0.461	2.20	0.210	1.00
Loser*RIO			0.601	2.27
Winner*RIO			0.807	3.08

TABLE 7
Monthly Returns for Portfolios Based on Price Momentum
and the Investment Constraints by Different Types of Institutions

Table 7 presents the average monthly returns (in percent) of portfolios independently double-sorted by momentum and overweight ratio (Low, Med, or High) separately for quasi-indexers and for transient institutions. P1 refers to the portfolio with the lowest past six-month return and P5 the highest. We report the average monthly equal-weighted returns of the momentum-investment constraints portfolios over the subsequent 3 to 6 months (holding period $K=3, 6$ months).

Quasi-Indexer Institutions		K=3					K=6				
Momentum	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.	
P1	0.621	0.955	1.104	0.484	3.81	0.674	0.975	1.013	0.339	2.83	
P2	1.211	1.237	1.263	0.051	0.57	1.157	1.189	1.255	0.098	1.30	
P3	1.237	1.381	1.359	0.122	1.42	1.245	1.328	1.395	0.150	2.00	
P4	1.170	1.309	1.276	0.106	1.21	1.271	1.354	1.338	0.067	0.91	
P5	1.353	1.491	1.616	0.263	2.53	1.360	1.533	1.593	0.234	2.56	
D(5,1)	0.732	0.536	0.512			0.685	0.558	0.581			
t-stat.	2.90	2.11	2.26			3.02	2.49	2.89			
P(H,L)	0.248		0.995			0.347		0.919			
t-stat.	1.03		3.96			1.65		3.91			

Transient Institutions		K=3					K=6				
Momentum	Low	Med	High	D(H,L)	t-stat.	Low	Med	High	D(H,L)	t-stat.	
P1	0.727	0.921	0.940	0.213	1.88	0.776	0.968	0.857	0.081	0.84	
P2	1.210	1.273	1.215	0.005	0.05	1.170	1.209	1.219	0.049	0.56	
P3	1.299	1.318	1.349	0.051	0.54	1.293	1.301	1.357	0.064	0.77	
P4	1.243	1.272	1.272	0.029	0.30	1.312	1.320	1.346	0.034	0.41	
P5	1.346	1.559	1.542	0.195	1.78	1.319	1.532	1.590	0.272	2.93	
D(5,1)	0.619	0.638	0.602			0.543	0.564	0.734			
t-stat.	2.54	2.49	2.51			2.54	2.50	3.35			
P(H,L)	0.406		0.815			0.462		0.814			
t-stat.	1.58		3.50			2.06		3.75			

TABLE 8
Monthly Returns for Portfolios Based on
Institutional Trading and Investment Constraints

Panel A presents average monthly returns (in percent) of portfolios double sorted on stock price momentum and institutional trading activity. Panel B presents average monthly returns (in percent) of portfolios double sorted on institutional trading activity and the overweight ratio. In Panel A, at the end of each quarter, all available stocks are sorted into five momentum quintiles (P1-P5) based on stock returns over the past six months. P1 refers to the portfolio with the lowest return and P5 the highest. The stocks are then independently sorted based on aggregate institutional trading activity during the same six month period into three groups (Sell, Med, Buy). The momentum-trading portfolios are obtained by intersecting these two sorts. We report average monthly equal-weighted returns of the momentum-trading portfolios over the subsequent 3 to 6 months (holding period $K=3, 6$ months). We also report the difference in average monthly returns between the high net institutional trading portfolio and the low net institutional trading portfolio for each momentum sort (column D(B-S)). In Panel B, we double sort stocks based on aggregate institutional trading activity during the past six months (Sell, Med, Buy) and the overweight ratio of the stocks at the end of the quarter (Low-OR, Med, High-OR). We report average monthly equal-weighted returns of the trading-OR portfolios over the subsequent 3 to 6 months (holding period $K=3, 6$ months). In addition, we report: (1) difference in average monthly returns between the high overweight ratio portfolio and the low overweight ratio portfolio for each institutional trading sort (column D(H-L)); (2) the difference of institutional trading portfolio within each overweight ratio portfolio (row D(B-S)); and (3) difference in average monthly returns between the high overweight ratio/Buy portfolio and the low overweight ratio/Sell portfolio, as well as between the low overweight ratio/Buy portfolio and the high overweight ratio /Sell portfolio (row labeled by “P(H,L)”).

Panel A. Independent Double Sort on Price Momentum and Institutional Trading Activity

Momentum	K=3					K=6				
	Sell	Med	Buy	D(B,S)	t-stat.	Sell	Med	Buy	D(B,S)	t-stat.
P1	0.742	0.769	0.566	-0.176	-1.87	0.752	0.828	0.617	-0.135	-1.79
P2	1.203	1.270	1.137	-0.066	-0.80	1.186	1.196	1.089	-0.096	-1.47
P3	1.297	1.385	1.139	-0.158	-2.10	1.309	1.335	1.197	-0.113	-1.82
P4	1.248	1.207	1.260	0.012	0.17	1.318	1.312	1.295	-0.023	-0.41
P5	1.495	1.411	1.479	-0.016	-0.17	1.502	1.447	1.472	-0.029	-0.37

Panel B. Independent Double Sort on Institutional Trading Activity and Overweight Ratio

Trade	K=3					K=6				
	Low OR	Med	High OR	D(H,L)	t-stat.	Low OR	Med	High OR	D(H,L)	t-stat.
Sell	1.030	1.300	1.312	0.282	3.30	1.094	1.312	1.276	0.182	2.28
Med	1.121	1.300	1.338	0.217	2.55	1.158	1.313	1.342	0.184	2.33
Buy	1.129	1.258	1.290	0.161	1.82	1.106	1.271	1.304	0.197	2.47
D(B,S)	0.099	-0.042	-0.023			0.012	-0.041	0.028		
t-stat.	1.180	-0.500	-0.290			0.170	-0.600	0.430		
P(H,L)	-0.183		0.260			-0.170		0.209		
t-stat.	-1.820		2.560			-1.930		2.150		