

# Mutual funds' reporting frequency and firms' responses to undervaluation: The role of share repurchases

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## Abstract

We examine a regulatory change that increased the reporting frequency of mutual funds' portfolios. Using a difference-in-differences design, we find that firms with greater ownership by mutual funds increase share repurchases following the regulatory change. We show that these share repurchases are a firm's rational response to undervaluation, which occurs because fund managers become shortsighted following the regulation and sell companies with good long-term prospects. Collectively, our results shed light on an unintended consequence of more frequent reporting in a delegated asset management framework.

## KEYWORDS

mutual funds, myopia, reporting frequency, share repurchases

## Fréquence de communication de rapports par les sociétés d'investissement et réponses des entreprises à la sous-évaluation : le rôle des rachats d'actions

## Résumé

Les auteurs étudient une modification réglementaire qui a augmenté la fréquence de la communication des rapports relatifs aux portefeuilles des sociétés d'investissement. À

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l'aide d'un modèle en différences doubles, les auteurs constatent que les entreprises détenues en majorité par des sociétés d'investissement effectuent plus de rachats d'actions en réponse à la modification réglementaire. Ils montrent que ces rachats d'actions sont une réponse rationnelle d'une entreprise à la sous-évaluation de leurs actions, qui se produit parce que les gestionnaires de fonds développent une vision à court terme à la suite de la réglementation et vendent des entreprises ayant de bonnes perspectives à long terme. Dans leur ensemble, les résultats mettent en lumière une conséquence involontaire d'une fréquence accrue de communication de rapports dans un cadre de gestion d'actifs déléguée.

#### MOTS-CLÉS

fréquence de communication de rapports, myopie, rachats d'actions, sociétés d'investissement

## 1 | INTRODUCTION

In May 2004, the SEC passed a regulation that increased the reporting frequency of mutual funds' portfolios from semiannually to quarterly. The rule was intended to increase the transparency of capital markets by providing investors with more timely and more granular information about individual funds' portfolios. Yet fund managers publicly opposed this regulation, arguing that it would increase attention to individual portfolio holdings and encourage a short-term investment perspective (Tyle, 2001). Building on insights from theoretical studies, we predict and find that (1) increased reporting frequency translates into myopic behavior for mutual fund managers, and (2) portfolio firms rationally respond to this change by increasing their stock repurchases.

The logic underlying our predictions is grounded in prior studies that offer theoretical guidance on how more frequent portfolio disclosure may alter fund managers' incentives. These models distinguish between information about an agent's actions (input) and information about the consequences of such actions (output; Prat, 2005). Although more information on an agent's output increases the agent's accountability, more information on an agent's input (actions) exacerbates monitoring by the principal, which amplifies the agent's career concerns and, thus, induces short-termism (Shleifer & Vishny, 1990).

The intuition from these models applies well to the mutual fund setting because fund managers are aware that fund investors are monitoring their actions (Prat, 2005). Although funds' past performance is constantly observable, fund investors are uncertain about fund managers' long-term performance, and fund managers behave as if they are evaluated based on their stock picks (input) and not just fund returns (output; see, e.g., Wermers, 2011). Yet a fund manager cannot credibly communicate private information about stock picks to the fund investors, as there is no credible disclosure commitment. Hence, more frequent disclosure about a fund manager's actions incentivizes fund managers to ignore their own private information and engage in conforming behavior, taking actions that fund investors perceive as high-ability actions in the short term, even if the fund manager's private information suggests that some other actions would be preferable. To put it differently, more frequent disclosures about fund managers' stock picks create incentives for the fund manager to show a winning stock-picking strategy in these short-term disclosures. The fund manager has incentives to divest from stocks that—according to private information—have good long-term prospects

but can appear to be “poor” stock picks in the short-term portfolio disclosures (Lakonishok et al., 1991).<sup>1</sup>

In this scenario, we argue that mutual funds’ trading—determined by the short-term considerations discussed above—can distort the asset prices of the firms they sell (Edmans et al., 2018), causing some portfolio firms to become undervalued. Prior studies show that firm managers tend to repurchase shares when they consider their stock undervalued (Dittmar, 2000; D’Mello & Shroff, 2000), with survey evidence indicating that 86.4% of executives repurchase shares when their company’s stock price is low by recent historical standards (Brav et al., 2005). Hence, we predict that firms in the portfolio of funds affected by the regulation will increase share repurchases, with the effect concentrated among firms that experience undervaluation post-regulation.

To test our predictions, we use a difference-in-differences design to estimate the change in stock repurchases over the 2002–2006 period centered on the SEC regulatory change of May 2004. We assign listed firms into either a treatment or a control group based on the level of their pre-regulation ownership by active mutual funds affected by the regulation. Hence, our research design keeps ownership constant at the pre-regulation level and relies on variation in the intensity of the exposure to mutual funds’ short-termism (arising from the 2004 reporting frequency regulation) between treatment and control firms.

Consistent with our prediction, we find a significantly larger increase in share repurchases following the regulation for treatment firms (i.e., those with higher ownership by affected mutual funds), relative to control firms (i.e., those with lower ownership by affected mutual funds). The increase in share repurchases is economically significant. Our estimates translate into an average increase in the dollar value of share repurchases of approximately 0.3% of total assets.<sup>2</sup>

Next, we examine whether the documented increase in share repurchases is a response to the stock undervaluation caused by mutual funds’ myopia, as we hypothesized. This undervaluation mechanism hinges on three sequential steps, which we test directly. The first step is that more frequent portfolio disclosures increase the fund manager’s costs for holding firms that have good long-term prospects according to the managers’ private information (which, however, cannot be credibly communicated to fund investors) but can appear to be “poor” stock picks in the short-term portfolio disclosures. Hence, fund managers become myopic and divest from these companies. Consistent with this argument, we document that fund managers reduce their portfolio exposure to firms with high levels of R&D expenditures and a large number of patents. These firms are likely to generate value in the long term based on fund managers’ private information (Bushee, 1998; Fang et al., 2014; Goldman & Slezak, 2003), but may appear to be “poor” stock picks to fund investors given the uncertain payoffs to R&D and patenting activities.

The second step underlying the undervaluation prediction is that companies divested by myopic mutual funds become undervalued. Using a comprehensive undervaluation measure developed by Stambaugh et al. (2015), which combines 11 return anomalies, we confirm that treatment firms that are divested by myopic mutual funds become undervalued after the 2004 regulatory change.

Having established that mutual fund managers become myopic and divest firms with good long-term prospects—which tend to become undervalued—the third and last step is that the documented increase in share repurchases should be concentrated in the subsample of firms that become undervalued with the passage of the regulation (i.e., as a result of mutual funds’ short-

<sup>1</sup>This notion is also confirmed in a report by the Investment Company Institute (ICI)—a fund managers’ association. The ICI argues that more frequent disclosure of fund portfolios would encourage mimicking in stock-picking strategy and might skew fund managers’ portfolio strategies toward those with a short-term horizon (Wermers, 2001).

<sup>2</sup>Our dynamics analysis shows that treatment and control firms behave similarly pre-regulation, which supports the parallel trends assumption.

termism). To test this step, we partition firms between those that become undervalued in the post-period (relative to the pre-period) and those that do not, and examine how stock repurchases vary among these two groups. Consistent with our prediction, we find that the effect of the mutual funds' reporting frequency on share repurchases is between two and three times larger for firms that become undervalued with the passage of the disclosure regulation.

Furthermore, to triangulate our findings and ensure that share repurchases post-regulation are a firm's rational decision, we examine long-term returns, which capture the value created by share repurchases. We find that firms divested by affected mutual funds—that have high levels of R&D expenditures or a large number of patents—experience higher long-term returns after repurchasing their shares. This result confirms that managers of firms with good long-term prospects rationally respond to their firm undervaluation caused by mutual funds myopia.

Finally, a fundamental argument in the theory discussed above is that agents' short-termism, subsequent to greater disclosure about their actions, stems from career concerns. To support this argument, we perform two tests. First, we document that fund managers' career concerns increase in the post-regulation period (relative to the pre-period). Second, we find that the documented increase in repurchases among treated firms is stronger when fund managers' career concerns are high.

Overall, our results provide robust evidence that firms with greater ownership by mutual funds increase share repurchases following the regulation that increased the reporting frequency of portfolio holdings. Importantly, we show that these share repurchases are a rational response to firm undervaluation, which occurs because fund managers become shortsighted following the regulation and sell companies with good long-term prospects.

Our results are subject to some potential caveats. One concern is that our treatment and control firms could be systematically different, and these differences could cause changes in share repurchases after the 2004 regulation for reasons unrelated to disclosure requirements. To corroborate the robustness and plausibility of our findings, we first conduct a placebo test where we compare the effect on repurchases by affected active mutual funds with the effect by four other groups of investors: (1) voluntary reporting adopters, (2) non-mutual fund institutions, (3) hedge funds, and (4) index funds. The rationale for exploiting the first three groups is that they are unaffected by the 2004 SEC regulation. Index funds (the fourth group) are affected by the 2004 SEC regulation, but they passively track an index and thus they cannot voluntarily sell shares of their portfolio firms (i.e., exit; see Heath et al., 2022) and cause firm undervaluation. The placebo tests support our inferences, since we find that the effect in the placebo groups is significantly smaller than that in our treatment group. Second, we examine whether our main results hold for a subsample of firms with at least one repurchase in the pre-regulation period. Third, we examine a fully interacted model, allowing our controls to vary in the post-regulation period. Fourth, we use an alternative fixed-effect structure that controls for time-series variation in institutional holdings, and finally we use two alternative classifications for treatment and control groups. These additional analyses confirm the robustness of our inferences.

Our paper makes three contributions. First, it adds to the literature on the consequences of more frequent reporting—a fundamental question in accounting research. Prior studies examine the effect of mandatory increases in the frequency of corporate reporting on the myopia of firm managers (Ernstberger et al., 2017; Fu et al., 2020; Kraft et al., 2018). In contrast, we examine the effect of mandatory increases in the frequency of funds' portfolio reporting on fund managers' myopia. This distinction is important because in the corporate setting, more frequent reporting means that firm performance is observable more frequently (i.e., the reporting is about firm performance). In the mutual fund setting, performance (fund returns) is observable daily. Thus, more frequent reporting means that the fund manager's actions (portfolio holdings) are observable more frequently. To the extent that fund investors mostly care about funds' returns, then a change in reporting frequency may not affect the fund manager's incentives. But

if fund investors do examine portfolio holdings to infer the fund manager's ability (Prat, 2005; Wermers, 2011), then the impact of more frequent reporting on myopic behavior may be even stronger than in the corporate setting. This is because in the fund setting the business model is simple, and thus quarterly portfolio holdings disclosure is more informative about a fund manager's ability than firm quarterly performance reports are about a firm manager's ability. Furthermore, our setting allows us to examine the impact of changes in fund managers' myopia on the behavior of portfolio firms, as discussed next.

Our second contribution is to the literature examining the effect of investors' horizon on firms' policies. Prior studies document that investors with short-term horizons provide firm managers with implicit and explicit short-term incentives.<sup>3</sup> Along these lines, in the mutual funds' setting Agarwal et al. (2018) show that—following the 2004 SEC regulation—firms cut innovation, a finding that they interpret as an example of managerial myopia transmitted from investors. In contrast, our evidence suggests that firm managers respond to the increased myopia of their investors by engaging in stock repurchases as a rational way to offset the undervaluation caused by such myopia. Thus, we identify an alternative channel by which investors' myopia can affect corporate policies. Future research could investigate whether firms cut innovation because they employed resources to reduce undervaluation caused by investors' myopia (e.g., via share repurchases).

Third, our paper speaks to the literature on payout policy. We show that one important aspect of institutional ownership; namely, mutual fund managers' myopia, contributes to stock repurchases through the undervaluation channel. In doing so, we add both to studies examining the influence of various types of ownership on payout policies (Brav et al., 2008; Grinstein & Michaely, 2005; Mullins, 2014) and to studies examining the undervaluation motive behind repurchases (Dittmar, 2000; D'Mello & Shroff, 2000; Farre-Mensa et al., 2014; Ikenberry & Vermaelen, 1996). Importantly, rather than being a form of managerial myopia (as in Almeida et al., 2016), our findings show that share repurchases can be a *rational* response to investors' myopia. In that, our results are informative to the current policy debate on repurchases, and suggest caution when interfering with a firm's ability to optimize their share repurchases, for example by imposing taxes.<sup>4</sup>

## 2 | BACKGROUND

In this section, we first discuss the principal-agent theory that establishes that more information about an agent's actions induces the agent's short-termism. Second, we describe the important features of the 2004 SEC regulation. Third, we explain how theory predicts that more frequent reporting of fund managers' portfolio choices will make them more short-term focused. Finally, we describe the mechanism through which fund managers' heightened short-termism transfers to the corporate sector by increasing firms' incentives to repurchase shares.

### 2.1 | Theoretical framework

Theoretical work by Prat (2005), Hermalin and Weisbach (2012), Gigler et al. (2014), and Edmans et al. (2016) explains why more frequent portfolio disclosure makes fund managers behave myopically. These studies argue that more information about an agent's actions

<sup>3</sup>See, for example, Dechow and Sloan (1991), Bushee (1998), Matsumoto (2002), Bushee (2010), Cadman and Sunder (2014), Houston et al. (2015), Edmans et al. (2017), and Cadman et al. (2023). Furthermore, other studies on myopia focused on the private benefits that managers obtained from engaging in myopic behavior (Bhojraj et al., 2009; Hribar et al., 2006; Stein, 1989).

<sup>4</sup>The Inflation Reduction Act of 2022 imposes a 1% excise tax on the aggregate fair market value of stock repurchased by publicly traded firms, and a proposal to increase the excise tax to 4% is currently being discussed.

motivates the agent to focus excessively on short-term performance due to career concerns. A common feature of these models is that the principal is uncertain about the agent's ability, and agents lack a disclosure commitment through which they can credibly communicate their superior knowledge about the long-term returns of their portfolio strategy.<sup>5</sup> Hence, in order to reduce this uncertainty, the principal uses information about the agents' actions and their consequences to assess their ability. If the principal receives more information about an agent's actions, the agent will be motivated to take actions (1) that the principal would immediately view favorably, and (2) that would not carry negative consequences (e.g., a reduction in performance). In other words, more information about an agent's actions amplifies the agent's focus on short-term performance.

Prat (2005) provides the fundamental intuition behind this result. He develops a model of career concerns in which the principal is unsure about the agent's ability *ex ante* and therefore uses the available information to assess the agent. Importantly, the principal observes two types of information: information about the agent's actions (e.g., the fund manager's portfolio choices), and information about the consequence of the agent's actions (e.g., the fund manager's portfolio performance). The principal forms a posterior about the agent's type (i.e., ability) and decides whether to keep or replace the agent. In this model, the agent is an expert who receives a signal about the state of the world, the precision of which depends on the agent's type.<sup>6</sup> Given the agent's career concerns, the information asymmetry between the agent and the principal, and the lack of a credible disclosure commitment, agents who realize that their actions are going to be observed by the principal have incentives to act in accordance with how the principal expects "good" agents to behave, even if this behavior conflicts with the actions suggested by their private signals. In other words, more information about the agent's actions (e.g., via more frequent disclosure) creates incentives for the agent to take "conformist" actions that the principal sees as indicative of a high ability to generate better outcomes.<sup>7</sup> This implies that agents will forgo investments with positive long-term returns, as indicated by their private signals, if they cannot credibly communicate their favorable prospects to the principal.<sup>8</sup>

Other theoretical studies also examine the relation between disclosure frequency and the agent's short-termism. For example, Gigler et al. (2014) argue that in a real effect setting (as in our paper), the price pressure generated by high reporting frequency motivates managers to adopt a short-term perspective in selecting the firm's investments. Edmans et al. (2016) show that the increased disclosure of hard information increases a manager's incentive to prioritize hard information over soft information, which in turn leads to cutting investments to boost earnings. Similarly, Hermalin and Weisbach (2012) develop a model with a career-concerned agent and an uninformed principal who uses periodic reporting to assess the agent's ability. More frequent reporting increases the agent's incentives to boost short-term performance in order to avoid termination.

Taken together, these theoretical models support the prediction that greater disclosure frequency increases the agent's short-termism.

<sup>5</sup>In other words, it is not possible to commit to convey credible information as in the model of Leuz and Verrecchia (2000). This exacerbates information asymmetry, especially for fund managers with short tenure since they have less historical performance that the fund investors can evaluate.

<sup>6</sup>Prat (2005) argues that what differentiates good agents from bad agents is their ability to understand the state of the world—that is, expertise.

<sup>7</sup>An important feature of the model in Prat (2005) is that the agent is an expert, but the principal is not. It follows that more information about an agent's action cannot improve the agent's quality (e.g., in the mutual funds setting, more frequent reporting cannot make fund managers better monitors of their portfolio firms). More information will only make the agent behave in line with the principal's expectations. In other words, agents will disregard their private signals and act in a purely conformist way. There is no moral hazard in Prat (2005).

<sup>8</sup>This implies that more information about the agent's action will make the agent myopic even when the principal is not myopic.

## 2.2 | Institutional setting and empirical predictions

The functioning of capital markets depends on the information available to investors to guide their trading. Mandatory portfolio holdings disclosure by institutional investors is a fundamental piece of information used by investors (Agarwal et al., 2015), and in fact mutual funds are required to disclose their portfolio holdings through periodic filings with the SEC. Prior to May 2004, the disclosure landscape was heterogeneous. Individual mutual funds were required to disclose their portfolio holdings semiannually through Form N-30D. Some funds voluntarily disclosed their holdings on a more frequent basis on their websites, but typically only the largest holdings (e.g., the top 10 by market capitalization).<sup>9</sup> Furthermore, institutional investors were required to file a quarterly Form 13F, which, however, only required the disclosure of *aggregate* holdings at the fund family level and thus was not informative about the portfolio choices of individual funds.<sup>10</sup>

To increase market transparency, in May 2004 the SEC amended the Investment Company Act of 1940 and required individual mutual funds to file their portfolio holdings quarterly through Forms N-CSR and N-Q. This new disclosure regime provided investors with more *timely* information about the portfolio holdings of individual funds (quarterly rather than semi-annually). It also provided more *granular* quarterly information relative to Form 13F (portfolio holdings at the individual fund rather than at the family fund level). Given that mutual fund families include multiple funds, the information disclosed in Form 13F is less informative about the portfolio choices of the individual funds. In contrast, the quarterly Forms N-CSR and N-Q provide much richer and timelier information about the investment of *all* the individual mutual funds within a fund family, thus lowering information processing costs for investors (Blanquespoor et al., 2020).

In such a scenario, prior evidence suggests that fund investors with access to more timely and granular information about a fund manager's portfolio holdings will incrementally rely on that information to assess the fund manager's ability (Wermers, 2011). In particular, prior studies document that investors use portfolio disclosure as a means of obtaining information about a fund manager's ability incremental to fund returns. For example, Agarwal et al. (2014) document that fund flows are associated with incremental information in portfolio holdings above and beyond the information provided by fund returns. Similarly, Schaumburg and Meier (2005) show that mutual fund rating companies and sophisticated investors increasingly scrutinize reported holdings for evidence of stock selection and market timing ability, while Lakonishok et al. (1991) show that fund managers take actions suggesting that they know they are evaluated on their portfolio holdings.

In light of this evidence, we predict that the 2004 regulatory change from semiannual to quarterly portfolio disclosure affects fund investors' assessment of fund managers' stock-picking ability and, as a result, affects fund managers' behavior, consistent with the theory discussed in Section 2.1. Specifically, under the new disclosure regime, the more timely and granular information about a fund manager's portfolio choices should allow the fund's investors to better observe portfolio activity, which in turn should increase fund managers' career concerns and thus incentives to take conformist actions that fund investors consider "good" (i.e., actions that they believe show a winning stock-picking strategy in the short term). Fund managers will have incentives to divest from stocks that they know (via private information) have good long-term

<sup>9</sup>We randomly selected 20 mutual funds from our sample and examined their current website disclosure. We observed that these funds currently disclose their holdings with a quarterly or higher frequency, but the majority of them (55%) disclose only their top 10 holdings. Since we were not able to retrieve the 2004 version of these websites from the Wayback Machine, it is reasonable to think that website disclosure could have been even more sparse prior to the SEC disclosure regulation of May 2004.

<sup>10</sup>Furthermore, Form 13F is filed only by fund families that have more than \$100 million of assets under management (AUM) and include holdings only of positions where the aggregate fund's holding is more than 10,000 shares and has a market value exceeding \$200,000. Forms N-CSR and N-Q do not have such disclosure constraints.

prospects if those stocks can appear to be “poor” stock picks in the short-term portfolio disclosures (see, e.g., Lakonishok et al., 1991), because this private information cannot be credibly communicated to the fund’s investors. Put differently, a fund manager who is willing to take long-run investments based on private information risks funds’ divestiture (and at the margin job termination), because fund investors may interpret investment in firms with lower short-term performance as reflecting poor ability on the part of the fund manager.<sup>11</sup>

Such myopia-driven divestiture of mutual funds can distort the asset prices of the firms they sell (Edmans et al., 2018). It follows that some firms in the mutual fund’s portfolio can become undervalued and thus take rational actions to reduce undervaluation induced by mutual funds’ myopia. Specifically, prior studies show that firm managers have strong incentives to repurchase shares when they consider their stock undervalued (Dittmar, 2000; D’Mello & Shroff, 2000; Ikenberry & Vermaelen, 1996). This incentive is confirmed by survey evidence, which indicates that 86.4% of firms repurchase shares when their executives believe the company’s stock price is low by recent historical standards (Brav et al., 2005). Thus, we predict that share repurchases increase for firms in the portfolio of mutual funds that become short-sighted following the 2004 increase in portfolio reporting frequency, with the effect being concentrated in firms that become undervalued as a result of mutual funds’ short-termism.

### 3 | DATA AND RESEARCH DESIGN

#### 3.1 | Sample construction

Our sample consists of a firm-quarter panel of US-listed firms available on Compustat for the 2002–2006 period centered on the 2004 SEC regulation pertaining to the reporting frequency of mutual fund portfolio holdings. We require that firms have at least 1 year of observations around the 2004 SEC regulation to balance the sample. We exclude regulated utility firms (SIC codes 4900–4949) and financial firms (SIC codes 6000–6999). Furthermore, we require firms in our sample to have positive total assets and non-missing values for our main variables of interest. Our final sample contains 59,341 firm-year-quarter observations for 3,669 unique firms.<sup>12</sup>

#### 3.2 | Main variables of interest

For each US-listed firm, we compute the fraction of shares owned by mutual funds affected by the 2004 SEC regulation (i.e., the funds that were required to increase their portfolio disclosure frequency following the 2004 SEC regulation). We start by obtaining a list of all US domestic equity mutual funds from Kacperczyk et al. (2008).<sup>13</sup> As Kacperczyk et al. (2008) suggest, we parse the list of fund names to exclude index funds and exchange-traded funds (ETFs) since our

<sup>11</sup>Anecdotal evidence is consistent with concerns that the 2004 regulation would shorten the horizon of fund managers. Specifically, the fund managers’ association Investment Company Institute publicly opposed this regulation, arguing that it would increase attention to individual portfolio holdings and encourage a short-term investment perspective (Tyle, 2001). Moreover, according to a report by the Independent Regulatory Review Commission (IRRC, 2010), mutual fund managers believe that their incentive system is too aggressively tilted toward quarterly performance, and fund managers are concerned that the risk of being fired increases the “recency bias” (i.e., the tendency of switching in/out of investment products based on their recent performance rather than fundamental analysis of their long-term prospects). Similarly, a report by Kay (2012) on the UK equity market highlights that the pressure to engage in short-term decision-making arises from excessively frequent reporting. This suggests that the forces at play in our study generalize to capital markets outside of the United States.

<sup>12</sup>Subsamples may vary based on data availability.

<sup>13</sup>We thank the authors for making their SAS code pertaining to mutual funds publicly available.



predictions pertain to the effect of active investors.<sup>14</sup> Next, we exclude mutual funds that voluntarily adopted quarterly portfolio disclosure before the mandated change of 2004. We classify funds as voluntary adopters when they disclose their portfolios four times in 2003 and at least three times in 2002. This information is obtained either from the Thomson Reuters Mutual Fund holdings database (S12) or the SEC EDGAR server. We merge our resulting list of funds with the CRSP mutual fund data using the Wharton Research Data Services (WRDS) MFLINKS tables to obtain fund returns adjusted by expense ratio. These procedures yield a final sample of 1,283 affected active mutual funds during the 2-year period before the 2004 SEC regulation, which includes most of the largest active mutual funds as measured by assets under management (AUM) in the period prior to the regulatory change. Finally, we compute the aggregated ownership by the 1,283 affected active funds in our sample for each US-listed firm  $i$  ( $MFOwn_{i,q}$ ) by retrieving their portfolio holdings data in quarter  $q$  from the Thomson Reuters S12 database. We sum the number of shares of firm  $i$  held by active fund  $j$  at the end of quarter  $q$  and scale that number by the total number of shares outstanding for firm  $i$  at the end of quarter  $q$ .<sup>15</sup>

We create two measures of share repurchases: *NetRepurchase* and *Repurchase*. First, we follow Fama and French (2001) and Almeida et al. (2016) and define *NetRepurchase* as the increase in common treasury stock if common treasury stock is not zero or missing. If treasury stock is equal to zero in both the current and prior quarters, we measure *NetRepurchase* as the difference between stock purchases and stock issuance using information from the statement of cash flows. If either of these amounts is negative, *NetRepurchase* is set to zero. Next, we follow Hribar et al. (2006) and Sikes (2017) and define *Repurchase* as the total common and preferred repurchases, less any decrease in preferred stock outstanding. Both *NetRepurchase* and *Repurchase* are scaled by total assets measured at the end of the prior quarter.

Finally, we define firm undervaluation (*MispScore*) as the quarterly average of the monthly mispricing measure constructed by Stambaugh et al. (2015), scaled by 100. Specifically, *MispScore* is a continuous measure of firm undervaluation constructed by combining 11 return anomalies that survive adjustment for the three factors of Fama and French (1993). The anomalies are based on financial distress (1 and 2), net stock issues and composite equity issues (3 and 4), total accruals (5), net operating assets (6), momentum (7), gross profitability premium (8), asset growth (9), return on assets (10) and investment to assets (11).<sup>16</sup> This measure relies on a ranking where stocks with high values of *MispScore* are overpriced, while stocks with low values of *MispScore* are underpriced. Given the comprehensiveness of the return anomalies included the ranking, this mispricing measure is effective in diversifying the noise in anomaly rankings.

This valuation model has received strong support and it is widely used in the finance literature because it overcomes the limitation of other proxies used in the past.<sup>17</sup> For example, while prior studies used market-to-book to examine the relation between a firm's valuation and stock repurchases (Baker & Wurgler, 2002), subsequent studies have shown that market-to-book is a poor proxy for firm undervaluation because it captures growth opportunities and debt overhang problems.<sup>18</sup> Furthermore, the assumption that high market-to-book firms underperform low market-to-book firms, as in residual income models (e.g., Frankel & Lee, 1998), has lower predicting power in more recent years (Green et al., 2017).

<sup>14</sup>We identify index funds and ETFs by using the CRSP Mutual Fund database index fund indicator and by finding fund names containing the following terms: index, S&P, Russell, NASDAQ, and Dow Jones.

<sup>15</sup>For observations in the pre-regulation period, when portfolio compositions were disclosed semiannually, we follow prior studies and replace  $Shares_{i,j,q}$  with  $Shares_{i,j,q-1}$  if the number of shares in the current quarter is missing but available for the previous quarter. If the information is missing for two consecutive quarters, then we set  $Shares_{i,j,q}$  equal to zero.

<sup>16</sup>See Stambaugh et al. (2015, appendix B) for more details of the 11 anomalies.

<sup>17</sup>See, for example, Akbas et al. (2015), Avramov et al. (2020), Engelberg et al. (2018), Han et al. (2022), Heiko (2016), and Ramachandran and Tayal (2021).

<sup>18</sup>Consistent with this, Lee et al. (1999) document that the actual performance of market-to-book as a valuation measure is weak as it predicts only 0.33% of the variation in stock returns.

### 3.3 | Research design

We use a difference-in-differences research design that allows us to compare changes in share repurchases around the 2004 SEC regulation for firms with high ownership by active mutual funds (treatment firms) to changes in share repurchases for firms with low ownership by active mutual funds (control firms). We estimate the following empirical model:

$$Repurchase_{i,q} = \beta_1 Post_q + \beta_2 Treat_i + \beta_3 Post_q \times Treat_i + \sum X_{i,q-1} + \alpha_i + \gamma_q + \epsilon. \quad (1)$$

*Post* is an indicator variable that equals one for quarters subsequent to the passage of the SEC regulation in May 2004, and zero otherwise. Observations in the transitional quarter 2004Q2 are excluded, so *Post* is equal to one for the last two quarters of the year 2004 and for all quarters in the years 2005 and 2006, and it is equal to zero for all quarters in the years 2002 and 2003, and for 2004Q1.<sup>19</sup> We follow Agarwal et al. (2018) and code our *Treat* variable as one if a firm's average ownership by active mutual funds affected by the SEC regulation over the 2 years prior to May 2004 is above the sample median, and zero otherwise. This allows us to keep the firm ownership constant at the level of the pre-regulation period and examine variation in the intensity of mutual funds' short-termism (arising from the 2004 reporting frequency regulation) between treatment and control firms. Hence, our difference-in-differences estimate ( $\beta_3$ ) captures the difference between the change in share repurchases pre-/post-May 2004 for firms with *high* ownership by affected active mutual funds (first difference) relative to the change in share repurchases pre-/post-May 2004 for firms with *low* ownership by affected active mutual funds (second difference).

Prior research has shown that a number of factors affect share repurchases, such as size, profitability, capital structure, growth opportunities, and excess cash.<sup>20</sup> We take the following steps to isolate the short-termism of mutual funds from these alternative determinants of share repurchases. First, we rely on the regulatory change, which is unlikely to generate different variations in these determinants between treatment and control firms; second, we include in our regression model a vector of time-varying firm covariates (*X*) that directly control for these determinants of share repurchases. Specifically, we control for market capitalization (*Size*), return on assets (*ROA*), leverage (*Leverage*), market-to-book ratio (*Market-to-book*), seasonal sales growth (*Sales Growth*), and cash holdings (*Cash*). Detailed variable definitions are in the [Appendix](#). Finally, to reduce the potential concern of correlated omitted variables, we include both firm fixed effects and time fixed effects in our specifications. Firm fixed effects ( $\alpha_i$ ) control for time-invariant unobservable firm characteristics, while year-quarter fixed effects ( $\gamma_q$ ) account for time-varying macroeconomic conditions and trends in our dependent variable. Hence, this fixed effects' structure sweeps out time trends and time-invariant differences across firms, and it allows us to compare within-firm variation between treatment and control firms.<sup>21–22</sup>

### 3.4 | Summary statistics

Table 1, Panel A presents the summary statistics for our pooled sample of treatment and control firms over our entire sample period.<sup>23</sup> We find that the mean ownership of a firm by

<sup>19</sup>In a robustness test reported Table A4 (Column 5) in the Supplementary Appendix, as well as in the parallel trends test of Table A5 in the Supplementary Appendix, we show that our findings hold when we include the transition quarter in our sample.

<sup>20</sup>See, for example, Ikenberry et al. (1995), Dittmar (2000), Grullon and Michaely (2004), and Oler and Picconi (2014).

<sup>21</sup>Note that these fixed effects subsume  $\beta_1$  and  $\beta_2$ , the coefficients on the non-interacted *Post* and *Treat* variables from our specifications.

<sup>22</sup>To correct for serial correlation at the firm level, we cluster standard errors by firm. In untabulated tests, we check the robustness of our results to clustering standard errors by firm and year-quarter. The results are unchanged.

<sup>23</sup>We winsorize all continuous variables at 1% in each tail to mitigate the potential effect of outliers.

TABLE 1 Descriptive statistics.

Panel A: Summary statistics								
Variable	Mean (1)	P5 (2)	P25 (3)	P50 (4)	P75 (5)	P95 (6)	STD (7)	N (8)
<i>MFOwn</i>	0.079	0.000	0.011	0.067	0.128	0.218	0.072	59,341
<i>NetRepurchase</i>	3.407	0.000	0.000	0.000	0.000	22.518	11.521	59,341
<i>Repurchase</i>	4.067	0.000	0.000	0.000	0.005	26.809	12.854	56,939
<i>Size</i>	5.752	2.350	4.198	5.731	7.169	9.439	2.115	59,341
<i>ROA</i>	-0.004	-0.112	-0.008	0.009	0.021	0.050	0.057	59,341
<i>Leverage</i>	0.473	0.114	0.278	0.457	0.627	0.908	0.254	59,341
<i>Market-to-book</i>	2.752	0.397	1.192	1.974	3.354	8.253	3.497	59,341
<i>Sales Growth</i>	0.157	-0.376	-0.037	0.082	0.229	0.847	0.505	59,341
<i>Cash</i>	0.202	0.005	0.031	0.114	0.306	0.684	0.221	59,341

Panel B: Sample difference before the 2004 SEC regulation			
Variable	Treatment sample	Control sample	Difference test
	(1) Mean	(2) Mean	(3) Mean
<i>MFOwn</i>	0.129	0.017	0.112***
<i>NetRepurchase</i>	3.237	1.283	1.944***
<i>Repurchase</i>	4.015	1.400	2.614***
<i>Size</i>	6.509	4.150	2.359***
<i>ROA</i>	0.005	-0.020	0.025***
<i>Leverage</i>	0.471	0.495	-0.024***
<i>Market-to-book</i>	2.438	2.321	0.117**
<i>Sales Growth</i>	0.130	0.163	-0.033***
<i>Cash</i>	0.185	0.211	-0.026***

Note: Panel A reports the summary statistics of our key variables of interest. Panel B reports the difference in means of our key variables between treatment and control groups before the 2004 SEC regulation (year = 2003). We classify a firm in the treatment (control) group when its 2-year average ownership by affected mutual funds is above (below) the sample median. Variables are described in the [Appendix](#).

\*\* and \*\*\* indicate significance at the 5% and 1% two-tailed levels, respectively.

affected active funds (*MFOwn*) is 7.9%, while the median is 6.7%. The mean for *NetRepurchase* (*Repurchase*) is 0.34% (0.41%) of a firm's total assets. These numbers are qualitatively similar to those reported in Sikes (2017) and Edmans et al. (2022).

In Panel B of Table 1, we report the statistical differences between firms in our treatment and control groups measured in the year before the change in regulation (the pre-treatment period). We observe that on average, treatment firms have 12.9% ownership by affected active funds, whereas control firms have only 1.7%. This large economic difference gives us confidence in the research design described above, since it should provide enough power to detect differential effects of the 2004 SEC regulation on treatment and control firms. In Panel B of Table 1, we also compare our treatment and control groups across various dependent and independent variables in the year before the change in regulation. Our univariate comparisons reveal that firms in our treatment group are more likely to repurchase shares, and they also differ across all other dimensions. We formally account for these differences in a test reported in Table A3 in the Supplementary Appendix.

## 4 | RESULTS

### 4.1 | Mutual funds' reporting frequency and share repurchases

We start our empirical analysis by testing our baseline prediction of whether increased reporting frequency by mutual funds leads to more share repurchases by portfolio firms. In Table 2, we report two estimations of Equation (1), our difference-in-differences specifications described in Section 3.3. The coefficient of interest is  $Treat \times Post$ , which estimates the difference between the treatment and control groups in changes in repurchases before and after the 2004 SEC regulation. In Column 1, we examine the effect of mutual funds' reporting frequency on *NetRepurchase*, whereas in Column 2 we examine the effect of mutual funds' reporting frequency on *Repurchase*. Our estimated treatment effect is positive and statistically significant at the 1% level in both columns. The economic magnitude of the estimated treatment effect is meaningful. It corresponds to an average increase in the dollar value of *NetRepurchase* (*Repurchase*) of 0.28% (0.33%) of the firm's total assets.<sup>24</sup>

Our research design hinges on the parallel trends assumption. That is, we assume that the share repurchases of treatment and control firms would not have changed absent the 2004 SEC regulation.

TABLE 2 Mutual funds' reporting frequency and share repurchases.

Dependent variable	<i>NetRepurchase</i> (1)	<i>Repurchase</i> (2)
<i>Post</i> × <i>Treat</i>	2.826*** (0.239)	3.255*** (0.272)
<i>Size</i>	0.437*** (0.114)	0.533*** (0.134)
<i>ROA</i>	0.553 (1.077)	2.458** (1.189)
<i>Leverage</i>	-5.237*** (0.550)	-6.063*** (0.640)
<i>Market-to-book</i>	0.019 (0.021)	0.043 (0.028)
<i>Sales Growth</i>	-0.188** (0.084)	-0.264*** (0.085)
<i>Cash</i>	3.343*** (0.685)	4.116*** (0.751)
Firm FE	Yes	Yes
Year-quarter FE	Yes	Yes
$R^2$	0.306	0.357
Observations	59,341	56,939

Note: This table reports the results on the effect of mutual funds' reporting frequency on share repurchases consistent with the difference-in-differences specification of Equation (1). Both firm and year-quarter fixed effects are included. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level.

\*\* and \*\*\* indicate significance at the 5% and 1% two-tailed levels, respectively.

<sup>24</sup>In untabulated analyses, we exclude control variables and fixed effects and observe that the estimated treatment effect and the  $R^2$  remains stable across the different models examined. This provides confidence that we are not capturing spurious effects from correlated omitted variables (Oster, 2019).

In Figure 1, we plot the average *NetRepurchase* for the quarters around the 2004 SEC regulation for our treatment and control groups separately. A few points from the graph are worth noting. First, while the results in Table 2 suppress the main effect of *Treat* and *Post* due to the use of time and firm fixed effects, Figure 1 gives visual univariate evidence of the separate trends of the treatment and control groups post-2004. We observe that *NetRepurchase* increases for the treatment group but remains stable for the control group. Second, consistent with the summary statistics in Panel B of Table 1, firms in our treatment group, on average, repurchase more than firms in our control group. However, while the levels differ, the trends are closely aligned in the pre-regulation period, which supports the validity of the parallel trends assumption. Next, in Figure 2, we move from univariate statistics and plot our difference-in-differences estimates in event time. Specifically, we use the net repurchase in the latest quarter before the SEC regulation (2004Q1;  $t = -1$ ) as the benchmark period, and report the estimations for the quarters before and after the regulation (2004Q2;  $t = 0$ ). Once again, we find that our estimates are not statistically different for the treatment and control groups in the pre-regulation period, but are different in the post-regulation period.<sup>25</sup>

## 4.2 | Mechanism: Undervaluation

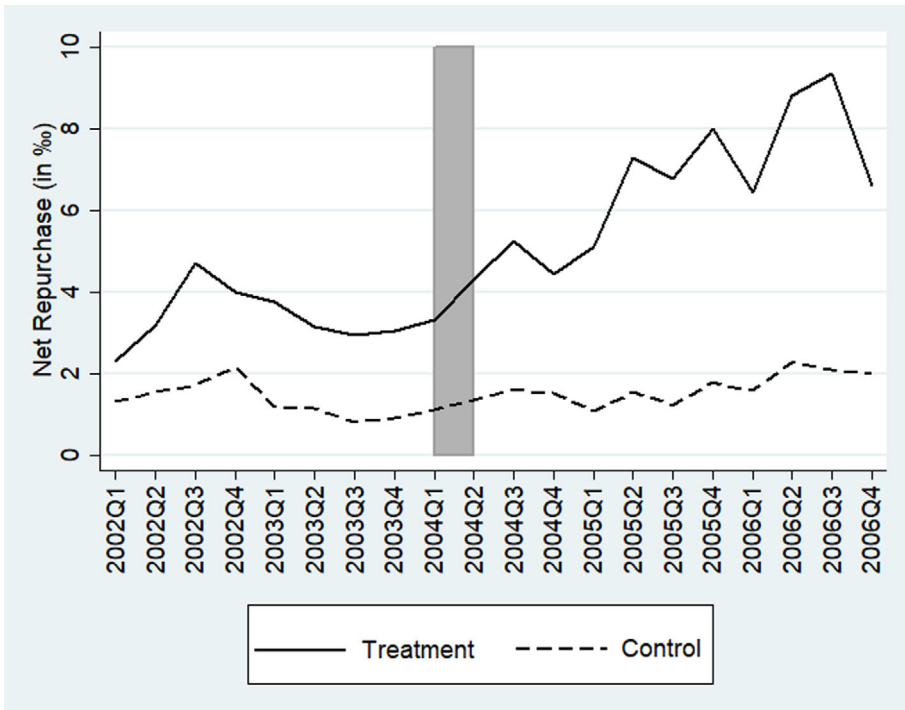
After having established that treatment firms experience more share repurchases post-regulation, we next turn to the mechanism behind this adjustment in corporate behavior. Specifically, we examine whether the documented increase in share repurchases is a response to the stock undervaluation caused by mutual funds' myopia, as we hypothesized. This undervaluation mechanism hinges on three sequential steps, which we test directly. First, we analyze whether mutual funds affected by the regulation rebalance their portfolios to reduce their exposure to stocks that could have good long-term prospects but may not look like "winning" picks in the short-term portfolio disclosures (Step 1). Second, we test whether mutual funds' portfolio rebalancing leads to firm undervaluation in the post-regulation period (Step 2). Third, we examine whether firms that become undervalued post-regulation are driving our stock repurchase results (Step 3).

### 4.2.1 | Mutual funds' myopia and portfolio activity

We first examine whether fund managers become myopic post-regulation and sell firms with good long-term prospects that may not appear to be "winning" picks in the short-term portfolio disclosure (Step 1). In order to define firms that have good long-term prospects, we borrow from prior studies and identify firms with high levels of R&D expenditures or a large number of patents (Bushee, 1998; Fang et al., 2014; Goldman & Slezak, 2003). These firms are likely to generate value in the long term, but can appear to be "poor" stock picks in the short-term portfolio disclosures if the future payoffs from R&D and patenting are unclear to the funds' investors. Specifically, we examine mutual funds' portfolio activity with the following equation model:

$$\begin{aligned} \Delta MFOwn_{i,q+1} = & \beta_1 Post_q \times Treat_i \times Dummy_i + \beta_2 Post_q \times Treat_i \\ & + \beta_3 Treat_i \times Dummy_i + \beta_4 Post_q \times Dummy_i \\ & + \beta_5 Dummy_i + \beta_6 Treat_i + \beta_7 Post_q \\ & + \sum X_{i,q-1} + \alpha_i + \gamma_q + \epsilon. \end{aligned} \quad (2)$$

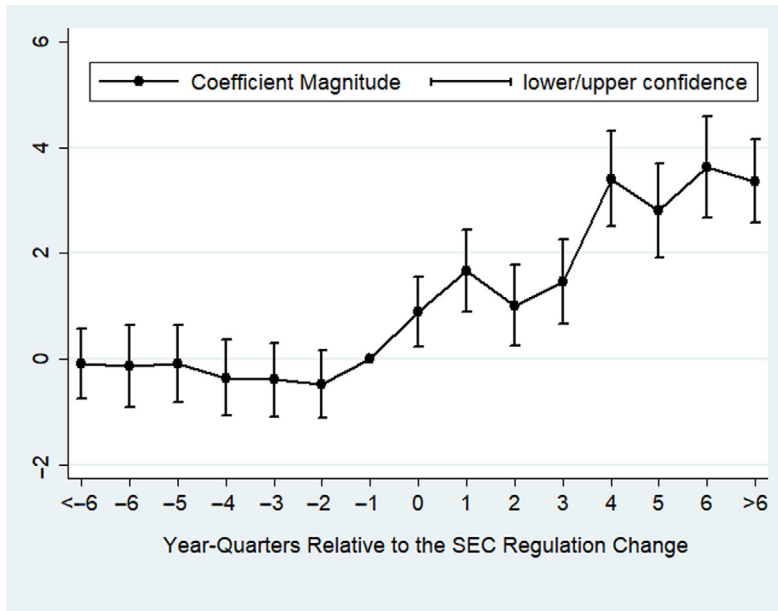
<sup>25</sup>We also conduct multivariate analyses and modify Equation (1) by replacing the indicator *Post* with indicators for the quarters prior and subsequent to the 2004 regulation. The results are reported in Table A5 of the Supplementary Appendix.



**FIGURE 1** Parallel trends. This figure plots, by year-quarter, the average *NetRepurchase* of the treatment and control groups from 2002 to 2006. The gray bar identifies the year-quarter in which the SEC changed the regulation on mutual fund portfolio reporting frequency.

$\Delta MFOwn$  is defined as the change in a firm’s ownership from quarter  $q$  to quarter  $q + 1$  by affected mutual funds that hold firm  $i$  during the pre-regulation period. We use two indicators (*Dummy*) that identify firms that have either R&D expenditures or a number of patents above the pre-period sample industry median. Hence, the model in Equation (2) keeps firms’ long-term prospects constant at the pre-regulation level, which prevents our results from being confounded by the effect of the regulation on firm policies. The coefficient on the triple interaction  $Post \times Treat \times Dummy$  identifies cross-sectional variation (from the pre-period to the post-period) in mutual funds’ portfolio exposure to firms with good long-term prospects. The vector of controls and fixed effects used in this analysis is the same as that used in prior tables.

The results are tabulated in Table 3. We find a significant negative coefficient on the triple interaction  $Post \times Treat \times Dummy$ , consistent with fund managers myopically reducing their portfolio exposure to firms likely to have good long-term prospects. We also observe that the coefficient on the triple interaction is significantly larger than the coefficient on  $Post \times Treat$  (almost twice as large in Column 1, and about 20% larger in Column 2), and that the coefficient on  $Post \times Dummy$  is positive. This is consistent with (1) the overall rebalancing of affected mutual funds’ portfolios after the regulation being largely at the expense of firms with good long-term prospects (hence the larger coefficient on the triple interaction compared to the coefficient on  $Post \times Treat$ ), and (2) with affected fund managers wanting to show a conformist stock-picking strategy after the regulation, as we discuss in Section 2 (hence the positive coefficient on  $Post \times Dummy$ , which indicates that affected funds are likely to invest in some of the firms in the portfolios of unaffected funds).



**FIGURE 2** Coefficients plot. This figure plots, by year-quarter, the coefficients on *NetRepurchase* from our main regression model (Equation 1). We use *NetRepurchase* in the latest year-quarter before the 2004 SEC regulation (2004Q1;  $t = -1$ ) as a benchmark. The  $X$ -axis represents the year-quarters relative to the year-quarter in which the SEC changed the regulation on mutual fund portfolio reporting frequency ( $t = 0$ ). The dotted lines represent the coefficient on *NetRepurchase* at the 95% confidence interval.

#### 4.2.2 | Mutual funds portfolio activity and firm undervaluation

Next, we examine whether the trading behavior of myopic mutual funds around the regulatory change distorts the asset prices of the firms they sell (Step 2). To do so, we use a regression model similar to Equation (2), except that firm undervaluation (*MispScore*) is our outcome variable of interest in this case. We examine the triple interaction  $Post \times Treat \times Divest$ , where *Divest* is equal to one when a firm's average ownership by affected mutual funds prior to the regulation is greater than the average ownership by affected mutual funds after the regulation (i.e.,  $\Delta MFOwn < 0$ ). Hence, a firm with negative  $\Delta MFOwn$  experiences a divestment by affected mutual funds following the 2004 regulation. The triple interaction isolates the changes in undervaluation for treatment firms that are divested by affected mutual funds.

The results are reported in Table 4. In Column (1), we include the same vector of controls and fixed effects used in prior tables. In column (2), for robustness, we add controls for bid-ask spread (*Illiquidity*) and idiosyncratic volatility (*IVOL*), consistent with Stambaugh et al. (2015). In line with the undervaluation channel, we find that treatment firms that are divested by affected mutual funds following the 2004 SEC regulation become significantly more undervalued than other firms (the coefficient on  $Post \times Treat \times Divest$  is negative and statistically significant).<sup>26</sup> This indicates that mutual funds' portfolio rebalancing following the regulatory change plays a direct role in portfolio firms' undervaluation.

<sup>26</sup>We also observe that the coefficient on  $Post \times Treat$  is negative and statistically significant at conventional levels in Table 4. Although we cannot isolate the drivers of undervaluation for firms not divested by affected mutual funds, we note that treatment firms that are divested by affected mutual funds become significantly (approximately 71%) more undervalued relative to non-divested firms in the portfolio of affected mutual funds.

TABLE 3 Mutual funds' myopia and portfolio activity

Dependent variable	$\Delta MFOwn_{q+1}$	$\Delta MFOwn_{q+1}$
	(1) <i>Dummy</i> = 1 if average R&D before shock > sample median	(2) <i>Dummy</i> = 1 if average patents before shock > sample median
<i>Post</i> × <i>Treat</i> × <i>Dummy</i>	−0.154** (0.061)	−0.122** (0.054)
<i>Post</i> × <i>Treat</i>	−0.089*** (0.029)	−0.103*** (0.033)
<i>Post</i> × <i>Dummy</i>	0.107*** (0.027)	0.115*** (0.031)
<i>Size</i>	−0.162*** (0.018)	−0.161*** (0.018)
<i>ROA</i>	0.383** (0.177)	0.386** (0.177)
<i>Leverage</i>	0.026 (0.064)	0.024 (0.064)
<i>Market-to-book</i>	−0.000 (0.003)	−0.000 (0.003)
<i>Sales Growth</i>	0.002 (0.015)	0.002 (0.015)
<i>Cash</i>	0.046 (0.078)	0.051 (0.078)
Firm FE	Yes	Yes
Year-quarter FE	Yes	Yes
$R^2$	0.092	0.092
Observations	54,125	54,125

Note: This table reports the results on mutual funds' portfolio activity subsequent to the 2004 SEC regulation, consistent with Equation (2). In Column 1, *Dummy* is an indicator equal to one if a firm's average R&D before the 2004 SEC regulation is above the sample median, and zero otherwise. In Column 2, *Dummy* is an indicator equal to one if a firm's average number of patents before the 2004 SEC regulation is above the sample median, and zero otherwise.  $\Delta MFOwn_{q+1}$  is defined as the change from  $q$  to  $q+1$  in firm  $i$ 's ownership by the active mutual funds affected by the regulation that held firm  $i$  during the pre-regulation period. Both firm and year-quarter fixed effects are included. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level.

\*\* and \*\*\* indicate significance at the 5% and 1% two-tailed levels, respectively.

### 4.2.3 | Firm undervaluation and shares repurchases

To close the loop and document that share repurchases are induced by firm undervaluation caused by mutual funds' myopia—that is, mutual funds' divestiture of firms with good long-term prospects—we analyze whether undervalued firms are more likely to repurchase shares post-regulation (Step 3). To do so, we augment Equation (1) by adding a partitioning variable (*Uval*) that captures a firm's change in undervaluation from the pre-period to the post-period. For each firm, we calculate the difference between the average *MispScore* in the pre-period and the average *MispScore* in the post-period, and we set *Uval* equal to one if the difference is negative ( $\Delta MispScore < 0$ , that is, if a firm becomes undervalued with the passage of the 2004 SEC regulation). Thus, we examine the following empirical model:



TABLE 4 Mutual funds divestiture and firm undervaluation.

Dependent variable	<i>MispScore</i> (1)	<i>MispScore</i> (2)
<i>Post</i> × <i>Treat</i> × <i>Divest</i>	−0.024** (0.010)	−0.021** (0.010)
<i>Post</i> × <i>Treat</i>	−0.014*** (0.004)	−0.014*** (0.004)
<i>Post</i> × <i>Divest</i>	0.009 (0.008)	0.006 (0.009)
<i>Size</i>	0.002 (0.003)	0.001 (0.003)
<i>ROA</i>	−0.590*** (0.029)	−0.590*** (0.030)
<i>Leverage</i>	0.017 (0.012)	0.015 (0.012)
<i>Market-to-book</i>	−0.002*** (0.000)	−0.002*** (0.000)
<i>Sales Growth</i>	0.003 (0.002)	0.002 (0.002)
<i>Cash</i>	−0.164*** (0.010)	−0.165*** (0.010)
<i>Illiquidity</i>		−0.004*** (0.002)
<i>IVOL</i>		0.421*** (0.059)
Firm FE	Yes	Yes
Year-quarter FE	Yes	Yes
<i>R</i> <sup>2</sup>	0.593	0.596
Observations	38,701	38,028

Note: This table reports the results on the effect of mutual funds' reporting frequency on firm undervaluation. We use the specification of Equation (2) but examine *MispScore* as dependent variable. *Divest* is equal to one when a firm's average ownership by affected mutual funds prior to the regulation is greater than the average ownership by affected mutual funds after the regulation ( $\Delta MFOwn < 0$ ), and zero otherwise. Hence, a firm with negative  $\Delta MFOwn$  experienced a divestment by affected mutual funds following the 2004 SEC regulation. In Column 2, we include controls for *Illiquidity* and *IVOL*. Both firm and year-quarter fixed effects are included. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level.

\*\* and \*\*\* indicate significance at the 5% and 1% two-tailed levels, respectively.

$$\begin{aligned}
 Repurchase_{i,q} = & \beta_1 Post_q \times Treat_i \times Uval_i + \beta_2 Post_q \times Treat_i \\
 & + \beta_3 Treat_i \times Uval_i + \beta_4 Post_q \times Uval_i \\
 & + \beta_5 Uval_i + \beta_6 Post_q + \beta_7 Treat_i \\
 & + \sum X_{i,q-1} + \alpha_i + \gamma_q + \epsilon.
 \end{aligned} \tag{3}$$

The coefficient on the triple interaction (*Post* × *Treat* × *Uval*) identifies share repurchases of firms that became undervalued with the passage of the regulation, whereas the coefficient on

$Post \times Treat$  identifies share repurchases of firms that did not become undervalued with the passage of the regulation.<sup>27</sup> If our predictions are correct, the coefficient on the triple interaction should be positive and statistically significant.

We report the results in Table 5. Similar to the analysis in Table 2, in Column 1 our dependent variable is *NetRepurchase*, whereas in Column 2 our dependent variable is *Repurchase*. The vector of controls and fixed effects used in this analysis is the same as that used in prior tables and defined in Section 3.

Consistent with our predictions, we find that the triple interaction in Equation (3) is positive and statistically significant at the 1% level. Our results show that treatment firms that become undervalued with the passage of the disclosure regulation engage in significantly more share repurchases. Interestingly, we also find that the main effect ( $Post \times Treat$ ) is positive and statistically significant (at the 5% level), albeit economically weaker than the incremental effect for undervalued firms. Thus, treatment firms that do not become undervalued with the passage of the regulation might still have incentives to repurchase shares for reasons unrelated to their valuation. For example, they might respond to pressure from myopic investors as in Agarwal et al. (2018). In that case, the undervaluation channel and the myopia channel would not be mutually exclusive. Yet our results highlight that the undervaluation motive is more relevant, as the coefficient on the triple interaction is between two and three times larger than the coefficient on the main effect (depending on the measure of share repurchases examined).

To triangulate our findings and ensure that share repurchases post-regulation are a firm's rational response to their investors' myopia, we examine long-term returns, which capture the value created by share repurchases. If firm managers rationally repurchase shares when their firms are undervalued, long-run returns should be positive.

The results are reported in Table 6. We focus on firm-quarters in which repurchases are conducted in the post-period, and we regress buy and hold abnormal returns (*BHAR*) on *Affected Firm*. *BHAR* is calculated for the 3 years following the event quarter relative to the returns on the CRSP value-weighted index.<sup>28</sup> In the analyses reported in Columns 1–3 of Table 6, *Affected Firm* identifies treatment firms divested by mutual funds that have an above-sample-median level of R&D expenditures. In Columns 4–6 of Table 6, *Affected Firm* identifies treatment firms divested by mutual funds that have an above-sample-median number of patents.

We find that the coefficient on *Affected Firm* is positive and statistically significant across all six specifications. Repurchasing firms divested by affected mutual funds—that have high levels of R&D expenditures or a large number of patents—experience between 2% and 16% higher abnormal returns relative to other treatment firms.<sup>29</sup> This result confirms that managers of firms with good long-term prospects rationally respond to their firm undervaluation caused by mutual funds myopia.

Taken together, the results in Section 4.2 document an economically rational explanation of why firms change their repurchasing behavior: fund managers' selling induced by their short-termism distorts the asset prices of the firms they sell, increasing firm managers' incentives to repurchase shares at depressed prices.

<sup>27</sup>For example, firms that are divested by affected mutual funds but promptly purchased by other investors and therefore experience a quick price correction.

<sup>28</sup>We calculate *BHAR* over 1 ( $q + 1, q + 4$ ), 2 ( $q + 1, q + 8$ ), and 3 ( $q + 1, q + 12$ ) years from the first stock repurchase after the regulation.

<sup>29</sup>The results are robust to an alternative benchmark for calculating abnormal returns. In the Supplementary Appendix Table A7, we report results for calculating *BHAR* using the Daniel et al. (1997) characteristic-based portfolio matched by size, book-to-market, and prior year return. The characteristic-based benchmark is important because firms with good long-term prospects should have high growth options and therefore low book-to-market ratios.

TABLE 5 Firm undervaluation and share repurchases.

Dependent variable	NetRepurchase (1)	Repurchase (2)
<i>Post</i> × <i>Treat</i> × <i>Uval</i>	2.399*** (0.699)	3.118*** (0.790)
<i>Post</i> × <i>Treat</i>	1.157** (0.453)	1.040** (0.518)
<i>Post</i> × <i>Uval</i>	1.053** (0.500)	1.219** (0.561)
<i>Size</i>	0.876*** (0.273)	0.938*** (0.319)
<i>ROA</i>	6.275* (3.692)	9.228** (4.289)
<i>Leverage</i>	-11.098*** (1.215)	-12.921*** (1.407)
<i>Market-to-book</i>	0.120** (0.049)	0.169*** (0.063)
<i>Sales Growth</i>	-1.021*** (0.247)	-0.759*** (0.278)
<i>Cash</i>	4.683*** (1.400)	6.410*** (1.592)
Firm FE	Yes	Yes
Year-quarter FE	Yes	Yes
<i>R</i> <sup>2</sup>	0.311	0.351
Observations	36,969	35,640

Note: This table reports the results on the effect of mutual funds' reporting frequency on share repurchases conditional on a firm's changes in undervaluation, consistent with the specification of Equation (3). *Uval* is equal to one when a firm becomes undervalued with the passage of the 2004 SEC regulation ( $\Delta MispScore < 0$ ), and zero otherwise. Both firm and year-quarter fixed effects are included. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level.

\*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% two-tailed levels, respectively.

### 4.3 | Fund managers' career concerns

A fundamental argument in the theory discussed in Section 2 is that agents' short-termism, subsequent to greater disclosure about their actions, stems from career concerns. That is, increased portfolio transparency encourages the fund manager to take actions that will reduce career concerns. To further link our analysis to this theory, we examine variation in our main results related to fund managers' career concerns.

First, we confirm a fundamental result in Prat's (2005) model, which is that fund managers' career concerns are exacerbated by increased disclosure about their actions. We find that when funds' investors can observe fund managers' actions in a timelier (and granular) manner and thus better link those actions with realized fund performance, fund manager turnover-performance sensitivity substantially increases (see the results in Table A8 in the Supplementary Appendix). These results are also in line with predictions about the signal-to-noise ratio (Holmström, 1979), but most importantly, they suggest that the 2004 regulation increases fund managers' career concerns in expectation.

Second, we examine whether fund managers' career concerns interact with our estimated treatment effect. We use a regression model consistent with Equation (3) and rely on three proxies for a

TABLE 6 Long-term returns to share repurchases.

Dependent variable	<i>BHAR_1y</i>	<i>BHAR_2y</i>	<i>BHAR_3y</i>	<i>BHAR_1y</i>	<i>BHAR_2y</i>	<i>BHAR_3y</i>
	(1)	(2)	(3)	(4)	(5)	(6)
	Average R&D before shock > sample median			Average patents before shock > sample median		
<i>Affected Firm</i>	0.056*** (0.017)	0.093*** (0.024)	0.120*** (0.031)	0.022* (0.012)	0.096*** (0.017)	0.163*** (0.022)
<i>Size</i>	-0.007** (0.003)	-0.002 (0.004)	0.010* (0.006)	-0.008*** (0.003)	-0.006 (0.004)	0.003 (0.006)
<i>ROA</i>	-0.144 (0.268)	0.023 (0.369)	-0.364 (0.439)	-0.148 (0.271)	0.105 (0.376)	-0.204 (0.441)
<i>Leverage</i>	0.090*** (0.028)	0.138*** (0.041)	0.064 (0.050)	0.090*** (0.028)	0.149*** (0.041)	0.085* (0.051)
<i>Market-to-book</i>	-0.002 (0.001)	-0.003 (0.002)	0.004 (0.003)	-0.002 (0.001)	-0.003 (0.002)	0.003 (0.003)
<i>Sales Growth</i>	0.085*** (0.019)	0.104*** (0.032)	0.086** (0.040)	0.086*** (0.019)	0.107*** (0.032)	0.090** (0.040)
<i>Cash</i>	-0.021 (0.028)	-0.045 (0.040)	-0.059 (0.051)	-0.011 (0.028)	-0.048 (0.040)	-0.074 (0.050)
Year-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>R</i> <sup>2</sup>	0.020	0.016	0.014	0.018	0.018	0.020
Observations	5,286	4,944	4,683	5,286	4,944	4,683

Note: This table reports results for the long-term abnormal returns to share repurchases. The analysis is conducted in quarters with repurchases in the post-regulation period. We examine the buy-and-hold abnormal returns (*BHAR*) for individuals that buy in the repurchase quarters and hold the shares for 1 ( $q + 1, q + 4$ ), 2 ( $q + 1, q + 8$ ), and 3 ( $q + 1, q + 12$ ) years. In Columns 1–3, *Affected Firm* identifies treatment firms divested by mutual funds that have an above-sample-median level of R&D expenditures. In Columns 4–6, *Affected Firm* identifies treatment firms divested by mutual funds that have an above-sample-median number of patents. Year-quarter fixed effects are included. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% two-tailed levels, respectively.

fund manager's career concerns (*Dummy*). First, consistent with our results in the Supplementary Appendix Table A8, we use the fund's past portfolio return (*PastFundRet*), which is an indicator equal to one if the average portfolio return (net of expense ratio) over the past 12 months of a firm's affected mutual funds is below the sample median at the end of quarter  $q - 1$ , and zero otherwise. Our second proxy is funds' past capital outflows (*PastFundFlow*), which is an indicator equal to one if the average percentage change in AUM (after adjusting for fund returns over the past 12 months) of a firm's affected mutual funds is below the sample median at the end of quarter  $q - 1$ , and zero otherwise. The intuition behind this proxy is that when a fund experiences a substantial reduction in AUM, the fund manager's career risk is high (Khorana, 1996). Finally, our third proxy for fund managers' career concerns is *Tenure*, which is an indicator equal to one if the average tenure of a firm's affected mutual funds' managers is below the sample median before the 2004 SEC regulation, and zero otherwise. Consistent with a Bayesian learning model, fund managers without an established track record are more concerned than experienced fund managers about showing their ability in the short term (Gibbons & Murphy, 1992; Holmström, 1999).

We report results in Table 7 and use *NetRepurchase* as our dependent variable across the three models.<sup>30</sup> In Column 1, we use the partitioning variable *PastFundRet*; in Column 2, we use *PastFundFlow*; in Column 3, we use *Tenure*. Consistent with our predictions, across the

<sup>30</sup>The results for the dependent variable *Repurchase* are consistent with those tabulated in Table 7 but are omitted for brevity.

TABLE 7 Fund managers' career concerns.

Dependent variable	<i>NetRepurchase</i> (1) <i>Dummy</i> = 1 if <i>PastFundRet</i> < median	<i>NetRepurchase</i> (2) <i>Dummy</i> = 1 if <i>PastFundFlow</i> < median	<i>NetRepurchase</i> (3) <i>Dummy</i> = 1 if <i>Tenure</i> < median
<i>Post</i> × <i>Treat</i> × <i>Dummy</i>	1.231*** (0.390)	1.476*** (0.422)	1.092** (0.537)
<i>Post</i> × <i>Treat</i>	2.177*** (0.278)	2.093*** (0.291)	1.671*** (0.340)
<i>Post</i> × <i>Dummy</i>	-0.123 (0.237)	-0.356 (0.288)	-0.120 (0.285)
<i>Treat</i> × <i>Dummy</i>	-0.474** (0.217)	-1.024*** (0.219)	
<i>Dummy</i>	0.055 (0.141)	0.340** (0.166)	
<i>Size</i>	0.434*** (0.114)	0.447*** (0.114)	0.339** (0.142)
<i>ROA</i>	0.541 (1.075)	0.450 (1.073)	1.488 (1.412)
<i>Leverage</i>	-5.238*** (0.549)	-5.260*** (0.548)	-6.804*** (0.750)
<i>Market-to-book</i>	0.020 (0.021)	0.019 (0.021)	0.043* (0.025)
<i>Sales Growth</i>	-0.181** (0.084)	-0.182** (0.084)	-0.321*** (0.104)
<i>Cash</i>	3.352*** (0.685)	3.356*** (0.685)	3.530*** (0.865)
Firm FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes
<i>R</i> <sup>2</sup>	0.306	0.307	0.315
Observations	59,341	59,341	53,265

Note: This table reports the results on the effect of mutual funds' reporting frequency on share repurchases (*NetRepurchase*) conditional on fund managers' career concerns. In Column 1, *Dummy* is equal to one when the average portfolio net returns over the past 12 months of a firm's affected active mutual funds is below the sample median at the end of quarter  $q - 1$ , and zero otherwise (*PastFundRet*). In Column 2, *Dummy* is equal to one when the average percentage change in fund asset under management (AUM) over the past 12 months of a firm's affected active mutual funds is below the sample median at the end of quarter  $q - 1$ , and zero otherwise (*PastFundFlow*). In Column 3, *Dummy* is equal to one when the average tenure of a firm's affected active mutual fund managers before the 2004 SEC regulation is below the sample median, and zero otherwise (*Tenure*). Both firm and year-quarter fixed effects are included. In Column 3, firm fixed effects suppress the effect of *Dummy* and its interaction with *Treat* because *Tenure* is a time-invariant firm-level indicator measured before the 2004 SEC regulation. Variables are described in the Appendix. Robust standard errors, reported in parentheses, are clustered at the firm level.

\*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% two-tailed levels, respectively.

three models we find that the increase in share repurchases is between 0.1% and 0.15% of total assets larger when fund managers have higher career concerns. We conclude that the findings in Table 7 provide further empirical support for our predictions and confirm that career concerns exacerbate fund managers' short-term actions.

## 5 | ROBUSTNESS TESTS

In the Supplementary Appendix, we present an array of additional tests to complement our main findings and ensure that our results are robust to different specifications and alternative explanations. First, in Supplementary Appendix Table A1, Panel A, we conduct a placebo test where we compare the effect on repurchases by affected active mutual funds with the effect by four other groups of investors: (1) voluntary reporting adopters, (2) non-mutual fund institutions, (3) hedge funds, and (4) index funds. The first three groups of investors are unaffected by the 2004 SEC regulation. Index funds (the fourth group) are affected by the 2004 SEC regulation, but they are passive investors that track an index and thus cannot voluntarily sell shares of their portfolio firms (i.e., exit; see Heath et al., 2022) and cause firm undervaluation. We confirm that the effect of the placebo groups is significantly smaller than that of our treatment group.<sup>31</sup>

Second, we examine the intensive and extensive margins of our estimated effect. In Supplementary Appendix Table A2, we show that our effect is driven by both. Third, we examine a fully interacted model, allowing our controls to vary in the post-regulation period. The results in Supplementary Appendix Table A3 show that our difference-in-differences estimates remain positive and statistically significant. Fourth, in Supplementary Appendix Table A4 we use an alternative fixed-effect structure that controls for time-series variation in institutional holdings, and two alternative classifications for treatment and control groups. These additional analyses confirm the robustness of our inferences.

Finally, we address concerns of possible confounding events related to tax reforms during our sample period, such as the American Jobs Creation Act of 2004 (AJCA), which created a temporary tax holiday for US firms that repatriate profits from foreign subsidiaries, and the Job and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), which lowered the tax rate on both dividends and capital gains. We show that both tax reforms do not confound our results.

## 6 | CONCLUSION

We examine the 2004 SEC regulation that increased the reporting frequency of mutual funds' portfolio holdings to their capital providers. First, we find that post-regulation, affected mutual funds are more likely to divest from stocks that have good long-term prospects. This result provides direct evidence that more frequent disclosure shortened the horizon of mutual funds, in line with the theory in Prat (2005). Second, we find that mutual funds' divestiture induces firm undervaluation and therefore increases firms managers' incentives to repurchase shares at depressed prices. Finally, we find that fund managers' myopia increases when they face higher career concerns, consistent with the argument in Shleifer and Vishny (1990) and Hermalin and Weisbach (2012).

Collectively, our evidence speaks to a fundamental issue in accounting research—the costs of more frequent reporting—by showing an important unintended consequence of reporting frequency between mutual funds and their capital providers. Our evidence also speaks to the myopia literature and to the literature on payout policies by showing that mutual funds' myopia affects portfolio firms' policies, such as stock repurchases. More specifically, our findings suggest that firm managers respond to the increased myopia of their investors by engaging in stock repurchases as a rational way to offset the undervaluation caused by such myopia. Future research could investigate the consequences (including welfare implications) of employing corporate resources to counteract myopia-induced firm undervaluation.

<sup>31</sup>In an additional falsification test, we replicate our main analysis of Equation (1) in a sample of financial firms. Since those firms repurchase shares and pay dividends frequently, it is plausible that their share repurchases are less affected by mutual funds' myopia induced by the 2004 SEC regulation. In Table A1, Panel B, we confirm this is the case: the estimated treatment effect for financial firms is between 3 and 4 times smaller than our main effect in Table 2.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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## APPENDIX: VARIABLE DEFINITIONS

Variable	Definition
<b>Independent variables</b>	
<i>Treat</i>	An indicator variable equal to one for firms with an above-sample-median average ownership by actively managed mutual funds whose portfolio disclosure frequency is increased by the SEC regulatory change in May 2004, and zero otherwise. Average ownership by affected mutual funds is measured over the 2 years prior to the 2004 SEC regulation
<i>Post</i>	An indicator variable equal to one for year-quarters subsequent to the passage of the SEC regulation in May 2004, and zero otherwise
<i>Affected Firm</i>	An indicator variable equal to one for treatment firms that are divested by mutual funds and also have an above-sample-median level of R&D expenditures or an above-sample-median number of patents, and zero otherwise
<b>Dependent variables</b>	
<i>NetRepurchase</i>	Following Fama and French (2001) and Almeida et al. (2016), we measure <i>NetRepurchase</i> as the increase in common treasury stock in quarter $q$ divided by total assets at the end of quarter $q - 1$ (in %) if treasury stock is not zero or missing; we measure <i>NetRepurchase</i> as the difference between stock purchases and stock issuance from the statement of cash flows divided by total assets at the end of quarter $q - 1$ if treasury stock is zero in the current and prior quarters; if either of these amounts is negative, <i>NetRepurchase</i> is set to zero
<i>Repurchase</i>	Following Sikes (2017) and Hribar et al. (2006), we measure <i>Repurchase</i> as the total common and preferred repurchases in quarter $q$ , less any decrease in preferred stock outstanding in quarter $q$ divided by total assets at the end of quarter $q - 1$ (in %)
$\Delta MFOwn_{q+1}$	The change from quarter $q$ to quarter $q + 1$ in a firm's ownership by the active mutual funds that held firm $i$ during our pre-regulation period and whose portfolio disclosure frequency was affected by the 2004 SEC regulation
<i>MispScore</i>	The quarterly average of the monthly mispricing measure constructed by Stambaugh et al. (2015) by combining 11 return anomalies, scaled by 100. Stocks with high values of <i>MispScore</i> are overpriced, while the stocks with low values of <i>MispScore</i> are underpriced
<i>BHAR</i>	The buy-and-hold abnormal returns over 1 ( $q + 1, q + 4$ ), 2 ( $q + 1, q + 8$ ), and 3 ( $q + 1, q + 12$ ) years following the event quarter $q$ , calculated by geometrically compounding its monthly raw returns during the period and then subtracting the CRSP value-weighted index. In the Supplementary Appendix Table A7, we calculate <i>BHAR</i> using the Daniel et al. (1997) characteristic-based portfolio matched by size, book-to-market, and prior year returns
<b>Control variables</b>	
<i>Size</i>	The natural logarithm of the firm's market capitalization at the end of quarter $q - 1$
<i>ROA</i>	The operating income at the end of quarter $q - 1$ , divided by lagged total assets
<i>Leverage</i>	The sum of long-term debt and current debt divided by total assets, both at the end of quarter $q - 1$
<i>Market-to-book</i>	The ratio of the market value of equity to the book value of equity, both at the end of quarter $q - 1$
<i>Sales Growth</i>	The seasonal difference in sales growth at the end of quarter $q - 1$
<i>Cash</i>	Cash and short-term investments at the end of quarter $q - 1$ , divided by lagged total assets
<i>Illiquidity</i>	The natural logarithm of quarterly average of daily closing quoted bid-ask spread divided by its midpoint
<i>IVOL</i>	The standard deviation of residuals from the regression of excess daily returns on the Fama and French (1993) three factors model, computed following Ang et al. (2006)
<b>Partitioning variables</b>	
<i>Divest</i>	An indicator equal to one when a firm's average ownership by affected mutual funds prior to the regulation is greater than the average ownership by affected mutual funds after the regulation ( $\Delta MFOwn < 0$ ), and zero otherwise

(Continues)

## APPENDIX (Continued)

Variable	Definition
<i>Uval</i>	An indicator equal to one when a firm becomes undervalued with the passage of the 2004 SEC regulation ( $\Delta MispScore < 0$ ), and zero otherwise
<i>PastFundRet</i>	An indicator variable equal to one if the average portfolio net returns over the past 12 months of a firm's affected active mutual funds is below the sample median at the end of quarter $q - 1$ , and zero otherwise
<i>PastFundFlow</i>	An indicator variable equal to one if the average percentage change in fund AUM over the past 12 months of a firm's affected active mutual funds is below the sample median at the end of quarter $q - 1$ , and zero otherwise
<i>Tenure</i>	An indicator variable equal to one if the average tenure of a firm's affected active mutual fund managers before the 2004 SEC regulation is below the sample median, and zero otherwise