# Can disclosure decrease price efficiency? Evidence from mutual fund disclosures

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February 2018

## Abstract

We examine the consequences of mandatory disclosure of portfolio holdings on the information content of trades and the information impounded into prices. We document that the disclosure of portfolio holdings is associated with an increase in stock return noise. Returns reverse on disclosure days 38% more over the subsequent 30 days than on the average day when no disclosure takes place. Asset pricing anomalies also earn negative returns, consistent with the noise in returns leading prices to diverge from fundamental value. We then use fund-level data to show that mutual fund managers are more likely to reverse trades initiated on disclosure days, providing support for the hypothesized link between fund disclosure requirements and distortions in asset prices. Examining how the supply of liquidity responds to the decrease in informed trade, we demonstrate that liquidity increases, and the increases are concentrated in smaller stocks. As a result, there are greater price distortions in larger stocks. These results demonstrate that mandated disclosure may have the unintended consequence of decreasing price efficiency in equity markets.

Key Words: Mandatory Disclosure, Return Reversal, Market Efficiency, Price Pressure

# Introduction

Justifications for mandatory disclosure often focus on the externalities of information production. Most studies assume these externalities are positive – in deciding to disclose, firms do not internalize the benefits external users obtain from the information produced (Zingales 2009; Hart 2009; Leuz and Wysocki 2016). This rationale applied to mutual funds suggests funds can use the portfolio holdings other firms disclose to make better asset allocation decisions, increasing economic efficiency. In this paper, we examine whether in the process of producing information about their portfolio holdings, financial intermediaries execute trades which distort prices. Because asset prices in secondary markets are used to allocate capital (Hayek 1945), such distortions would constitute a negative externality of mandatory disclosure. Our research, while not speaking to the overall efficiency of disclosure regulation, documents a novel externality of mandatory disclosure, answering Leuz and Wysocki's (2016) call for more research documenting specific externalities of mandatory disclosure.

Because fund managers control a significant fraction of market capitalization, 33.4% of total stock ownership in 2016, their mandated disclosures have the potential to affect price efficiency, but ex-ante the direction of the impact is unclear.[1] If disclosure disciplines managers into concentrating their holdings in undervalued securities, disclosure deadlines will accelerate fund managers' information into price, improving price efficiency. Alternatively, if fund managers engage in window dressing by purchasing or selling stocks to make it difficult for investors and competitors to infer their true strategy, trades induced by disclosure would have less information

[1] The SEC mandates mutual funds disclose their past periods' portfolio holdings to mitigate agency problems so that investors can make informed portfolio allocation decisions and better monitor fund managers.

about intrinsic value than trades at other times, leading to price distortions. Liquidity provision could also adjust to disclosures, further complicating the impact of disclosure on price efficiency. In particular, if market makers recognize that the ratio of uninformed to informed trades changes when funds must disclose holdings, corresponding changes in their supply of liquidity could counter-balance any variation in information content. The variation in liquidity provision creates the possibility that fund managers trade to distort the inference investors form from disclosure, (Agarwal, Gay, and Ling, 2014; Carhart, Kaniel, Musto and Reed, 2002; Gigler, Kanodia, Sapra and Venugopalan, 2014; Meier and Schaumburg, 2004; Solomon, Soltes and Sosyura, 2014; Wermers, 2001), but doing so has a minimal effect on price efficiency.

Our empirical strategy is to compare the efficiency of security prices on dates when many funds disclose (predominantly quarter end dates) to the efficiency of security prices on days when few funds disclose. In our first set of tests, we test for price distortions (or increased "noise" in returns) by regressing future returns on (i) daily returns, (ii) daily fund disclosures (the market value of securities disclosed on a day valued at last year's prices divided by the total market value of securities disclosed that entire year, again valued at last year's prices) and our variable of interest, (iii) the interaction of daily returns and fund disclosures. If mutual fund disclosures lead to price changes away from intrinsic values, we would expect returns on disclosure days to have larger subsequent reversals as prices move back toward intrinsic value (Biais, Hillion and Spatt, 1999). Alternatively, if mutual fund disclosures lead to more information about intrinsic values, we would expect price changes on days of disclosure to exhibit momentum as subsequent investors trade in the same direction as the informed trades induced by disclosure (Campbell, Grossman, and Wang, 1993).

We find economically large and statistically significant difference in return reversals for disclosure days compared to non-disclosure days. In particular, we find that days with mutual fund disclosures are associated with a 38% greater reversal over the subsequent 30 trading days than the average day during the year. As returns reverse an average of 10% on non-disclosure days, the 38% increase equates to a 380% increase in return reversals. Over half of this effect occurs more than one day after the disclosure day. In fact, calculating reversals beginning two trading days after the disclosure, we find a 350% increase in return reversals for disclosure days relative to non-disclosure days. Our findings hold after including firm fixed effects, day fixed effects and controlling for the impact of earning announcements (EAs) and day of the week on return reversals. We also provide evidence on the duration of the distortions in asset prices. We show that return reversals are not isolated on the day of the disclosure as the day prior to disclosures also has significantly larger return reversals (15%). We find insignificant effects on other days leading up to disclosure, suggesting that less-informed trades associated with window dressing primarily occur on the day of disclosure and the day beforehand.

To enhance our interpretation of disclosure day returns as a convergence away from fundamental value, we show that asset pricing anomalies earn lower returns on days with more disclosures, consistent with lower price discovery (Engelberg, McLean, and Pontiff, 2017) on those days. Post-earnings announcement drift strategies, which are commonly thought to be the result of mispricing, lose three times as much on disclosure days as they earn on a typical day. We document that three of the four non-market Fama and French (2016) factors exhibit significant losses on disclosure days, with only size exhibiting positive returns.

We conduct a series of tests which establish our reversal results relate to mutual fund disclosure requirements rather than some correlated omitted event. First, using institution-level transactions data that enables us to follow fund positions through time, we document that mutual funds are more likely to reverse trades in the next week when those trades have been entered into on a disclosure day, which is suggestive of window dressing and supports the hypothesized link between fund trades and return reversals. Second, we use this dataset to show position reversals increase more in money managers who could be subject to these disclosure requirements than in pension fund managers and wealth managers who will not be. Third, we exploit a shift in fund disclosure timing induced by the 2004 securities regulation, which caused some funds to shift their disclosure timing from quarter end days (i.e. March 31$^{st}$) to non-quarter end month end days (i.e. January 31$^{st}$ or February 28$^{th}$). We find that non-quarter month end day reversals significantly increase following the regulation, consistent with the shift in fund disclosures impacting return reversals. Fourth, we consider the hypothesis that payments (i.e. the tendency for companies to pay employees around month-end) contribute to our results and find evidence inconsistent with this hypothesis.

Our empirical finding that mutual fund disclosures contribute to noise in returns suggests the supply of liquidity does not adjust to the increase in liquidity trades (Admatti and Pfleiderer 1988). Our next set of analyses seeks to understand how the supply of liquidity adjusts and provides some intuition as to why the adjustment is not sufficient to neutralize the price impact of the uninformed trades around disclosure days. First, we document evidence the supply of liquidity responds to disclosure requirements. Both spreads and price impact decrease when funds disclose. Second, using both investor level and market-level data, we show the increase in liquidity is concentrated in the most illiquid securities. One explanation for this result is that the larger spreads available in these securities make the supply of liquidity more responsive to shifts in uninformed trade. Our estimates suggest at least a portion of the supply of liquidity to smaller stocks is attracted away from larger stocks, as disclosure has little effect on liquidity in the largest securities. Third, in untabulated analyses, we show the availability of arbitrage capital has almost no effect on return reversals, suggesting risk or capacity (i.e. market makers can only trade so many stocks) explanations for the insufficient adjustment of liquidity provision rather than the price of arbitrage capital.

Relatedly, we investigate the money left on the table by failing to supply liquidity to disclosure induced trade. Using only the five hundred largest stocks in the economy, a portfolio that front-runs the reversals by taking a long (short) position in firms with the smallest (largest) quarter end returns beginning at the open of the following trading day earns 1.6% over the subsequent month. We document investors could earn a further thirty basis points by taking a long (short) position in stocks that increased (decreased) in value the last two days of the prior quarter, front-running future uninformed trade predictable by last quarter's uninformed trade.

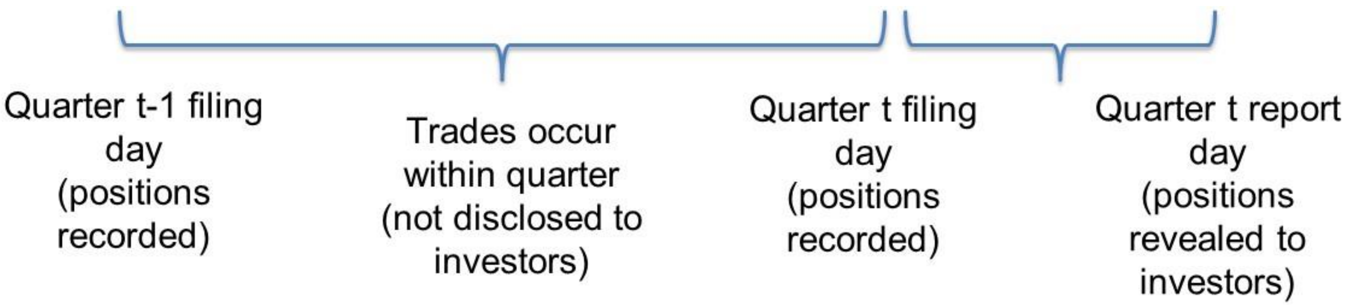
This paper contributes to three streams of literature. The first contribution is related to the literature on the information externalities of mandating disclosure. Previous studies implicitly assume these externalities are positive because information has an ameliorative effect on market functioning. Our study documents that providing information about fund holdings distorts secondary market prices, which may be of interest to regulators because they could plausibly affect the information extracted from prices (Hayek 1945). However, we caution that our focus is on documenting a novel externality of mandatory disclosure and we do not conduct tests which evaluate the efficiency of securities regulation more broadly.

Second, this paper is also related to the literature on price discovery by documenting how the supply of liquidity adjusts to an increase in uninformed trade. Our findings suggest the supply of liquidity does not adjust sufficiently to an increase in uninformed trade generating price distortions. Interestingly, we find liquidity increases more in smaller stocks.

Third, this paper is related to the literature on how investors adjust trade to disclosure requirements. Much of the prior literature focuses on specific strategies (such as buy winners and sell losers) that funds implement. In contrast, we abstract away from the specific strategies and test for changes in price efficiency. We document large decreases in the information content of prices, suggesting disclosure requirements have substantial effects on the securities investors choose to hold.

# 1. Institutional Background and Literature Review

The SEC recognizes the need for disclosure of institutional investors' portfolio holdings as a key aspect of the securities market regulation. Institutional investors are subject to two mandatory ownership disclosure requirements by the SEC – Form 13F filings and Form N-CSR and N-Q (these forms replaced Form N-30D in May, 2004). While both these disclosures are filed at quarterly basis, Form 13-F filings are aggregated at a company level while Forms N-CSR and Form N-Q are filed at the individual fund level. Since mutual funds companies operate several mutual funds, each fund having a different fund manager – Form 13F filings are seen to be less informative than Forms N-CSR/Q. A second major difference between the two filings is that Form 13F is only filed by large investors (the SEC defines large investors as those with more than $100 million USD in holdings of equities, convertible bonds and exchange-listed options) and includes information only on large positions (defined as more than 10,000 shares and market value exceeding $200,000 USD)[2]. On the other hand, Forms N-CSR/Q are filed by all mutual funds regardless of the fund's size or the size or type of the holdings. These filings are meant to increase mutual fund transparency to investors so that they can better monitor how their fund managers are investing. However, an increase in the transparency of portfolio holdings also increases the risk of revealing fund managers' investment strategies which could lead to copy-cat trades or front-running by competing mutual funds. Keeping this in mind, the SEC allows funds to file their disclosure forms with a 60-day delay.




## 1.1. Literature review

Two prior studies investigate the impact of disclosure requirements on security prices, Carhart, Kaniel, Musto, and Reed (2002) and Hu, McLean, Pontiff, and Wang (2014). Both examine whether managers "portfolio pump" or inflate net asset values (NAVs) by placing buy orders just before the end of the year. Specifically, Carhart, Kaniel, Musto and Reed (2002) shows that funds' NAVs systematically rise on disclosure days and reverse the following day. Their findings suggest that fund managers systematically trade around disclosure days to inflate performance. However, the focus of their paper is on short-term pricing increases at the fund level, and they show stronger

[2] For details on 13F Filing procedures, see http://www.sec.gov/divisions/investment/13ffaq.htm

effects in more ***illiquid*** securities. In contrast, our paper shows longer-term pricing impacts and stronger effects in more ***liquid*** securities.

Hu, McLean, Pontiff and Wang (2014) examine portfolio pumping using institutional trades. They finds that year-end price inflation is driven by a lack of institutional selling rather than buying. Consistent with portfolio pumping, they also find that funds tend to buy stocks in which they already hold large positions. We expand on this study by showing in untabulated analysis that disclosure-induced return reversals have similar magnitude for negative and positive price movements. In other words, although fund disclosures may incentivize more funds to buy rather than sell, we show that sales also have low information content.

Other studies investigate the specific strategies managers use to window dress (e.g. Meier and Schaumburg, 2004; Agarwal, et al., 2014 etc.), or hold securities that they would not hold but for the disclosure requirements in order to demonstrate their superior stock picking skills or hide previous unprofitable trades from investors.[3] We abstract away from the specific strategies and create tests which capture the aggregate effect of low information content trades induced by fund disclosures on price efficiency.

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[3] Early work in this area includes work by Lakonishok, Shleifer and Vishny (1992) who find weak evidence of both herding and positive feedback trading among pension fund managers, with slightly stronger evidence in smaller sized stocks. Grinblatt, Titman and Wermers (1995) examine the trading strategies of mutual fund managers over a ten-year period from 1974 to 1984 and found that 77% of fund managers engage in momentum trading for past winners but refrain from selling past losers. Managers engaging in such practices outperformed other fund which did not engage in such practices. Wermers (1999) examines the trading activity of mutual fund industry from 1975 to 1994 and finds that while herding for the average stock is statistically weak, herding is present in smaller stocks and stocks held by growth-oriented funds. Another strand of literature examines the potential costs of disclosure for informed traders (such as mutual fund managers and active traders) due to front-running and copycat trading strategies by less informed traders (Wermers, 2001; Frank, Poterba, Shackelford and Shoven, 2004). Solomon, Soltes and Sosyura, (2014) show that media coverage of mutual funds significantly effects investors' capital allocation decisions, so funds have incentives to report positions that will interest the media. Overall, studies show that managers distort their portfolio holdings and a portion of the reason they do so, is to support sales.

There is also a large literature on how the release of fund holdings affects investor allocation decisions.[4] We focus in our empirical work on how the obligation to disclose might also lower the information content of prices.

# 2. Hypothesis Development

Whether disclosure-induced trades will distort security prices or lead prices to converge toward fundamental value depends on how these trades are related to intrinsic value. If disclosure incentivizes a fund manager to temporarily trade into a position for reasons unrelated to intrinsic value (e.g., to cater to investor preferences), holding liquidity constant, the initial trade can exert price pressure, but since the price movement does not reflect intrinsic values, subsequent price movements will reverse out the price impact. Alternatively, if disclosure induces investors to adopt positions that better reflect their information about intrinsic values, we would expect more permanent price changes since the trade presumably pushes price towards its intrinsic value.

Whether disclosure-induced trades affect security prices will also depend how the provision of liquidity adjusts around disclosure dates. If liquidity providers anticipate fund managers will attempt to reverse positions entered into on disclosure days because these trades reflect window dressing, they will be more willing to supply liquidity. This will reduce the price pressure of trades and mitigate the impact of temporary trades on return reversals.

[4] Allowing investors to condition their demand for securities on the revealed holdings of other investors has the potential to increase the information reflected in securities prices. Grinblatt and Titman (1989, 1993) and Cohen, Coval and Pástor (2005) show that changes in portfolio holdings can be used to construct fund specific performance benchmarks that can then be used to evaluate manager performance. Agarwal, et al. (2015) examine the change in the reporting frequency of portfolio disclosures by mutual funds from a semi-annual basis to quarterly basis in 2004 improved the liquidity of the stocks held by mutual funds.

Because it is ex-ante unclear how fund managers and liquidity providers will react to disclosure requirements, it is necessary to test for their impact. We will primarily test for an effect of disclosure on price efficiency by examining whether there is a change in price reversals around mutual fund disclosure days. An increase in price reversals on disclosure days would be indicative of a decrease in price efficiency, while a decrease in price reversals on disclosure days would suggest an increase in price efficiency. However, we will supplement these tests by examining how major asset pricing anomalies perform, under the assumption that asset pricing anomalies earning positive returns leads to a convergence toward fundamental values (i.e. greater price efficiency) and negative returns lead to a divergence from fundamental values.

We also test how price reversals interact with liquidity in the cross-section. If investors initiate low information content trades in response to disclosures, we expect that fund managers will trade more heavily in stocks with low trading costs (i.e. those stocks which are more liquid and heavily traded). Because the benefits to window dressing are unlikely to vary systematically with stock liquidity, this suggests that any negative impact on price efficiency caused by window dressing, ignoring any potential change in liquidity provision by market makers, should be greater among more liquid stocks. Thus, we predict return reversals following mutual funds disclosures should be larger for more liquid stocks.

# 3. Data, Research Design and Results

## 3.1. Data and Descriptive Statistics

We construct our dataset by obtaining disclosed mutual fund positions from the S12 master file from Thomson Financial mutual fund holdings database from 1981 to 2012[5]. We merge the holdings disclosures data with prices of the securities held from the Center for Research in Security Prices (CRSP) database. For all observations (at the firm-date level), we calculate return variables such as value weighted returns, market excess returns, lead/lagged returns, trading volume etc. We also construct firm level variables such as book-to-market ratio, asset growth, operating profit, etc. by merging these observations with COMPUSTAT. We use two proxies for firm-level liquidity – firm size (measured as market value of equity) and the average ratio of the daily absolute return to the dollar trading volume on that day (commonly known as the Amihud (2002) illiquidity measure). We limit the sample to common shares (i.e. share code 10 or 11) that trade on the NYSE, AMEX or Nasdaq with a prior month-end market capitalization larger than ten million dollars.

We construct our measure of the intensity of mutual fund disclosures by measuring the proportion of fund holdings disclosed on a particular day, across the universe of stocks. Specifically, we first take the product of the number of shares disclosed (split-adjusted and valued at last year's prices), and then sum these values across all firms and all funds to create a value of fund disclosures at the date level. If a share is reported on a non-trading day, we assign it to the most recent past trading day. To transform this daily value into a percentage, we divide this value by the sum of the disclosed holdings over the year and multiply by four (*QTPER*). We multiply by four so our results can be interpreted as the effect of a quarterly fund disclosure on price efficiency.

[5] We end our sample in 2012 due an unresolved issue in the S&P feed that supplies institutional ownership data to Thomson Reuters. This issue causes the Thomson Reuters data to incorrectly refresh (or not refresh) the data at the quarterly levels which leads to inconsistent share adjustments around reporting dates. We use older versions of the S12 database to get around these data problems.

$$QTPER = \frac{Market\ capitaliztion\ of\ disclosed\ positions\ on\ a\ day}{Market\ capitalization\ of\ all\ disclosed\ positions\ in\ a\ year} * 4$$

An illustration will help make the calculation a bit more transparent. The combined market capitalization for all disclosed positions on 03/31/2009 (valued at 12/31/2008 prices) equal $2.7 trillion USD and total market capitalization of disclosed holdings for all of 2009 equals $12.5 trillion USD. Thus, QTPER for 03/31/2009 equals (2.7/12.5*4) or 0.866. (If all funds made their quarterly disclosures on the same four days of the year, *QTPER* would equal 1 on those four days and equal zero on all other days). We measure QTPER as of the day these portfolio holdings are recorded rather than filed with the SEC on Form S-12 (which occurs sometime over the next sixty days), because we expect the anticipation of other firms/investors viewing their holdings induces firms to make low information content trades. We value disclosed positions at the previous year's prices to avoid any mechanical association between *QTPER*, and stock market indices.[6]

For our trade tests, we use a proprietary dataset called Ancerno from Abel Noser Solutions, a financial services firm that provides trading cost analytics advice to institutional asset owners, managers and brokers such as mutual funds and hedge funds. The observations from the Ancerno dataset allow us to observe trade level data such as the date of a transaction by a fund manager, the stock symbol of the trade, the number of shares traded, dollar principal traded etc. The dataset anonymizes the name of the trading institution/fund manager but identification codes for managers are provided which allows us to track an institution's trades across stocks and over time. We merge this data with our *QTPER* measure and then run cross-sectional tests to examine the serial correlation in the trades by fund managers when they disclose their portfolio holdings. We measure

[6] Two advantages of calculating our measures at the aggregate level are: (i) our measure is orthogonal to all firm-level variables that could be related to price formation and (ii) there are issues with measuring the timing of portfolio holdings and we expect the issues are less significant at the market level. .

serial correlation in trades as the direction of subsequent trades by fund managers in the one to six-week window following the portfolio disclosure. These serial variables are set to one if the subsequent trades are in the same direction as the trades prior to the disclosure and negative one if the subsequent trade reverses the prior trade. These variables will be used to examine whether and to what extent managers reverse their trades following portfolio disclosures.

## 3.2 Descriptive Statistics

We begin by first examining when mutual funds disclose their portfolio holdings. Prior to passage of Regulation N-CSR/Q in 2004, mutual funds were mandated to disclose their portfolios semiannually. However, owing to investor demand, some funds voluntarily chose to disclose their holdings on a quarterly basis. Following 2004, the frequency of disclosure was changed to a quarterly basis. This not only increased the frequency of disclosure but also the times of the year when funds chose to disclose their holdings, as more funds began disclosing on non-quarter end days (which we elaborate upon more in a subsequent section).

[Insert Table 1 around here]

Table 1 reports the frequency of the mutual funds' portfolio disclosures. We split the entire sample (from 1981 to 2012) into three sub-periods: 1981-90, 1991-2000 and 2000 onwards. The total numbers of disclosure events approximately equal a hundred thousand. Throughout our sample, the majority (approx. 76%) of the disclosures happen on the quarter end date. Roughly 23% of the disclosures take place on month end dates that are not quarter end dates (i.e. months other than March, June, September and December). Disclosures on mid-month days are rare and account for just 0.5% of the overall sample.

We also examine the average return, average absolute return and liquidity by quarter-end, month-end and mid-month dates. On quarter-end days stocks exhibit larger returns, earning 0.4% on average. The corresponding figures for the month-end dates and mid-month dates are 0.13% and 0.04% respectively. Stocks are also more liquid, providing initial evidence liquidity provision does adjust to at least some extent to disclosures. Finally, absolute market-adjusted returns are higher as well. Our subsequent tests will examine whether the quarter-end increase in returns correspond to increased information about intrinsic values.

## 4. Results

### 4.1 Are mutual fund disclosures associated with return reversals?

We start our tests by examining whether trades that occur on mutual fund disclosure days are associated with differences in price discovery. Following past market microstructure research, we examine this question by ascertaining whether security returns reverse in the period following a disclosure day (Biais, et al. 1999). Trades that do not reflect information about the intrinsic value of a security by definition will not impound information about long-term value into prices. If disclosure requirements induce 'uninformed' or 'noise' trades (e.g., via window-dressing), holding liquidity constant, then these uninformed trades would cause the price of the asset to go up (in the case of uninformed buying) or down (in the case of uninformed selling) temporarily followed by market makers reversing the trades so that the price of the asset is 'reset' to its original fundamental value (Campbell et al., 1993; Biais et al., 1999). In other words, if mandated mutual fund disclosures reduce price discovery, future returns should be more negatively associated with contemporaneous returns on these disclosure days. We thus estimate the following model:

$$Ret(t+1,t+s)_i = \alpha_i + \beta_1.QTPER + \beta_2.Ret(t) + \beta_3.QTPER * Ret(t) + controls + \varepsilon_i \quad (1)$$

where ‘s’ indexes trading days and can take values from 1 to 30 depending on the specification. A negative sign on the coefficient on the interaction term ($\beta_3$) would indicate that trades that occur on disclosure days exhibit greater subsequent reversals. Standard errors are clustered by date to account for the correlation of returns within a given day.

We begin our analysis by regressing the six week buy-and-hold return on the portfolio disclosures, returns and their interactions. Table 2, column (1) estimates this model and finds that the coefficient on the interaction term *QTPER*Ret(t)* is significantly negative (β=–38.18%) which indicates that returns on disclosure days reverse by approximately 38% more in the six weeks following disclosure, compared to a typical day. In column (2), we include one and two days prior return to the regression specification and find that one day prior return reverses by approximately 15.6%. The greater reversal on the day prior to disclosure could be consistent with some mutual fund managers making window dressing trades that distort asset prices on the one day prior to disclosure. The coefficient on the second day before the disclosure is insignificantly negative, indicating return reversals are concentrated in the two-day window around disclosure. The significant coefficient on the prior days’ returns interacted with *QTPER*, also provides evidence that the price distortions generated by requiring disclosure do not unwind after a single day.

[Insert Table 2 around here]

In column (3), we include indicators for each day of the week and interact the indicators with the returns on that day. We also include indicator variable for earnings announcement days and interact the indicator with the returns on that day. For the sake of brevity, we only display the interaction terms. Finally, we also include firm fixed effects. The main interaction term, *QTPER*Ret(t)* continues to remain significantly negative.

In order to provide additional evidence on the duration of return reversals, we re-estimate equation (1) thirty times, each time incrementing the time index, *s*, by 1 day. This allows us to construct a time series of the return reversal from day 1 to day 30 following portfolio disclosures by mutual funds. We create Figure (1) by plotting the coefficients on *Ret(t)* and *QTPER*Ret(t)* from these thirty regressions. Figure (1) shows that the coefficient on contemporaneous returns, *Ret(t)*, reaches -10% within eight trading days following the disclosure day and remains constant thereafter. However, the coefficient on *QTPER*Ret(t)* has a steep decline of -20% in the first two days following the disclosure day and then continues to exhibit a downward drift in the following days – reaching -36% after twenty trading days following the disclosure day.

[Insert Figure 1 around here]

Next, we split the thirty day compound returns into the one day following the disclosure, *Ret(t+1)*, and Day 2 to Day 30 returns, *Ret(t+2, t+30)*. In untabulated results, we find that returns reverse by 17.73% on the first day after the portfolio disclosure suggesting that a fair amount of the noise is unwound immediately following the disclosure event. However, Column (4) shows that more than half of the reversal (20.45%) continues to unwind over the remaining twenty-nine trading days. These reversals suggest that distortions induced by trading around disclosure days do not dissipate as quickly as has been suggested previous work (Carhart, et al., 2002). The noise in security prices that is impounded into price by trades around portfolio disclosure days continues to persist up to six weeks (or 30 trading days) following the disclosure day. We also re-run the specifications in columns (2) and (3) using *Ret(t+2, t+30)* as the dependent variable in columns

(5) and (6) and find similar results that suggest that reversals are also orthogonal to day of the week fixed effects and earnings announcements.

Finally, in column (7) we examine whether the returns prior to the disclosure day reverse on the disclosure date itself. We check this by regressing the disclosure day returns, *Ret(t)* on the returns on the day prior to the disclosure, *Ret(t-1)*, *QTPER*, and their interaction. We expect that if managers are engaged in window dressing trade on this day, we might expect returns to begin to reverse after the disclosure day. We find evidence that pre-disclosure returns have insignificant incremental return reversals (3.5%) on the disclosure day. This contrasts with the significant incremental return reversals for the same day, when we examine reversals beginning after the disclosure day, as seen in column (2) (-15.5%). For the day before the disclosure (15.5/(3.5+15.5) 81.6% of the incremental returns reversal occurs more than one day after the disclosure, a higher proportion (20.4/38.1) 54.5%, than observed for the disclosure day.

## 4.2 Fund disclosures, return reversals, and stock liquidity

We next examine whether stock liquidity is associated with the extent of return reversals observed on mutual fund disclosure dates. If fund managers wish to report a portfolio different from the portfolio they wish to hold, they would determine their portfolio allocations at the time of disclosure trading off this preference with the trading costs of doing so. Trading costs are negatively associated with stock liquidity, so the costs of rebalancing in response to disclosure will vary with liquidity, but the reporting preferences will not. Given this, we might expect a higher fraction of window dressing trade in more liquid stocks, and if the greater return reversals on disclosure days are driven by window-dressing, we might also expect to observe the disclosure day reversals to be differentially larger for more liquid stocks.

To test whether liquidity is associated with larger return reversals on mutual fund disclosure days, we extend the regression specification in our first section (equation 1) by interacting the independent variables with proxies for liquidity.

$$\begin{aligned} Ret(t+1, t+s)_i = {} & \alpha_i + \beta_1.QTPER + \beta_2.Ret(t) + \beta_3.LIQ + \beta_4.QTPER * Ret(t) \\ & + \beta_5.QTPER * LIQ + \beta_6.LIQ * Ret(t) \\ & + \beta_7.QTPER * LIQ * Ret(t) + controls + \varepsilon_i \end{aligned} \tag{2}$$

We select two proxies for liquidity: size and Amihud (2002) liquidity. We calculate our first liquidity proxy size using the market capitalization the prior month and we rank this value by month in our empirical tests (*RankME*). We expect that if disclosure has a larger impact on asset prices for large firms, the coefficient on triple interaction term between *QTPER*, *Ret(t)* and *LIQ* ($\beta_7$) should be significantly negative. Table 3 presents the results for this specification.

[Insert Table 3 around here]

As we expect, price reversals are larger among larger (i.e., more liquid) stocks. This is shown in Column (1) of Table 3. The coefficient on *QTPER*RankME*Ret(t)* is significantly negative ($\beta_7$=-43.50) when using *Ret(t+1, t+30)* as the outcome variable. In other words, for each percentile rank increase in firm size, disclosure would increase return reversals by 43.5 basis points. For a $25^{th}$ percentile ranked firm, incremental return reversals would equal 31.69% (-20.81+25*(-0.435)) over the next thirty days. The corresponding return reversal for a $75^{th}$ percentile ranked firm would equal 53.44% (-20.81+75*(-0.435)). The cross-sectional difference between a $75^{th}$ percentile size rank and a $25^{th}$ percentile size ranked firm is approximately 21.75%. The greater reversal among larger stocks continues to hold if we exclude returns on the day immediately following disclosure and instead analyze *Ret(t+2, t+30)*; this is shown in Column (2) of Table 3.

We repeat these tests in Columns (3) and (4) by replacing firm size with the Amihud illiquidity measure which is calculated as the ratio of the daily absolute return to the dollar trading volume on that day for a particular stock. As the ratio gets larger, each dollar traded in the security has a larger price impact which suggests such stocks have lower liquidity. Since both daily returns and volume on the trading day for a stock will be influenced by trades by fund managers on the disclosure day, we lag the measure by 10 days to avoid drawing incorrect inferences. Similar to firm size, we form percentile ranks of the measure for each month. We find that for a one percentile decrease in the Amihud illiquidity measure (i.e. one percentile decline in stock illiquidity), the return reversal increases by 0.381% (Table 3, Column 3). The interquartile difference between a $75^{th}$ percentile rank and a $25^{th}$ percentile rank is approx. 19.05%. Again, the liquidity results are robust to instead analyzing *Ret(t+2, t+30)* (Column 4).

These findings also have import from a different viewpoint. It is typical for asset pricing anomalies to be concentrated more heavily in smaller sized stocks where market inefficiencies can persist for longer periods due to lower trading by informed traders. However, in our setting, we find the opposite. The greater return reversals around disclosure days increases with firm size.

To further establish that liquidity has a differential effect on window dressing trades, we examine the effect of the 1997 tick size change for security prices on the NYSE. On June 24, 1997, the NYSE reduced the minimum price variation for quoting and trading stocks from an eight (1/8) to a sixteenth (1/16) as the first change in a move towards decimalization. This change had an effect of improving the liquidity of traded stocks which should have had an effect on the window dressing trades by mutual funds managers around disclosure dates. We exploit this shock to the liquidity of traded stocks to examine whether the reduction in tick size is associated with an increase in return reversals. We examine this by replacing the *RankME* term in equation (2) with a dummy variable (*Tick1997*) that takes a value of 1 after June 24th 1997 and 0 otherwise. Since we expect an increase in window dressing trades after the reduction in tick size, we expect the coefficient on the triple interaction – *QTPER*Ret(t)*Tick1997* to be negative. We limit the sample to the three years before and after 1997, to create a balanced panel. Columns (5) and (6) show the results for these tests. While, we find reversals becoming larger after the tick size was reduced from 1/8th to 1/16th for single day returns, reversals for Day 2 to Day 30 are not significantly negative. This suggests that while the change in tick size is associated with an increase in reversals, this is only true for reversals that occur over a short time duration.

In untabulated results, we carried out similar tests for the 2001 ticker size reduction which reduced the minimum price variation for traded securities from 1/16th to 0.01. While the coefficients were negative, the results were not significant. The lack of an association could be because the second tick size reduction did not increase liquidity for a large number of stocks.

## 4.2.1 Sub-period Analysis

[Insert Table 4 around here]

In Table 4, we examine how disclosure day return reversals have evolved over time by splitting our sample into three sub-periods by decades (1981-90; 91-2000 and 2000 onwards). We find that disclosure day return reversals, while significantly negative, were smaller in magnitude in the 1980s. Return reversals increased significantly in absolute magnitude from 13.5% in the 1980s to over 45% in the 1990s. Since 2000, reversals have declined marginally by 3.7% points from their 1990s levels to approx. 41.9%. The increase in return reversals since the 1980s could be attributable to market level changes such as the introduction of electronic trading, reduction in ticker size etc. which would have led to an increase in overall stock liquidity.

## 4.3 Fund disclosures and the supply of liquidity

Our central result is that returns on disclosure days exhibit greater reversals. In this section, we examine how liquidity responds to the increase in uninformed trades. While our return reversal tests suggest liquidity provision does not adjust sufficiently in response to disclosure, these set of tests enable us to assess whether it responds at all during disclosure days.

We first examine the effect of fund disclosures (*QTPER*) on two proxies for stock liquidity – the closing bid-ask spread scaled by the stock price (*SPR*) and price impact (*LIQ*), measured as in Amihud (2002). Higher levels of both measures reflect a lower level of liquidity. We then extend the model by including firm size and the interaction of size with *QTPER* to examine whether any association between liquidity and disclosures varies across firm size. In order to reduce the effect of outliers and ease interpretation, we use the monthly percentile ranks of the liquidity proxies (*RankSPR* or *RankLIQ*) and firm size (*RankME*) in the estimation.

Specifically, we estimate the following models:

$$\begin{aligned} &RankLIQ\ or\ RankSPR = \alpha_i + \beta_1 QTPER + \varepsilon_i \\ &RankLIQ\ or\ RankSPR = \alpha_i + \beta_1 QTPER + \beta_2 RankME + \beta_3 QTPER * RankME + \varepsilon_i \end{aligned} \quad (5a)$$

[Insert Table 5a around here]

Using this estimation, we find that liquidity increases around fund disclosures. Table 5a presents the results from these tests. In columns (1) and (2), we observe that both liquidity measures – spread and price impact – are significantly negatively associated with *QTPER*. Since both proxies are negatively associated with liquidity, this indicates that liquidity increases around fund disclosure days. However, the observed shift in liquidity is economically small. Relative to a day where no disclosures occur (i.e., *QTPER* = 0), liquidity is about one percent higher on an average quarter-end day.

Interestingly, the observed increase in liquidity on disclosure days appears to be concentrated among stocks with smaller market capitalizations. In columns (3) and (4), we extend the model to include firm size *(RankME*) and its interaction with *QTPER*. The positive coefficient on the interaction term (*QTPER***RankME*) implies that the effect of fund disclosure on liquidity declines as firm size increases. In particular, on disclosure days, a ten percentile increase in size ranking is associated with a 0.12%-0.16% smaller change in liquidity percentile.[7]

Evidence of an increase in liquidity on disclosure days, particularly among smaller stocks, is also found in fund-level data. To provide evidence on fund-level decisions to supply liquidity, we obtain data from Abel Noser on the trades executed by funds from 1998 – 2011 and create two measures of liquidity at the fund level: (1) whether the fund trades in the opposite direction of the market, which is commonly referred to as supplying liquidity to the market, and (2) whether the fund placed both a buy and sell order on the same day. We estimate analogous regressions to those above, regressing both measures of liquidity trades on *QTPER* alone and then *QTPER*, size and the interaction of *QTPER* and size. In untabulated analyses, we find that funds execute more liquidity trades on *QTPER* days, consistent with uninformed trades leading to an increase in the supply of liquidity. In addition, we continue to find the response is larger in smaller securities as the interaction between *QTPER* and size loads with a significantly negative coefficient.

[7] In untabulated results, we find qualitatively similar results to those shown in Table 5a using liquidity measures as computed from the intra-day trading provided in the TAQ database.

The increase in liquidity around disclosure dates is consistent with an increase in trades that have less information. However, our earlier finding pertaining to return reversals suggests that liquidity does not fully adjust to the change in trades around disclosure dates. As shown earlier, return reversals, which are often thought of as a positive measure of the price of liquidity provision (Nagel 2012), are higher on fund disclosure dates despite this increase in liquidity.

[Insert Table 5b around here]

We next examine the market response on disclosure days by considering the absolute returns and the dollar volume of trading of stocks on the disclosure days. Specifically, we estimate the following regressions:

$$AbsRet\ or\ DollarVol = \alpha_i + \beta_1 QTPER + \varepsilon_i$$
$$AbsRet\ or\ DollarVol = \alpha_i + \beta_1 QTPER + \beta_2 RankME + \beta_3 QTPER * RankME + \varepsilon_i \quad (5b)$$

If liquidity adjusts to uninformed trades, we would expect the market to have no significant returns or trading around disclosure days. Table 5b presents the results from these tests. Columns (1) and (2) show that the results where we observe that both the absolute value of returns and the dollar volume of trading is positively associated with the level of disclosure. We then extend the simple regression by including firm size and the interaction of size with QTPER similar to the previous tests. Consistent with our previous findings, we find that the effect of fund disclosure on absolute returns and volume of trading declines as firm size increases. In particular, on disclosure days, a one percentile increase in size ranking is associated with a 0.23% and 6.44% decline in absolute returns and dollar volume of trades respectively.

## 4.4 Can investors trade profitably on disclosure day reversals?

We next assess whether an understanding that mutual fund disclosure days have less information about intrinsic values would enable investors to trade profitably, and we benchmark these potential profits against those earned by existing asset pricing anomalies.

To test whether disclosure day returns can be used to construct viable trading strategies, we restrict our sample in a number of ways. First, we begin by selecting all stocks on CRSP with (i) a market capitalization over ten million dollars, (ii) that trade on either NYSE, AMEX or Nasdaq, and (iii) are common stocks (i.e. share codes 10 or 11). Second, we restrict our sample to observations with the necessary data to construct our variable of interest, returns on either the quarter end day (when 76% of mutual funds disclose) or the sum of returns on the last two days of the quarter. Because trading on quarter end day returns requires knowledge of the closing market price, we construct future returns using monthly returns from the open of the first day of the month until the close on the last trading day of the month, and because open prices are only available on CRSP beginning in 1992, we further limit the sample to only years after 1992. Finally, we limit the sample to the five hundred largest stocks that meet our sample selection criteria. Doing so ensures the stocks we trade are highly liquid.

To benchmark the profitability of this possible trading strategy, we construct seven asset pricing factors. First, we calculate size, operating profit, total asset growth, and book-to-market value of equity, which are factors that span several anomalies (Fama and French 2016). Second, we measure a stock's momentum using returns over the eleven-month period beginning the month before we trade the securities (Jegadeesh and Titman 1993). Third, we calculate returns from the past earnings announcement and the earnings surprise, two variables shown to have substantial power to explain future returns (Chan et al. 1996; Novy-Marx 2016). Requiring this last variable limits our sample to firms with (i) an available earnings announcement date in Compustat and (ii) at least six past quarters of income before extraordinary items in the Compustat quarterly file.

To ensure comparability of the profitability of trading strategies involving each factor, we percentile rank all independent variables, including disclosure day returns, by month. Moreover, we sort the resulting percentile ranks so that all coefficients, other than our variable of interest, would be expected to have a positive association with future returns (i.e. large firms have low values for size, because they would be expected to earn low returns).

[Insert Table 6 around here]

Our findings suggest the existence of a profitable trading strategy around disclosure days. This is shown in Table 6. In column (1), we select only monthly returns for January, April, July and October. These months follow a quarter end day, when mutual fund disclosures are most common (see Table 1). Regressing monthly returns on only the percentile rank of quarter end day returns, we find that disclosure day returns load with a highly significant coefficient of -0.018 (t=4.123). Our linear model would thus suggest a firm with returns in the bottom percentile would outperform the top percentile by 1.8% over the month. In column (2), we replace returns on the quarter end date with returns on the quarter end date and the day before, *Ret(t-1, t),* and find a slightly larger coefficient -0.021 (t=3.88). In untabulated analyses, we find that taking a long (short) position in securities with the highest (lowest) quintile of returns generates a monthly return of 1.6% (t=3.24), a fairly large return in securities of such large size.

The profitability of this trading strategy is robust to controlling for other asset pricing factors. This is shown in Table 6, column (3), where we include controls for the seven asset pricing factors discussed above. The coefficient on disclosure day returns remains large and statistically significant after controlling for these additional factors. Moreover, the coefficient for disclosure day returns is 2.5 times larger than the second largest coefficient (operating profit).

Consistent with mutual fund disclosures driving the significant reversals, we find smaller reversals in months not after quarter end dates. This is shown in Table 6, column (4), where instead of selecting months after quarter end dates, we select months after non-quarter end dates (i.e. February, March, May, June, August, September, November and December). Roughly eight times as many securities are reported on a month end date that coincides with a quarter end date relative to month end dates that do not. For months after non-quarter end dates, we find insignificant reversals that are less than one-third as large as those reported in columns (1) – (3).

The profitability of the trading strategy is not limited to just the largest stocks. In column (5), we present results again for quarter end months, but using all firms instead of just the 500 largest stocks. We find a slightly larger coefficient than columns (1) – (3), which is again larger than all other included asset pricing anomalies, although the difference is smaller.

The profitability of this trading strategy, however, only holds in the month immediately after a quarter end month. In untabulated analyses, we examine portfolio returns over the six months subsequent to quarter end disclosure days. We find no significant associations between disclosure returns and any subsequent months. (The coefficients are insignificantly negative (similar to the first month) in the second and third month after disclosure (-0.002) and near zero (0.000) over months (4) – (6)). The absence of any subsequent return dynamics, suggest that the initial reversals constitute a convergence toward fundamental value.

In column (6) – (7), we examine whether quarter end day returns predict returns on the subsequent quarter end day, *Q+1 Ret(t)*. Such an association would be consistent with investors having preferences for disclosing (withholding) certain securities from one quarter to the next and these preferences affecting return dynamics. It would also suggest investors can profit by anticipating the liquidity needs of window dressers. To test this, we regress returns for a subsequent quarter end day on percentile rank returns for the prior quarter end day. We find a significant coefficient of 0.003 (t=7.3) in column (6), suggesting strong positive serial correlation. This association is robust to including other asset pricing anomalies (see column (7)).

## 4.6 How do asset pricing anomalies perform on disclosure days?

Our final set of tests use asset pricing anomalies as benchmarks to test whether disclosure requirements mitigate or exacerbate price discovery. If larger anomaly returns reflect prices converging towards their fundamental value (Engelberg, McLean, and Pontiff, 2017), a negative anomaly return would be consistent with lower price discovery. We consider four factors previously identified in the asset pricing literature (Fama and French, 2016), that generate abnormal returns – operating profit, total asset growth, size (or market value or equity), and book-to-market ratio. We also include post-earnings announcement drift (both the earnings surprise and earnings announcement returns) as well as momentum (returns in the eleven-month period ending the month before the day on which we trade the portfolios). For each of these factors, we again generate percentile ranks for each month. We then interact these percentile ranks with our disclosure measures and run the following regression model:

$$
\begin{aligned}
Ret(t) \text{ or } LogRet(t)_i = \alpha_i &+ \beta_1 RankOP + \beta_2 RankCMA + \beta_3 RankME + \beta_4 RankMomentum \\
&+ \beta_5 RankBTM + \beta_6 RankSUE + \beta_7 RankEAR + \beta_8 QTPER \\
&+ \beta_9 RankOP * QTPER + \beta_{10} RankCMA * QTPER \\
&+ \beta_{11} RankME * QTPER + \beta_{12} RankMomentum * QTPER \\
&+ \beta_{13} RankBTM * QTPER + \beta_6 RankSUE * QTPER \\
&+ \beta_7 RankEAR * QTPER + \varepsilon_i
\end{aligned} \quad (5)
$$

where *RankOP*, *RankCMA*, *RankME*, *RankBTM*, *RankSUE*, *RankMomentum* and *RankEAR* are the percentile ranks for operating profit, total asset growth, market value of equity and book-to-market ratio, standardized unexpected earnings, momentum and earnings announcement returns respectively. We construct all of our percentile ranks so that if the anomalies earn returns consistent with the prior literature, the coefficients should be positive.

[Insert Table 7 around here]

If disclosure increases price discovery, we would observe positive coefficients for the interaction with *QTPER*. Contrary to this prediction, we find that most anomalies earn negative returns on disclosure days. For instance, in column (1), the coefficient on *RankCMA*QTPER* (β=-0.258) is significantly negative and over four times larger than the main effect on *RankCMA* (β=-0.069). Similarly, the coefficient on *QTPER*RankBTM*, *QTPER*RankSUE*, and *QTPER*RankOP* are also significantly negative. The only interaction with a significantly positive interaction is size. We find insignificant interactions for the momentum factor and the earnings announcement return factor. Overall, the evidence in column (1) suggests asset pricing factors aside from size tend to earn less returns on disclosure days. In columns (2) – (4), we show that these results are robust to including firm fixed effects and to using logged rather than raw returns.

The negative returns for the pricing anomalies is not present on other days around the disclosure day, and some of the pricing anomalies exhibit larger returns the day after disclosure.

This is shown in columns (5) – (8), where we regress lags and leads of returns on our independent variables to see whether the anomalous negative returns occur on days surrounding the disclosure. On the day following the fund disclosure, anomaly returns for operating profits, total asset growth, and book-to-market *increase* in magnitude which suggests asset prices start converging towards their fundamental value after the disclosure (column 7). We find few significant interactions in the days before disclosure (columns 5-6) or two days after disclosure (column 8).

## 4.7 Effect of the 2004 disclosure rule change on return reversals

In May 2004, the SEC mandated mutual funds to change their portfolio disclosure schedule from a semi-annual basis to a quarterly basis, and this mandate is associated with a change in when funds chose to disclose. Specifically, the number of positions disclosed on non-quarter month end dates (i.e. dates such as January 31st, April 30th, etc.) increased by 135% over the six years from 2001 from 2007 while quarter-end disclosures posted only a 10% increase. These frequency results are shown graphically in Figure 2, and as shown, the increase in non-quarter month end disclosures appears to be begin around the 2004 disclosure rule change.

[Insert Figure 2 around here]

If fund disclosures are driving the observed return reversals, we should expect an increase in return reversals for non-quarter month end days relative to quarter end days after the regulation relative to before. To test this prediction, we restrict our sample to three years before and after the disclosure rule change, i.e. from 2001 to 2007. We also only select month-end days. We then create two indicator variables – *NonQTRMonthEnd* – that takes a value of 1 for month end dates that are not quarter end dates and zero otherwise and *DiscChange*, which takes a value of 1 after the disclosure rule change (i.e. May 10th, 2004). We then regress returns for the thirty days subsequent to the month end days on (i) *NonQTRMonthEnd*, (ii) *DiscChange,* (iii) returns and all interactions of these variables. The triple interaction term (*NonQTRMonthEnd***DiscChange***Ret*) is our main variable of interest and captures how the non-quarter month end return reversals changed after the disclosure rule change.

[Insert Table 8 around here]

Consistent with fund disclosures driving the observed return reversals, we find a differential increase in return reversals on non-quarter month end days following the post-2004 increase in disclosures on those days. This is shown in Table 8. In the three years prior to the increase in non-quarter end month disclosures, we find little evidence of return reversals on non-quarter end month days; the sum of the coefficients for *Ret(t)* is *NonQTRMonthEnd***Ret(t)* is positive, economically small, and statistically insignificant. However, in the three-year period after the change in disclosure frequency, non-quarter month end disclosures exhibit an increase in return reversals; there is a 48.6 relative increase in return reversals for such days after 2004.

## 4.8 Fund level transaction results

To examine how fund managers trading behavior changes around disclosure days, our next set of tests tracks the trades of funds over time. Our analysis allows us to examine when managers build and reverse positions, so we can provide corroborative evidence that the reversals we observe in equity returns are driven by the behavior of fund managers. We conduct two main analyses using this data: (1) we examine whether managers are more likely to reverse trades entered into on disclosure days, suggesting that the increased reversals are driven by investor trading behavior and (2) we compare disclosure trade reversals for mutual funds to disclosure day trade reversals for non-mutual funds, which allows us to attribute the reversals to mutual fund disclosures rather than the other economic events which take place around quarter end dates.

### 4.8.1 Do managers reverse their trades on disclosure days?

To examine whether managers reverse trades, we obtain trade-level data from Ancerno, which allows us to track managers' trades over time. We test for window dressing by examining whether fund managers are more likely to reverse positions entered into on disclosure days relative to positions entered on other days during the quarter. We also test for the possibility that fund managers "complete positions" more frequently on disclosure days – and stop trading a security they had been actively trading. We predict this latter type of trade will also have low information content, because trades that complete rather than begin accumulating a position, will have a greater proportion of the managers' private information already impounded into price.[8] We test this by estimating the following model:

$$Serial_1 = \alpha_i + \beta_1 QTPER + controls + \varepsilon_i \quad (4)$$

*Serial*$_1$ measures the extent to which managers reverse their daily trades in the subsequent week. *Serial*$_1$ is set to 1 if the change in portfolio holdings over the subsequent week has the same sign as the trading day. If the fund reverses the trade in the subsequent period, *Serial*$_1$ it is set equal to negative one. If there is no trade on either the date or the subsequent period, we code the dependent variable equal to zero. A significantly negative coefficient on *QTPER*, $\beta_{1,}$ would

[8] For example, suppose an informed trader has private information that the security's market price exceeds intrinsic values by eighty cents. If the manager trades until price equals intrinsic value, the early trades will have greater information about intrinsic values.

indicate that managers reverse their transactions for higher level of portfolio disclosure. In several regressions, we weight observations by the managers' trades in the stock scaled by market capitalization, so that the observations will receive weight in estimating the coefficients proportional to the price pressure they exert.

To begin with, we analyze the correlation between $\textit{Serial}_1$ and *QTPER* after excluding observations where $\textit{Serial}_1$ equal zero (i.e., there are no subsequent trades in the week following disclosure). In column (1) of Table 9, Panel A, we show that this modified $\textit{Serial}_1$ is negatively associated with *QTPER*. The coefficient value indicates that *QTPER* correlates with a 13% greater likelihood of reversing a trade over the subsequent week. This is strong evidence that at least some managers "window dress" in response to disclosure requirements.

[Insert Table 9, Panel A around here]

In column (2), we include as an observation daily trades even if the fund does not trade in the subsequent week (i.e. we include observations for which the dependent variable equals zero). We find that the inclusion of these trades increases the magnitude of the negative coefficient on *QTPER*. In untabulated analysis, we find that on quarter end days, 26% of transactions have no subsequent trades while non-quarter end days have only 11%. In other words, funds appear more likely to complete building positions on disclosure days and to begin building positions on non-disclosure days. Because we expect the initial trades in a sequence to contain more information private information about valuation, the tendency to complete positions when QTPER is high likely contributes to the reversals.

In columns (3) – (4), we estimate the same regressions except we use weighted least squares in which each transaction receives weight proportional to the dollar value of the position taken over the one-week period (including both the trading day and subsequent week) scaled by the market value of equity. We find results that are weaker but qualitatively similar to the earlier results. The weaker magnitudes suggest firms are more likely to window dress using small trades. In addition, we note in untabulated analyses, we obtain similar inferences calculating the dependent variable over a six-week rather than one-week interval.

### 4.8.2 Do manager level trades cancel out in aggregate?

[Insert Table 9, Panel B around here]

One concern with our fund level trade data is that the fund level trades could cancel out in aggregate, so that these trades would not exert price pressure. The next two panels repeat the analysis from Panels A and B by summing up trades across funds to the firm level. We then recalculate $Serial_1$ using firm level data.

In Panel B, we regress the $Serial_1$ measures on *QTPER* and find results similar to those reported in Panel A.

### 4.8.3 Do mutual funds reverse trades more frequently than non-mutual funds?

[Insert Table 9, Panel C around here]

Finally, in Panel C, we disaggregate funds by the client categories and assess whether serial correlation differs across manager types. Ancerno identifies three types of clients – corporate pension funds, money managers and stock brokers/wealth managers. Since defined benefit pension have weaker fundraising incentives, we do not expect pension fund managers to window dress their portfolios to the same extent as money managers (i.e., they should exhibit fewer trade reversals on disclosure days). Additionally, stock brokers/wealth managers are not subject to quarterly disclosure requirement but would instead be subject to continuous disclosure to their clients, again reducing any incentive to engage in window dressing. On the other hand, money managers have an incentive to engage in window dressing since they are actively involved in fund raising and are subject to periodic disclosure requirements that affect fund raising. Therefore, if the negative serial correlation on disclosure days is driven by window dressing, we would only expect to find it among clients identified as money managers.

To test whether trade reversals are greater among money managers, we create a dummy variable "fund" that takes the value of 1 if the mutual fund is a money manager and 0 otherwise. We then regress $Serial_1$ on these subsamples and find that money managers are more likely to reverse their trades around disclosures, but other fund managers are not more likely to reverse their trades on disclosure days. While suggestive, the different coefficients across the subsamples, are not significantly different at conventional levels (see column 3). We note that our current analyses only include data between 2009 – 2011, the dates over which Ancerno identifies client type.

### 4.9 Alternative explanation: Do cash receipts and disbursements cause return reversals?

In a contemporaneous paper, Etula, Rinne, Suominen and Vaittinen (2018) argue that payment cycles (i.e. most individuals receive monthly paychecks around the first and fifteenth of the month) cause temporary fluctuations in asset prices. While the empirical anomalies in Etula et al. are obviously distinct from the ones we document, the broader story that the timing of payments triggers uninformed trade could explain our findings. We do not believe this alternative explanation fits the facts in the paper for several reasons:

First, cash disbursements tend to be made at both the beginning-of-month and end-of-month with similar frequencies. To examine whether these disbursements cause returns to reverse, we create a beginning of month indicator variable that takes a value of one for the first date of month (and zero otherwise) and interact this variable with stock returns on the date of fund disclosure. Columns (1) from Table 10 present the results from this regression. We do not see any increase in return reversals around beginning of month dates which suggests that our results cannot be explained by uninformed trades initiated in response to the 'receipt of cash' on the first of the month. In column (2), we obtain similar results setting the dummy equal to one on any of the first three days of the month.

[Insert Table 10 around here]

One possible explanation which would still fit the data is that the disbursement of cash in anticipation of paychecks leads to uninformed trades, while the receipt of cash does not. However, in preparing to disburse cash, funds would sell assets. There is intensive buying at quarter end, inconsistent with the payments explanation (Carhart et al. 2002; Agarwahl et al. 2014). In addition, in untabulated analyses, we observe equal reversals for both positive disclosure day returns and negative disclosure day returns. The disbursement of cash explanation predicts distortions predominantly in those stocks with negative returns.

Second, a large number of funds get transferred around the 15th of the month with no fund disclosures taking place on these dates. If such fund transfers result in price distortions, we should observe noise in returns increase around this time. To test this, we create a mid-month indicator variable that takes a value of 1 for the 15th of each month (and zero otherwise). We interact this with the returns to examine whether return reversals take place on these dates. Columns 3 and 4 from Table 9 show that no distortions take place around these dates.[9]

Third, return reversals on quarter-end dates are three times more in magnitude than return reversals on non-quarter-month-end dates. Because most people are paid monthly, the strong quarterly reversals do not fit the payments explanation.

Finally, our trade data suggests that investors reverse or complete positions when mutual funds disclose consistent with funds adjusting holdings in order to disclose. Alternatively, flow of payments explanations predict funds continue to trade in the direction of positions taken in response to flows.

# 5. Conclusion

We find that mandatory disclosure of portfolio holdings by mutual funds is associated with trades that add noise to the market and create distortions in security prices. We find these distortions continue to affect market prices for extended periods, adding to evidence of short duration one day effects (Carhart et al. 2002). We regard this as evidence that mandatory disclosures create incentives for managers to engage in behaviors that lead to less information in prices. Our findings on the returns to asset pricing anomalies also suggest that mandatory

[9] In the column (4) results, we set the indicator equal to one on dates ending the fourteenth, fifteenth or sixteenth.

disclosure of portfolio holdings leads to lower price discovery. In addition, the effects we document are larger in liquid stocks rather than illiquid stocks, consistent with the possibility that liquidity increases the execution of trades with lower information content. This is unusual as most asset pricing anomalies decrease with size.

Our study makes two important contributions to the literature. First, we add to the literature on the unintended consequences of regulation. Our findings suggest that requiring additional disclosures from mutual funds feeds back into and distorts asset prices. Second, we add to the literature on price discovery by showing that liquidity provision does not fully adjust to time-varying expected changes in uninformed trade.

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# Variable Definitions

| **Variable Name** | **Variable Description** |
|---|---|
| Fund Disclosure Variables | |
| TPER | Ratio of the market capitalization of mutual funds' portfolios disclosed on a date divided by the total market capitalization of funds' portfolios disclosed during the year. Portfolios are valued at last years' prices and split-adjusted. |
| QTPER | TPER multiplied by 4 |
| Return Variables | |
| Ret(t-2) | Returns two days prior to the day we measure mutual fund disclosure |
| Ret(t-1) | Returns one day prior to the day we measure mutual fund disclosure |
| Ret(t) | Returns the day we measure mutual fund disclosure |
| Ret(t+1) | Returns one day after we measure mutual fund disclosure |
| Ret(t+1, t+30) | Buy and hold return on the security held from day 1 to day 30 following the day we measure mutual fund disclosure |
| Ret(t+2, t+30) | Buy and hold return on the security held from day 2 to day 30 following the day we measure mutual fund disclosure |
| Serial Correlation Variables | |
| Serial1 | Indicator variable taking the value of 1 if the net trading activity in the week following the mutual fund disclosure is the same direction as the trades prior to the disclosure (i.e. if you bought on date t, you also bought during the next week). If the net trading is in the opposite direction of the trades prior to the disclosure, $Serial_1$ is set equal to negative one (i.e. if you bought on date t, you sold shares the rest of the week), and if there are no additional trades in the following week, $Serial_1$ equals to zero |
| Factor Variables | |
| RankAmihud | Monthly percentile rank of firm's Amihud illiquidity measure, measured over the ninety-day period beginning ten days before the trading day |
| RankLIQ | Monthly percentile rank of firm's liquidity on the trading day |
| RankME | Monthly percentile rank of firm's market value of equity |
| Rank OP | Monthly percentile rank of firm's operating profit |
| RankCMA | Monthly percentile rank of firm's asset growth |
| RankBTM | Monthly percentile rank of firm's book to market ratio |
| RankMOM | Monthly percentile rank of firm's momentum factor (calculated as the return over the eleven-month period prior to the month of trading) |
| RankSUE | Monthly percentile rank of firm's earnings surprise |
| RankEAR | Monthly percentile rank of firm's earnings announcement returns |
| Other Variables | |
| EA | Indicator variable that takes a value of 1 if the date is an earnings announcement and 0 otherwise |
| FUND | Indicator variable taking value of 1 if the entity executing the trade is a money manager (i.e. mutual fund or hedge fund) and 0 otherwise |

| | |
|---|---|
| BeginMonthDum | Indicator variable that takes a value of 1 for the first of each month and 0 otherwise |
| BeginMonthDumAlt | Indicator variable that takes a value of 1 for the first, second and third of each month and 0 otherwise |
| MidMonthDum | Indicator variable that takes a value of 1 for the 15th of each month and 0 otherwise |
| MidMonthDumAlt | Indicator variable that takes a value of 1 for the 14th, 15th and 16th of each month and 0 otherwise |
| NonQTRMonthEnd | Indicator variable that takes a value of 1 for month end dates that are not quarter end dates (i.e. dates like 31st January, 28th/29th February, 30th April, etc.) and 0 otherwise. |
| Tick1997 | Indicator variable taking value of 1 after June 24th 1997 (which is the date of the ticker size reduction from 1/8th to 1/16th) |
| Order Imbalance | Average net purchases for a given a stock by all fund managers on a given date |

# Table 1 – Descriptive Statistics

QTPER

| Disclosure Date | 1981-1990 | 1991-2000 | 2001-2012 | 1981-2012 |
|---|---|---|---|---|
| Quarter End | 84.47% | 70.70% | 75.54% | 76.07% |
| Month End (Non-quarter end) | 15.31% | 28.83% | 23.74% | 23.43% |
| Mid-Month | 0.22% | 0.47% | 0.72% | 0.50% |
| Overall | 100.00% | 100.00% | 100.00% | 100.00% |

Other Stock Characteristics

| | Avg. Return | Avg. Abs. Return | Avg. Amihud Rank |
|---|---|---|---|
| Quarter-End | 0.42% | 2.09% | 49.0 |
| Month-End (Non-quarter end) | 0.13% | 1.98% | 49.2 |
| Mid-Month | 0.04% | 1.95% | 49.5 |

This table reports the descriptive statistics by day for the entire sample period (1981-2012) and sub-periods. The first table reports the percent of total market capitalization reported by date. The last table reports other stock characteristics split across mid-month, month end and quarter end dates. Signed returns and absolute returns are market-adjusted by the value-weighted return on the market portfolio. Amihud liquidity is ranked using all days in the month.

# Figure 1

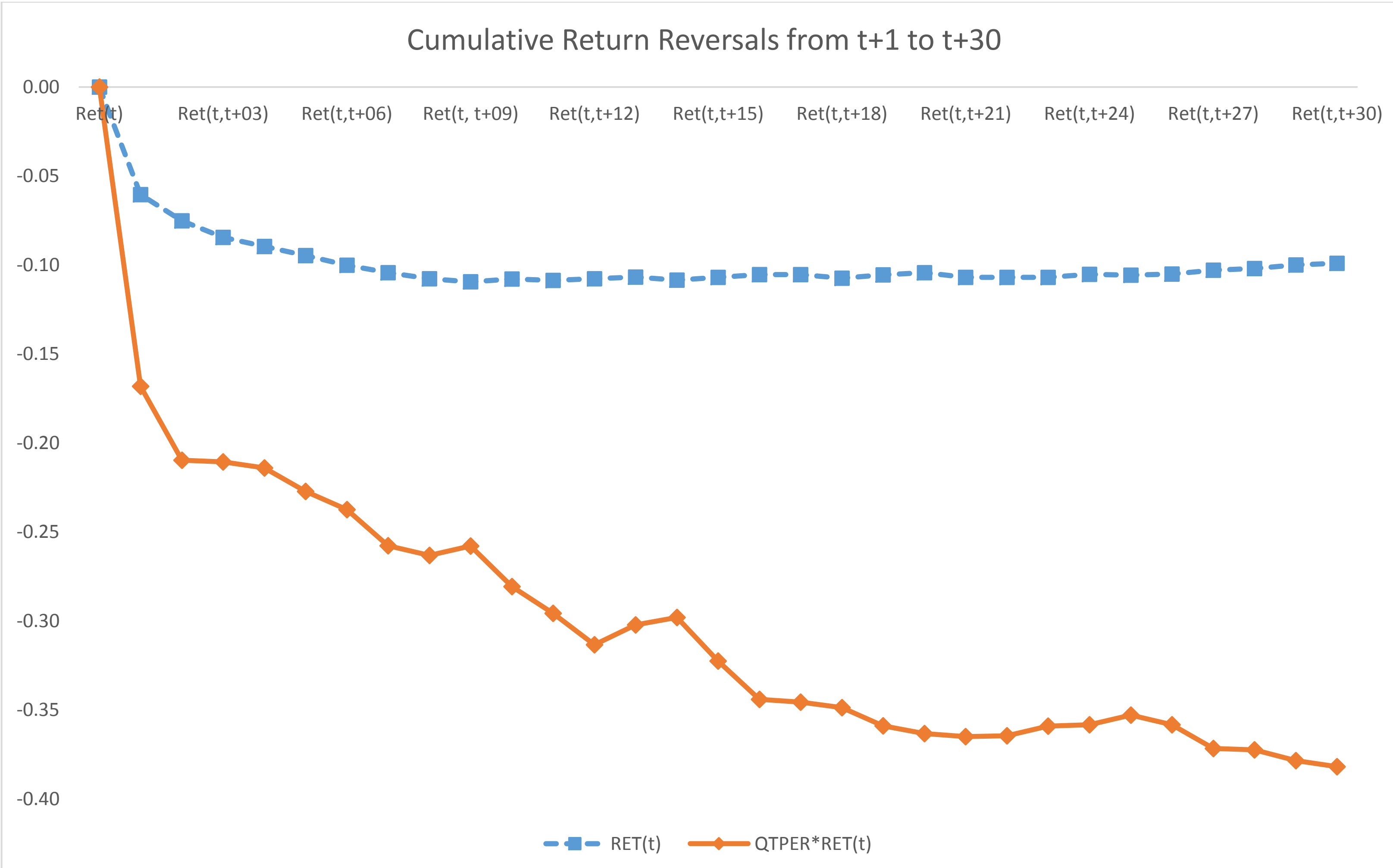



Figure 1 plots the OLS coefficients (Y-axis) from estimating 30 regressions that regress cumulative returns from day 1 to 30 (X-Axis) on fund disclosures (QTPER), returns on the disclosure day (Ret(t)) and the disclosure interacted with returns (QTPER*Ret(t)). The blue line graphs the estimated coefficients on Ret(t) and the orange line graphs the coefficients on QTPER*Ret(t). All coefficients are multiplied by 100 to allow interpretation at the percentage level. Robust standard errors are clustered by date.

# Table 2 – Return Reversals and Mutual Fund Disclosure Days

| | (1) Ret(t+1, t+30) | (2) Ret(t+1, t+30) | (3) Ret(t+1, t+30) | (4) Ret(t+2, t+30) | (5) Ret(t+2, t+30) | (6) Ret(t+2, t+30) | (7) Ret(t) |
|---|---|---|---|---|---|---|---|
| QTPER | -0.044 | -0.017 | 0.352*** | 0.109 | 0.129 | 0.184** | 0.459*** |
| | (-0.14) | (-0.05) | (2.87) | (0.36) | (0.42) | (2.55) | (6.66) |
| Ret(t) | -9.900*** | -10.262*** | -13.377*** | -6.059*** | -4.125*** | -6.952*** | |
| | (-15.46) | (-15.59) | (-10.55) | (-4.74) | (-6.51) | (-5.90) | |
| QTPER*Ret(t) | -38.182*** | -39.535*** | -33.233*** | -20.445*** | -22.747*** | -17.374*** | |
| | (-7.11) | (-7.36) | (-7.71) | (-4.43) | (-4.83) | (-4.91) | |
| Ret(t-1) | | -4.828*** | | | -2.937*** | | -6.140*** |
| | | (-7.35) | | | (-4.63) | | (-33.24) |
| QTPER*Ret(t-1) | | -15.573** | | | -10.953* | | -3.530 |
| | | (-2.35) | | | (-1.76) | | (-1.27) |
| Ret(t-2) | | -3.101*** | | | -2.016*** | | |
| | | (-4.93) | | | (-3.31) | | |
| QTPER*Ret(t-2) | | -5.586 | | | -4.548 | | |
| | | (-0.92) | | | (-0.73) | | |
| Monday*Ret(t) | | | -1.727 | | | -0.038 | |
| | | | (-0.92) | | | (-0.02) | |
| Tuesday*Ret(t) | | | 1.574 | | | 1.547 | |
| | | | (0.88) | | | (0.91) | |
| Wednesday*Ret(t) | | | 1.463 | | | 0.824 | |
| | | | (0.83) | | | (0.49) | |
| Thursday*Ret(t) | | | 1.409 | | | 1.583 | |
| | | | (0.77) | | | (0.92) | |
| EA*Ret(t) | | | 15.440*** | | | 9.736*** | |
| | | | (22.08) | | | (14.49) | |
| Firm Fixed Effects | No | No | Yes | No | No | Yes | No |
| Date Fixed Effects | No | No | Yes | No | No | Yes | No |
| Adj R2 | 0.001 | 0.001 | 0.058 | 0.000 | 0.000 | 0.000 | 0.004 |
| N | 25954873 | 25951059 | 25954836 | 25952794 | 25949117 | 25952794 | 25952997 |

This table reports regressions of future returns on fund disclosures, daily returns and fund disclosures interacted with returns. All coefficients are multiplied by 100 to allow interpretation at the percentage level. Robust standard errors are clustered by date. P-values are reported in parenthesis. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels for two-tailed tests respectively.

## Table 3 – Disclosure Days, Return Reversals, and Stock Liquidity

| | (1)<br>Ret(t+1, t+30) | (2)<br>Ret(t+2,t+30) | (3)<br>Ret(t+1, t+30) | (4)<br>Ret(t+2,t+30) | (5)<br>Ret(t+1, t+30) | (6)<br>Ret(t+2,t+30) |
|---|---|---|---|---|---|---|
| Ret(t) | -16.343*** | -2.798*** | 3.897*** | -4.992*** | -0.640 | -0.569 |
| | (-26.15) | (-4.75) | (2.84) | (-3.72) | (-0.70) | (-0.61) |
| QTPER | 0.068 | 0.302 | -0.175 | -0.066 | -16.793*** | -5.631*** |
| | (0.12) | (0.53) | (-0.57) | (-0.21) | (-23.87) | (-8.06) |
| QTPER*Ret(t) | -20.811*** | -11.548* | -60.879*** | -36.950*** | -35.335*** | -23.762** |
| | (-3.23) | (-1.91) | (-5.65) | (-4.04) | (-3.58) | (-2.55) |
| RankME | -0.356*** | -0.352*** | | | | |
| | (-5.72) | (-5.77) | | | | |
| QTPER*RankME | -0.225 | -0.381 | | | | |
| | (-0.33) | (-0.59) | | | | |
| RankMe*Ret(t) | 15.767*** | -2.832** | | | | |
| | (10.80) | (-1.98) | | | | |
| QTPER*RankMe*Ret(t) | -43.499*** | -26.087** | | | | |
| | (-3.41) | (-2.32) | | | | |
| RankAmihud | | | 0.250*** | 0.249*** | | |
| | | | (4.31) | (4.38) | | |
| QTPER*RankAmi | | | 0.256 | 0.347 | | |
| | | | (0.43) | (0.59) | | |
| RankAmi*Ret(t) | | | -23.648*** | 1.813 | | |
| | | | (-15.44) | (1.22) | | |
| QTPER*RankAmi*Ret(t) | | | 38.102*** | 24.575** | | |
| | | | (3.24) | (2.35) | | |
| Tick1997 | | | | | -0.288* | -0.286* |
| | | | | | (-1.80) | (-1.83) |
| QTPER*Tick1997 | | | | | 2.038 | 2.199 |
| | | | | | (1.23) | (1.32) |
| Tick1997*Ret(t) | | | | | 13.247*** | 5.470*** |
| | | | | | (6.28) | (2.69) |
| QTPER*Ret(t)*Tick1997 | | | | | -34.266* | -19.243 |
| | | | | | (-1.85) | (-1.13) |
| Sample Period | 1981-2012 | 1981-2012 | 1981-2012 | 1981-2012 | 1994-2000 | 1994-2000 |
| Firm Fixed Effects | No | No | No | No | No | No |
| Cluster SE | date | date | date | date | date | date |
| Adj R2 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| N | 25954873 | 25952794 | 25954873 | 25952794 | 6457669 | 6457577 |

This table reports regressions of future returns on fund disclosure, daily returns, a measure of liquidity and all interactions. We use two measures of liquidity rank of size (rankME) and rank of Amihud liquidity. Columns 1-4 are run on the full sample (1981-2012). Column 5 and 6 are run on samples from (1994-2000). The standard errors are robust and clustered at the date level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Table 4 – Disclosure Day Return Reversals by Sub-Period

| | (1) | (2) | (3) |
|---|---|---|---|
| | Ret(t+1, t+30) | Ret(t+1, t+30) | Ret(t+1, t+30) |
| Ret(t) | -13.139*** | -10.256*** | -7.799*** |
| | (-15.12) | (-9.97) | (-7.11) |
| QTPER | -0.096 | 0.614 | -0.603 |
| | (-0.22) | -0.94 | (-1.31) |
| QTPER*Ret(t) | -13.578*** | -45.662*** | -41.859*** |
| | (-3.12) | (-5.84) | (-4.26) |
| Sample Period | 1981-1990 | 1991-2000 | 2001-2012 |
| Fixed Effects | None | None | None |
| Cluster SE | date | date | Date |
| Adj R2 | 0.001 | 0.001 | 0.000 |
| N | 6746557 | 9570560 | 9637756 |

This table reports regressions of future returns on fund disclosures, daily returns and fund disclosures interacted with returns. We report results over three sub-periods: 1981-90; 91-2000 and 2001-12. The standard errors are robust and clustered at the date level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Table 5a – Liquidity on Disclosure Days

| | (1) RankSPR | (2) RankLIQ | (3) RankSPR | (4) RankLIQ |
|---|---|---|---|---|
| QTPER | -0.008*** | -0.013*** | -0.015*** | -0.019*** |
| | (-19.50) | (-43.48) | (-21.18) | (-33.10) |
| RankME | | | -0.380*** | -0.783*** |
| | | | (-74.98) | (-278.31) |
| QTPER*RankME | | | 0.016*** | 0.012*** |
| | | | (12.83) | (13.57) |
| Fixed Effects | None | None | None | None |
| Cluster SE | Firm | Firm | Firm | Firm |
| Adj R2 | 0.000 | 0.000 | 0.144 | 0.613 |
| N | 25954952 | 25954952 | 25954952 | 25954952 |

This table reports regressions of liquidity measures (rank of spread (RankSPR) and rank of daily liquidity (RankLIQ)) on our measure of daily portfolio holdings disclosure (QTPER), percentile rank of market value of equity by month-year (ME) and their interaction (QTPER*ME). The standard errors are robust and clustered at the firm level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Table 5b – Volume and Returns on Disclosure Days

| | (1)<br>AbsRET | (2)<br>DollarVol | (3)<br>AbsRET | (4)<br>DollarVol |
|---|---|---|---|---|
| QTPER | 0.0017*** | 0.314*** | 0.0028*** | 0.637*** |
| | (35.32) | (54.61) | (29.12) | (47.57) |
| RankME | | | -0.0072*** | 6.584*** |
| | | | (-25.68) | (67.41) |
| QTPER*RankME | | | -0.0023*** | -0.644*** |
| | | | (-14.82) | (-34.59) |
| Firm FE | Yes | Yes | Yes | Yes |
| Cluster SE | Firm | Firm | Firm | Firm |
| Adj R2 | 0.096 | 0.613 | 0.097 | 0.649 |
| N | 25954910 | 25583322 | 25954910 | 25583322 |

This table reports regressions of absolute returns and log of dollar volume on QTPER, RankME and their interaction. Robust standard errors are clustered by firm. P-values are reported in parenthesis. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels for two-tailed tests respectively.

## Table 6 – Portfolio Trading Tests

| | (1) Ret(t+1, t+30) | (2) Ret(t+1, t+30) | (3) Ret(t+1, t+30) | (4) Ret(t+1, t+30) | (5) Ret(t+1, t+30) | (6) Q+1 Ret(t) | (7) Q+1 Ret(t) |
|---|---|---|---|---|---|---|---|
| Ret(t) | -0.018*** | | | | | 0.003*** | 0.003*** |
| | (-4.123) | | | | | (7.323) | (6.851) |
| Ret(t-1, t) | | -0.021*** | -0.020*** | -0.006 | -0.025*** | | |
| | | (-3.882) | (-3.750) | (-1.057) | (-5.831) | | |
| RankOP | | | 0.008* | 0.011*** | 0.010** | | -0.002*** |
| | | | (1.967) | (3.615) | (2.047) | | (-5.223) |
| RankCMA | | | 0.001 | 0.004 | 0.013*** | | -0.000 |
| | | | (0.277) | (1.392) | (3.919) | | (-0.344) |
| RankME | | | -0.005 | 0.007*** | 0.017** | | 0.007*** |
| | | | (-1.817) | (2.799) | (2.083) | | (6.243) |
| RankBTM | | | 0.002 | 0.008* | 0.006 | | -0.003*** |
| | | | (0.388) | (1.893) | (0.871) | | (-4.274) |
| RankMOM | | | -0.009 | 0.015*** | -0.020* | | -0.001 |
| | | | (-1.092) | (2.928) | (-1.893) | | (-1.401) |
| RankSUE | | | 0.003 | 0.003 | 0.015*** | | -0.000 |
| | | | (0.891) | (1.531) | (5.082) | | (-0.855) |
| RankEAR | | | 0.001 | 0.004** | 0.010*** | | 0.000 |
| | | | (0.276) | (2.414) | (5.395) | | (0.778) |
| Month Selection Criteria | | Quarter End Date | | Non Quarter Month End Date | | Quarter End Date | |
| Index Selection Criteria | S&P 500 | S&P 500 | S&P 500 | S&P 500 | None | None | None |
| Sample | 1992-2012 | 1992-2012 | 1992-2012 | 1992-2012 | 1992-2012 | 1992-2012 | 1992-2012 |
| Adj R2 | 0.002 | 0.003 | 0.004 | 0.004 | 0.004 | 0.000 | 0.003 |
| N | 48,555 | 48,555 | 48,054 | 96,210 | 389,160 | 544,695 | 534,759 |

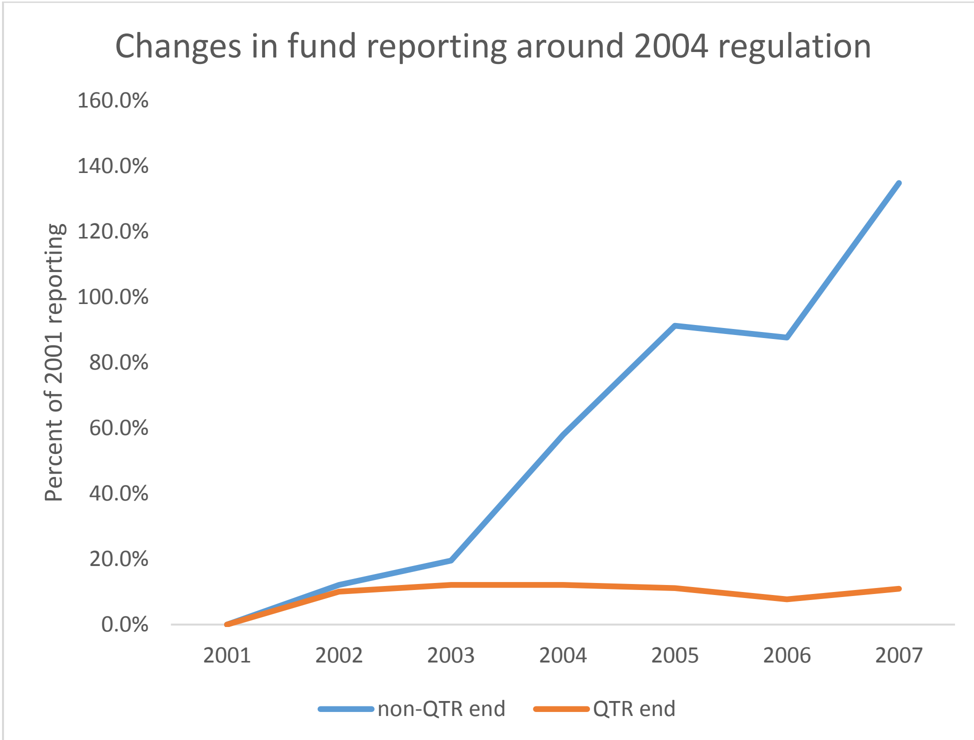
This table reports trading strategy tests regressing future returns on ranks of firm characteristics. Our variable of interest is the rank of either returns on the last day of the quarter or the last day of the quarter and the day prior. In columns (1) – (5), the dependent variable is monthly returns calculated from the opening price the first trading day of the month to the closing price the last day of the month. In columns (6) – (7) we regress returns from the quarter end day on returns from the prior quarter end day. All anomaly variables are computed percentile ranks calculate at the month-year level. OP = Operating Profit; CMA = Asset Growth; ME = Market value of Equity; MOM= One year momentum factor; BTM = Book to Market Ratio; SUE = Standardized Unexpected Earnings; EAR = Earnings Announcement Returns. Columns 1-4 limit the sample to the largest 500 firms in the sample; columns 5-7 impose no such restrictions. The standard errors are robust and clustered by month. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

# Table 7 – Asset Pricing Tests

| | (1) Ret(t) | (2) Ret(t) | (3) LogRet(t) | (4) LogRet(t) | (5) LogRet(t-1) | (6) LogRet(t-2) | (7) LogRet(t+1) | (8) LogRet(t+2) |
|---|---|---|---|---|---|---|---|---|
| QTPER | 0.616*** | 0.617*** | 0.604*** | 0.604*** | 0.223** | -0.059 | -0.287* | -0.025 |
| | (4.39) | (4.41) | (4.56) | (4.54) | (2.20) | (-0.52) | (-1.81) | (-0.15) |
| RankOP | 0.009 | 0.025*** | 0.029*** | 0.034*** | 0.025*** | 0.024*** | 0.075*** | 0.077*** |
| | (1.35) | (3.87) | (4.40) | (5.23) | (3.89) | (3.70) | (11.62) | (11.84) |
| RankOP*QTPER | -0.351*** | -0.352*** | -0.348*** | -0.348*** | -0.079 | 0.032 | 0.191** | 0.002 |
| | (-5.46) | (-5.55) | (-5.70) | (-5.73) | (-1.60) | (0.60) | (2.23) | (0.02) |
| RankCMA | 0.069*** | 0.053*** | 0.074*** | 0.053*** | 0.068*** | 0.067*** | 0.037*** | 0.041*** |
| | (12.72) | (10.05) | (13.77) | (10.05) | (12.65) | (12.36) | (6.95) | (7.65) |
| RankCMA*QTPER | -0.258*** | -0.260*** | -0.257*** | -0.259*** | -0.055 | 0.028 | 0.132** | 0.015 |
| | (-4.01) | (-4.04) | (-4.16) | (-4.17) | (-1.16) | (0.58) | (2.35) | (0.18) |
| RankME | 0.136*** | 0.557*** | 0.078*** | 0.515*** | 0.069*** | 0.066*** | -0.049*** | -0.035*** |
| | (12.62) | (25.94) | (7.31) | (24.23) | (6.39) | (6.16) | (-4.55) | (-3.26) |
| RankME*QTPER | 0.702*** | 0.701*** | 0.685*** | 0.684*** | -0.172 | -0.181* | -0.411*** | 0.057 |
| | (6.31) | (6.37) | (6.18) | (6.21) | (-1.45) | (-1.85) | (-3.04) | (0.49) |
| RankMOM | -0.058*** | -0.139*** | -0.047*** | -0.127*** | -0.040*** | -0.043*** | 0.049*** | 0.036*** |
| | (-4.82) | (-11.44) | (-3.96) | (-10.52) | (-3.34) | (-3.62) | (4.15) | (3.05) |
| RankMOM*QTPER | 0.017 | 0.023 | 0.028 | 0.034 | 0.124 | 0.153 | -0.234 | -0.060 |
| | (0.17) | (0.24) | (0.29) | (0.36) | (1.14) | (1.56) | (-1.57) | (-0.44) |
| RankBTM | -0.008 | 0.062*** | 0.030*** | 0.070*** | 0.025** | 0.023** | 0.079*** | 0.082*** |
| | (-0.74) | (6.63) | (2.91) | (7.54) | (2.47) | (2.20) | (7.72) | (8.06) |
| RankBTM*QTPER | -0.423*** | -0.424*** | -0.423*** | -0.424*** | -0.160* | 0.066 | 0.380*** | 0.070 |
| | (-5.16) | (-5.27) | (-5.40) | (-5.43) | (-1.93) | (0.71) | (2.95) | (0.52) |
| RankSUE | 0.048*** | 0.049*** | 0.055*** | 0.050*** | 0.056*** | 0.060*** | 0.065*** | 0.063*** |
| | (9.36) | (10.12) | (10.82) | (10.52) | (11.10) | (11.85) | (13.18) | (12.77) |
| RankSUE*QTPER | -0.146*** | -0.146*** | -0.141*** | -0.141*** | 0.071 | -0.009 | 0.040 | -0.026 |
| | (-3.63) | (-3.72) | (-3.71) | (-3.73) | (1.53) | (-0.18) | (0.62) | (-0.44) |
| RankEAR | 0.028*** | 0.016*** | 0.029*** | 0.018*** | 0.044*** | 0.064*** | 0.036*** | 0.034*** |
| | (7.66) | (4.46) | (8.06) | (4.92) | (11.73) | (15.64) | (10.53) | (9.73) |
| RankEAR*QTPER | 0.019 | 0.017 | 0.020 | 0.018 | -0.012 | -0.034 | 0.001 | -0.008 |
| | (0.52) | (0.47) | (0.55) | (0.52) | (-0.36) | (-1.00) | (0.01) | (-0.23) |
| Firm Fixed Effects | No | Yes | No | Yes | No | No | No | No |
| Cluster SE | date | date | date | date | date | date | date | date |
| Adj R2 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 22766923 | 22766888 | 22766923 | 22766888 | 22765338 | 22765233 | 22765191 | 22764986 |

Regressions of returns on anomaly ranks, QTPER and QTPER interacted with anomaly ranks. All factor variables are computed percentile ranks calculate at the month-year level. OP = Operating Profit; CMA = Asset Growth; ME = Market value of Equity; MOM= One year momentum factor; BTM = Book to Market Ratio; SUE = Standardized Unexpected Earnings; EAR = Earnings Announcement Returns. The standard errors are robust and clustered at the date level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Figure 2




The graph depicts fund positions disclosed on quarter-end and non-quarter end month end days from 2001 through 2007, where the positions are expressed as percentage increase over 2001 reporting. We find fund disclosure on non-quarter end month end days (i.e. January 31st or February 29th) increased by 135% over the six years from 2001 to 2007 while quarter end disclosures (i.e. March 31st) posted only a 10% increase. Moreover the changes seem to begin around the 2004 disclosure frequency change.

## Table 8 – Reversals after the 2004 Disclosure Rule Change

| | (1)<br>Ret(t, t+30) |
|---|---|
| Ret(t) | -52.805*** |
| | (-4.61) |
| DiscChange | -1.689* |
| | (-1.95) |
| DiscChange*Ret(t) | 32.629** |
| | (2.27) |
| NonQTRMonthEnd | 0.572 |
| | (0.71) |
| NonQTRMonthEnd*Ret(t) | 56.116*** |
| | (4.18) |
| DiscChange*NonQTRMonthEnd | -0.277 |
| | (-0.27) |
| DiscChange*NonQTRMonthEnd*Ret(t) | -48.586*** |
| | (-2.90) |
| Fixed Effects | None |
| Cluster SE | date |
| Adj R2 | 0.008 |
| N | 296670 |

This table reports regressions of future returns on fund disclosures, returns, a disclosure rule change indicator and a non-quarter-month-end indicator. The sample includes all month-end dates from 2001 – 2007. All coefficients are multiplied by 100 to allow interpretation at the percentage level. Robust standard errors are clustered by date. P-values are reported in parenthesis. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels for two-tailed tests respectively.

# Table 9 – Serial Correlation Tests

## Panel A – Manager level regressions

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | $Serial_1$ | $Serial_1$ | $Serial_1$ | $Serial_1$ |
| QTPER | -13.109*** | -17.468*** | -6.421** | -12.212*** |
| | (-40.89) | (-73.29) | (-2.04) | (-3.90) |
| Fixed Effects | None | None | None | None |
| Cluster SE | Firm | Firm | Firm | Firm |
| Sample | Trade next week | ALL | Trade next week | ALL |
| WLS | No | No | Yes | Yes |
| Adj R2 | 0.000 | 0.001 | 0.001 | 0.000 |
| N | 22404645 | 31016795 | 22261647 | 30873195 |

This table reports regressions of $Serial_1$ (a variable coded to capture funds following up trades with subsequent trades of the same sign) on fund disclosures (QTPER). The sample is all trades in the Ancerno database at the date-firm-manager level. Columns (1)-(2) report OLS regression while Columns (3)-(4) report WLS regressions, with the weight the dollar value of trade dividend by market capitalization. The standard errors are robust and clustered at the firm level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Panel B – Firm level simple regressions

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | $Serial_1$ | $Serial_1$ | $Serial_1$ | $Serial_1$ |
| QTPER | -8.592*** | -10.295*** | -6.823** | -8.471*** |
| | (-19.50) | (-26.21) | (-2.07) | (-2.73) |
| Fixed Effects | None | None | None | None |
| Cluster SE | Firm | Firm | Firm | Firm |
| Sample | Trade next week | ALL | Trade next week | ALL |
| WLS | No | No | Yes | Yes |
| Adj R2 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 5487174 | 5701193 | 5482183 | 5696049 |

This table reports regressions of $Serial_1$ (a variable coded to capture funds following up trades with subsequent trades of the same sign) on fund disclosures (QTPER). The sample is all trades in the Ancerno database summed up to the date-firm level. Columns (1)-(2) report OLS regression while Columns (3)-(4) report WLS regressions, with the weight the dollar value of trade dividend by market capitalization. The standard errors are robust and clustered at the firm level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

**Panel C – Serial Correlation across fund client types**

| | (1) Serial$_1$ | (2) Serial$_1$ | (3) Serial$_1$ |
|---|---|---|---|
| QTPER | 0.077 | -0.159*** | 0.077 |
| | (0.413) | (-48.834) | (0.413) |
| Fund | | | 0.019*** |
| | | | (2.605) |
| QTPER*Fund | | | -0.944 |
| | | | (-1.263) |
| Fund | Non-funds | Funds | All |
| Adj R2 | 0.000 | 0.000 | 0.002 |
| Sample Period | 2009-11 | 2009-11 | 2009-11 |
| N | 4,508,249 | 9,687,268 | 14,195,517 |

This table reports the OLS results where the dependent variable is the serial correlation in the direction of trades in the 1 week after the disclosure day. Observations in this regression specification are at the manager-firm-date level. The standard errors are robust and clustered at the firm level. P-values are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for two-tailed tests, respectively.

## Table 10 – Do funds' cash receipts and disbursements cause return reversals?

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Ret(t+1, t+30) | Ret(t+1, t+30) | Ret(t+1, t+30) | Ret(t+1, t+30) |
| Ret(t) | -10.078*** | -10.273*** | -9.977*** | -10.041*** |
| | (-15.16) | (-15.29) | (-15.36) | (-14.88) |
| QTPER | -0.045 | -0.054 | -0.044 | -0.045 |
| | (-0.15) | (-0.17) | (-0.14) | (-0.15) |
| QTPER*Ret(t) | -37.906*** | -37.598*** | -38.065*** | -37.965*** |
| | (-7.05) | (-6.99) | (-7.09) | (-7.06) |
| BeginMonthDum | -0.010 | | | |
| | (-0.08) | | | |
| BeginMonthDum*Ret(t) | 2.585 | | | |
| | (1.05) | | | |
| BeginMonthDumAlt | | -0.061 | | |
| | | (-0.61) | | |
| BeginMonthDumAlt*Ret(t) | | 3.592 | | |
| | | (1.64) | | |
| MidMonthDum | | | -0.012 | |
| | | | (-0.07) | |
| MidMonthDum*Ret(t) | | | 2.367 | |
| | | | (0.62) | |
| MidMonthDumALT | | | | -0.011 |
| | | | | (-0.11) |
| MidMonthDumALT*Ret(t) | | | | 1.401 |
| | | | | (0.66) |
| Fixed Effects | None | None | None | None |
| Cluster SE | date | date | date | date |
| Adj R2 | 0.001 | 0.001 | 0.001 | 0.001 |
| N | 25954873 | 25954873 | 25954873 | 25954873 |

This table reports regressions of future returns on fund disclosures, returns, disclosure interacted with returns, beginning or mid-month indicator variables and these indicator variables interacted with returns. BeginMonthDum (BeginMonthDumAlt) takes a value of one for the 1st (1st, 2nd and 3rd) of each month and zero otherwise. Similarly, MidMonthDum (MidMonthDumAlt) takes a value of 1 for the 15th (14th, 15th and 16th) of each month and zero otherwise. All coefficients are multiplied by 100 to allow interpretation at the percentage level. Robust standard errors are clustered by date. P-values are reported in parenthesis. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels for two-tailed tests respectively.