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The impact of accounting restatements on corporate innovation strategy

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ABSTRACT

This study examines the effect of accounting restatements on corporate innovation strategy. Using a sample of restating firms and propensity-score-matched non-restating firms from 2000 to 2009, we find that, after restatements, restating firms experience a greater increase in exploratory innovation and a greater reduction in exploitative innovation compared to non-restating firms. These results suggest that restating firms are associated with an increased risk appetite as managers believe the upside potential may yield corporate improvement. The results also differ between fraudulent and non-fraudulent restatements, and among restatements of varying severity. The results of this study shed light on a previously unexplored consequence of accounting restatement and highlight its real impact on corporate business strategy.

1. Introduction

This paper investigates whether and how accounting restatements affect a firm's innovation strategy. Chakravarthy et al. (2014) note that restatements likely stimulate changes to a firm's strategic orientation and priorities. In a restatement announcement in 2013, ModusLink Global Solutions Inc. (NASDAQ: MLNK) claims that "management is focused on executing a turnaround plan to improve operational and financial results."[2] Following a restatement in 2017, the CEO of Getinge Group announced a revised corporate strategy that "...will create a more focused business and organization that is better positioned to develop market leading offerings for our customers."[3] Despite a plethora of anecdotal evidence, there is a lack of systematic understanding about how accounting restatements affect a firm's strategic orientation. In this study, we attempt to fill this void in the literature by investigating the association between restatements and subsequent changes in a firm's innovation strategy.

We focus on innovation strategy because in today's competitive business environment, innovation has become a key determinant of long-term corporate success and growth (He and Tian, 2013; Jia and Tian, 2018). A PwC survey of corporate

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[2] https://www.moduslink.com/press-releases/moduslink-global-solutions-concludes-restatement-process/.

[3] https://www.prnewswire.com/news-releases/revised-strategy-new-financial-targets-and-restated-financial-information-for-getinge-excluding-arjo-300553716.html.

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CEOs shows that 97% of business leaders see innovation as a top strategic priority for their businesses.[4] While all firms are committed to investing more resources and organizational capacity to drive innovation, they exhibit significant heterogeneity in their innovation strategies. The management literature has identified two generic types of innovation: *exploratory* innovation and *exploitative* innovation (Levinthal and March, 1993; McGrath, 2001; Benner and Tushman, 2002). Exploration involves departing from existing knowledge and experimenting with new technologies and approaches. Although associated with higher financial and reputational payoffs (Schmidt and Calantone, 1998; Salomo et al., 2008), this type of innovation is also characterized by greater risk taking and higher failure rates (March, 1991). Exploitation, in contrast, pertains to "the refinement and extension of existing technologies and paradigms" (March, 1991). It is associated with less risk taking, and exhibits returns that are more proximate and predictable (He and Wong, 2004).

A priori, it is unclear whether accounting restatements are associated with an increased corporate focus on exploratory or exploitative innovation. On the one hand, research on organizational decline suggests that managers in organizations experiencing past failures will become more conservative, and avoiding risky projects that may result in future failures (Staw et al., 1981). As restatements are often regarded as financial reporting failures (Ashbaugh-Skaife et al., 2007; Amel-Zadeh and Zhang, 2015), it is therefore plausible that post-restatement firms will focus more on exploitative innovation. On the other hand, as Levinthal and March (1993) note, managers who have experienced failure in the past may increase risk taking because managers believe the upside potential may yield corporate improvement (financially and/or non-financially) (Palmer and Wiseman, 1999). It is therefore plausible that restating firms will focus more on exploratory innovation.

Besides changes in manager's risk tolerance level, restatements may be associated with other corporate changes that affect innovation orientation. They may signal weak managerial control, for example (Ashbaugh-Skaife et al., 2007; Amel-Zadeh and Zhang, 2015). As a remedial action, top leadership may commit to stronger governance in the post-restatement period by centralizing decision making and tightening organizational control (Desai, 2008; Chakravarthy et al., 2014; Burks, 2010), which prior studies have shown to hamper exploratory innovation (Pandey and Sharma, 2009). Restating firms also suffer severe reputation-related losses, so they may increase their focus on exploratory innovation as a reputation-repairing strategy (Karpoff et al., 2008; Chakravarthy et al., 2014).

Based on the above discussion, the impact of accounting restatements on corporate innovation strategy is an open, empirical question. To answer this question, we examine a sample of restating firms and propensity-score method (PSM)-matched non-restating firms over the period 2000–2009. Following prior studies (e.g., Hennes et al., 2008), we classify restatements into two types—whether the restatement is fraud-related (*Fraud*) or non-fraud-related (*Non-Fraud*). We measure innovation strategy using empirical constructs developed in prior research based on a firm's patent information (e.g., Balsmeier et al., 2017; Custódio et al., 2019; Katila and Ahuja, 2002). Specifically, the extent to which a firm adopts an exploratory (exploitative) innovation strategy *Explore (Exploit)* is calculated as the number of exploratory (exploitative) patents filed in a given year divided by the number of all patents filed by the firm in the same year.

Our main test entails an examination of changes in restating firms' innovation strategies between the pre- and post-restatement periods (i.e., 3 years before restatement and 3 years after restatement) relative to a sample of control firms that do not experience restatements. We find that restating firms experience a significantly greater increase (decrease) in the intensity of exploratory (exploitative) innovation in the post-restatement period compared to non-restating firms. These results differ between fraudulent and non-fraudulent firms.

Additional analyses suggest that exploratory innovation has a greater positive effect on future firm performance and that stock market investors react more positively to the announcement of exploratory projects. Finally, we conduct several robustness tests, including using alternative measures for innovation strategy, alternative event window, and alternative measure of restatement severity. Our main findings remain qualitatively unchanged.

Findings of this study complement prior research on the impact of restatements on corporate investments and the associated contagion effect (e.g., McNichols and Stubben, 2008; Durnev and Mangen, 2009; Beatty et al., 2013). Kedia and Philippon (2009), for example, find that firms hype up investment during periods of suspicious accounting and reduce investment when the misreporting is detected. However, these studies focus on the *level* of investments and do not examine the strategic *orientation* of these investments. The findings of this study shed lights on this latter issue.

This study also contributes to the growing literature on corporate innovation strategy (Hsu et al., 2015; Jia, 2017; Jia and Tian, 2018). The choice between exploratory and exploitative innovation is an important strategic decision that has implications for multiple aspects of corporate practices and performance. Little is known, however, about how the revelation of fraudulent accounting affects corporate choice between exploration and exploitation. This paper provides insight on this question.

The findings of this study provide new insights for regulators, practitioners, and investors who are concerned about the fallout of accounting restatements. From a regulatory and standard-setter perspective, it is useful to have a broad understanding of the various consequences of accounting restatements. We find that restatements appear to have material effects on managers' risk tolerance level, which, in turn, affects their investment orientation. Interestingly, firms that experience increasing risk in the financial dimension (as evidenced by accounting restatements) are associated with higher managerial appetite for risk in the product dimension. While the findings of prior studies mostly identify the adverse consequences of restatements, our evidence suggests that restatements are associated with a greater managerial willingness to undertake

[4] http://www.cyprusprofile.com/en/news/view/innovation-a-top-priority-for-business.

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breakthrough innovation projects, which is beneficial to the firm in the long run. We also find that such changes appear to be viewed positively by the investment community.

The remainder of the paper proceeds as follows. Section 2 reviews the related literature and develops testable hypotheses. Section 3 describes the data and presents descriptive statistics. Section 4 reports the main empirical results. Section 5 provides the results of additional analyses. Section 6 concludes the paper.

2. Related literature and hypothesis development

2.1. Corporate innovation strategy

Rapid technological change, increasing globalization, and intensified competition forces modern firms to continuously innovate in order to grow and stay competitive in the long run (Benner and Tushman, 2003; Tushman and O'Reilly, 1996). The management literature has identified two distinct innovation strategies: *exploratory* innovation and *exploitative* innovation (Levinthal and March, 1993; McGrath, 2001). Exploration is characterized by experimentation, risk taking and the creation of radically new products, services, or business models that serve new customer needs or create new demands (March, 1991; McGrath, 2001). Although exploration is associated with higher failure rate, prior research shows that successful explorations are also associated with higher payoffs. Outcomes of exploratory innovation strategies include superior new products and/or serving offerings, which generate sales in new or emerging markets (Benner and Tushman, 2003). Because such innovations are difficult for rivals to imitate, first-mover advantages may last for a long time, increasing the duration of monopolistic advantages and high financial returns (Schmidt and Calantone, 1998). In addition to financial payoffs, exploration also has significant and positive effects on a firm's image, reputation, and brands (Salomo et al., 2008).

In contrast, exploitative innovation strategy primarily builds on improvements and refinements of current skills and processes (Holmqvist, 2004; Levinthal and March, 1993) that lead to incremental product changes (Amason et al., 2006). Such innovation outcomes are rather familiar to the innovating firm and its customers; they thus involve lower risk. Although the returns from exploitative innovation are more predictable, they are associated with normal profits only (Bierly and Daly, 2007) and contribute less to corporate reputation (Salomo et al., 2008).

Both exploration and exploitation are crucial for firm survival and prosperity (Tushman and O'Reilly, 1996). Resource-constrained firms, however, are rarely able to emphasize both types of innovation. Such a trade-off reflects a key dilemma for organizations that aim to enhance both "adaptation to exploit present opportunities" and their "adaptability to exploit future opportunities" at the same time. One stream of management literature examines the determinants of corporations' choice of exploratory versus exploitative innovation strategies. Firms are less likely to engage in exploration when their shareholders/managers are risk-averse (Levinthal and March, 1993), when they pursue economies of scale (Crossan et al., 1999), when their innovative activities are more likely to be subjects of imitation (Cohen and Levinthal, 1994), or when their environment appears to be less volatile (McGrath, 2001). However, whether and how the revelation of financial misstatement affects this corporate choice remains unknown. This paper aims to shed light on this issue.

2.2. Restatements and corporate investment

A restatement occurs when a company, either voluntarily or prompted by auditors or regulators, revises previously reported financial information. Restatements constitute a public acknowledgement that the reported financial statements are not consistent with GAAP. They represent the most visible evidence of improper accounting (Palmrose and Scholz, 2004). As financial statements are a major channel through which managers convey firm information to various stakeholders, restatements also constitute a violation of a firm's commitment to them, and are therefore potentially very costly to the firm involved (Graham et al., 2008).

Prior studies have uncovered various consequences of restatements. One particular stream of research explores the extent to which restatements affect corporate investment as well as the associated contagion effect. Kedia and Philippon (2009) study a sample of firms that were forced by the SEC to restate previous, fraudulently overstated reported earnings. They find that, relative to industry peers, overstating firms overinvested by making excessive capital investments, over-hired during the earnings manipulation period, and then underinvested and shed employment after the enforcement action. Durnev and Mangen (2009) argue that restatements can contain news about the investment projects of restating firms' competitors. This news causes competitors to modify their subsequent investment decisions. In support of their argument, they find that restatements are associated with lower abnormal returns and reduced investment by non-restating firms in the industry. Beatty et al. (2013) also find that accounting frauds have a contagion effect as evidenced by greater peer investments during fraud periods. However, Gleason et al. (2008) argue that restatements cause investors to reassess the content and credibility of financial statements issued by other firms in the same industry (i.e., a transparency or "accounting quality" effect). Changes in firms' investment decisions following restatements by competitors could therefore be due to changes in the industry cost of capital.

Indeed, an untrustworthy firm may incur higher monitoring costs, bonding costs, and residual losses in its financing arrangements (Jensen and Meckling, 1976), which in turn affect corporate investments. Prior studies have shown that restatements lead to an increase in a firm's cost of capital. Hribar and Jenkins (2004) estimate that, depending on the model

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used, the relative percentage increase in the cost of equity capital averages between 10.8% and 19.5% in the month immediately following a restatement. Graham et al. (2008) study the effect of restatements on bank loan contracting. They find that, compared with loans initiated before restatements, loans initiated after restatements have significantly higher spreads, shorter maturities, higher likelihood of being secured, and more covenant restrictions. Moreover, they find that the increase in loan spread is significantly larger for fraudulent restating firms than for other restating firms.

While prior studies focus on the association between restatements and the *level* of investments, they are nevertheless silent on the *direction* of investments. We aim to shed light on this latter issue by examining the impact of restatements on the strategic orientation of investments in innovation activities.

2.3. Hypothesis development

A priori, it is unclear whether accounting restatements are associated with an increased corporate focus on exploratory or exploitative innovation. Restatements are often regarded as financial reporting failures (Ashbaugh-Skaife et al., 2007; Amel-Zadeh and Zhang, 2015). The organizational behavior literature suggests that past failures alter managers' risk tolerance level and their subsequent risk-taking behavior, although the direction is still under debate (Cyert and March, 1963; Levitt and March, 1988). On the one hand, research on organizational decline suggests that managers in organizations experiencing past failures will become more conservative (Staw et al., 1981). Managers forego long-term planning, become less tolerant of failure, and choose low-risk options to reduce the probability of future organizational failure (Audia and Greve, 2006). Manso (2011) notes that tolerance for failure is vital for innovation, especially for exploration. Heightened managerial risk aversion following restatements is therefore expected to have an adverse impact on investments in exploratory innovation.

On the other hand, some scholars in the organizational behavior literature argue the opposite case, that managers in organizations that are performing below targets *increase* risk appetite (e.g., Greve, 1998; Harris and Bromiley, 2007; Singh, 1986; Wiseman and Bromiley, 1996). Levinthal and March (1993) note that managers who have experienced failure in the past are driven to "frenzies of experimentation, change, and innovation" (p. 105). Risk taking will ensue because managers believe the upside potential may yield corporate improvement (financially and/or non-financially) (Palmer and Wiseman, 1999). Also, because restating firms suffer from an increase in their cost of capital, therefore they may need to pursue riskier projects to meet higher return requirement. It is therefore also plausible that restating firms are associated with an increased risk appetite and focus more on exploratory innovation.

March and Shapira (1987, 1992) propose an "attention focus" theory in an attempt to reconcile the two seemingly conflicting arguments discussed above. They argue that managers shift attention between an aspiration level and a survival point at which the organization fails due to extremely poor performance. When performance declines below the aspiration level and the focus is upward on exceeding the aspiration level in the future, risk taking will ensue because managers believe the upside potential may yield corporate improvement. However, when the firm is in an underperforming situation and the focus instead is on the survival point, risk aversion will ensue because riskier actions with uncertain outcomes could yield performance below the threshold for organizational failure. The extent to which past failures increase manager's risk tolerance level is thus negatively moderated by the severity of failure. In a similar spirit (albeit in a different setting), Bernile et al. (2017) examine how disasters that CEOs experienced in the past affect their attitudes toward risk. They find that CEOs who had previously experienced disasters without extremely negative consequences subsequently behave more aggressively, whereas CEOs who experienced fatal disasters subsequently behave more conservatively.

Besides changes in manager's risk tolerance level that may affect corporate innovation orientation, restatements may be associated with other corporate changes that affect innovation strategy. Restatements signal weak managerial control, for example (Ashbaugh-Skaife et al., 2007; Amel-Zadeh and Zhang, 2015). As a remedial measure, restating firms likely improve governance and internal control systems to reduce the likelihood of future restatements as well as to signal the firm's commitment to preventing misconduct (Gillespie and Dietz, 2009; Gertsen et al., 2006). Tightened control is expected to have an adverse effect on exploratory innovation because exploratory activities require an organizational structure that is marked by low formalization, low centralization, and high autonomy (Pandey and Sharma, 2009). Restating firms also suffer severe reputation-related losses, so they may increase focus on exploratory innovation as a reputation-repairing strategy (Karpoff et al., 2008; Chakravarthy et al., 2014).

Based on the above discussion, the net impact of accounting restatements on corporate innovation strategy is an open, empirical question. We state our hypothesis below (in null):

Hypothesis. Firms do not experience a change in their innovation strategies after accounting restatements.

3. Sample selection and summary statistics

3.1. Sample selection

Table 1 reports the selection procedure for the restatement sample used in this study. We obtain data on firms that restated their financial statements from *Audit Analytics* for the period 2000–2009. Our sample begins in 2000 because financial restatement data is unavailable in *Audit Analytics* prior to 2000. The sample period ends in 2009 because our patent data,

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Table 1
Sample selection.

Total number of restatements announced from 2000 to 2009 from AuditAnalytics	10,600
Less: Repeat restatements by the same company in a given year	(3733)
Less: Restatements by financial institutions (SIC codes from 6000 to 6999)	(958)
Less: Observations without patent and/or citation data from the USPTO to construct innovation strategy variables	(3419)
Less: Observations without full data for control variables	(1948)
Final sample of restating firms	542

This table reports the selection procedure for restating sample used in this paper.

which is used to construct measures of innovation strategy, is available up to 2012. We collect firm-year patent and citation information from the *Google USPTO Bulk Downloads*.[5] This database provides rich information on all patents filed to and granted by the USPTO, including patent application and grant date, patent assignee name (the entity that owns the patent), the technology class of the patent, and detailed information on subsequent patents that cite the focal patent, etc. The three-year lag follows from prior innovation research (e.g., He and Tian, 2013; Jia and Tian, 2018) and to accommodate the fact that patent procurement (from filing patent applications to approval by the USPTO generally takes 2–3 years). So innovation strategy variables in year t are constructed using patent information in year $t + 3$.[6] Consistent with prior studies (e.g., He and Tian, 2013; Jia and Tian, 2018), a substantial number of firms do not hold patents that are the basis of innovation strategy variables, so we had to remove these firm-years from our analysis.[7]

Because some firms incur multiple restatements in a year, we only retained one restatement for these firms. Financial institutions (Standard Industrial Classification [SIC] codes from 6000 to 6999) are excluded, because these firms' financial statements tend to be influenced by factors unique to the financial industry. We also exclude observations without financial information from *Compustat* and/or stock return data from *CRSP* to compute other required variables used in subsequent analyses.

We then proceed to construct a control group of firms that are matched to restating firms on all important observable characteristics prior to the events, but that do not experience a restatement. The pool of potential control firms includes all firm-years in *Compustat* that did not file an accounting restatement in 2000–2009. Our matching procedure relies on a nearest-neighbor matching of propensity scores, originally developed by Rosenbaum and Rubin (1983).[8] We first run a probit regression of a dummy variable that equals one if a particular firm-year observation belongs to our treatment group (and zero otherwise) on a comprehensive list of observable firm characteristics as well as year and 2-digit SIC industry dummies. The propensity-score-matching technique ensures that our control group is very similar in the likelihood that they are a restating firm, except that these firms did not file any restatement.

We draw from prior restatement research (e.g., Kinney and McDaniel, 1989; Beneish, 1999a,b; Dechow et al., 2011; Amel-Zadeh and Zhang, 2015; and Chakravarthy et al., 2014) to identify matching variables. These studies all found that restating firms tend to have greater capital market pressures (as measured by higher leverage and/or recent capital raised), higher market-to-book ratios, larger accruals, and stronger recent growth. Our propensity score model thus includes the following variables: leverage (measured by total debt divided by total assets); its one-year change, book-to-market; its one-year change, return on assets; its one-year change, the annual amount of financing raised (total stock and debt issuance divided by total assets); its one-year change, accruals (following Richardson et al. (2005)); and its one-year change, a binary variable for *ex ante* financing need (equals 1 if [(CFO—past three year average capital expenditures)/current assets] < −0.5), market capitalization, and fiscal year abnormal market returns (measured as buy-and-hold return, less the market return, over the fiscal year). The aforementioned variables are all measured as of the year-end prior to restatement.

For each of our restating firms, we identify a non-restating firm in the same year and industry that has the closest propensity score (without replacement). The PSM procedure leads to a final matched sample of 542 pairs of restating and non-restating firms with full data on innovation strategy and control variables for subsequent analyses. In untabulated analyses, we check the differences between covariates as well as the propensity scores of the treatment firms and those of matched control firms. The difference is quite trivial. The maximum difference in propensity scores, for example, is only 0.03, while the median difference is 0.

3.2. Variable measurement

3.2.1. Measuring innovation strategy

We provide detailed variable definitions in Appendix A. Our measure of exploratory intensity *Explore* is calculated as the number of exploratory patents filed (and eventually obtained) in a given year divided by the number of all patents filed by the firm in the same year. Similarly, our measure of exploitative intensity *Exploit* is calculated as the number of exploitative

[5] Google USPTO Bulk Downloads is available at http://www.google.com/googlebooks/uspto.html.

[6] Our main findings remain robust if we construct innovation strategies using patent information in year t+2 or t+4.

[7] Prior innovation studies (e.g., He and Tian, 2013; Jia and Tian, 2018) note that patent distribution is significantly skewed (i.e., a bulk of firms do not own patents).

[8] See, e.g., Rosenbaum and Rubin (1983) and Lemmon and Roberts (2010), for a more detailed discussion of the matching method and cautionary notes.

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patents filed (and eventually obtained) in a given year, divided by the number of all patents filed by the firm in the same year. These are commonly used measures of innovation strategy (see, e.g., Balsmeier et al., 2017; Custódio et al., 2019; Jia and Tian, 2018). These two measures are two opposite constructs that represent the two ends of a continuum.

Following the management literature, we define patents unrelated to a firm's existing knowledge and serving as pilot trials in new fields as "exploratory patents" and patents built on a firm's strength and expertise in the current domain as "exploitative patents" (e.g., Benner and Tushman, 2002; Katila and Ahuja, 2002; Phelps, 2010). Operationally, we follow Custódio et al. (2019) and Jia and Tian (2018) to classify a patent as exploratory if at least 60% of its citations are based on new knowledge. We define a firm's existing knowledge as its previous patent portfolio and the set of patents that has been cited by its own patents over the past five years. A higher value of *Explore* indicates a higher intensity of exploratory innovation. In contrast, a patent is classified as exploitative if at least 60% of its citations are based on current knowledge. A higher value of *Exploit* indicates a higher intensity of exploitative innovation.

3.2.2. Measuring restatement

Restatements can be classified as either fraudulent (i.e., irregularities or intentional misreporting) or non-fraudulent (i.e., errors or unintentional misapplications of GAAP). Hennes et al. (2008) develop a procedure to distinguish between these two types of restatement. They identify restatement firms by reviewing all Form 8-K filings on EDGAR. The authors then read all restatement announcements and relevant subsequent filings and classify a restatement as fraud if at least one of the following criteria are met: (1) the words "fraud" or "irregularity" are used when referring to the misstatement, (2) SEC or Department of Justice investigations exist related to the restatement, and (3) an independent investigation related to the restatement exists. If none of the three criteria is met, the restatement is classified as non-fraudulent.

We use data provided by Hennes et al. (2008) to classify our sample of restatements into fraudulent vs. non-fraudulent for the period 2000–2006.[9] For the remaining period, 2007–2009, we follow their classification criteria to distinguish between fraudulent and non-fraudulent restatement. Approximately 19.2% of restatements in our sample are classified as fraud-related.

3.2.3. Measuring control variables

Following the innovation literature (e.g., He and Tian, 2013; Jia and Tian, 2018), we control for a vector of firm characteristics that may affect a firm's innovation strategy. Our control variables include firm size (measured by the natural logarithm of total sales), profitability (measured by the return-on-assets ratio), leverage (measured by the total debt to total assets ratio), capital expenditures scaled by total assets, asset tangibility (measured by net property, plants, and equipment scaled by total assets), industry concentration and its squared term (measured by the Herfindahl index based on annual sales), growth opportunities (measured by Tobin's q), institutional ownership (measured by the percentage of institutional holdings), total innovation output (measured by total number of patents), as well as operational diversity and complexity (measured by the degree of business diversification).

Because corporate innovation strategy is shaped by corporate leaders, especially the CEO, we also include two CEO characteristics. Prior studies note that exploratory innovation requires the approval of strong authorities within the firm who are willing to allocate resources toward such high risk initiatives (Mueller et al., 2013). We therefore include a variable for CEO power, which is measured by CEO pay slice and calculated as the proportion of total annual compensation of the five highest paid executives in a firm captured by the CEO (Bebchuk et al., 2011).

Rajgopal and Shevlin (2002) show that a CEO's incentive convexity increases risky exploration activities. Shen and Zhang (2013), and Mao and Zhang (2018) find a significant positive relation between a CEO's incentive convexity, vega, and innovation output. We therefore include an additional variable to capture a CEO's incentive convexity, which is the sensitivity of CEO options holdings to stock price volatility. Following Core and Guay (2002), we calculate vega as the sensitivity of the executives' equity portfolio to a 0.01 change in stock volatility.

4. Summary statistics

In an attempt to provide a comprehensive view of restating firms and matched non-restating firms, in Table 2 we report descriptive statistics of an array of characteristics for these two types of firms, both in the pre- and post-restatement periods. Specifically, we compare characteristics along four dimensions: innovation performance, basic firm characteristics, corporate governance, and external environment. To minimize the effect of outliers, we winsorize all continuous variables at the 1st and 99th percentiles.

4.0.1. Innovation performance

As shown in Panel A, in the pre-restatement period, the average R&D intensity for restating firms is 0.071, which is significantly higher than the average of 0.066 for non-restating firms. While restating and non-restating firms differ in intensity of innovation input, they do not exhibit significant differences in the quantity of innovation output, as measured by total

[9] The classification of restatement types over the period 1997–2006 is available on Brian Miller's webpage (https://kelley.iu.edu/bpm/activities/errorandirregularity.html). We thank Hennes et al. (2008) for making the data publicly available.

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Table 2
Summary statistics and correlation matrix.

Panel A: Summary Statistics–Pre-Restatement Period

		Restating Firms					Matched Non-Restating Firms					Difference
	No. of Obs.	Mean (1)	S.D.	P25	Median	P75	Mean (2)	S.D.	P25	Median	P75	T-test (1)-(2)
Innovation Performance												
R&D	1373	0.071	0.072	0.018	0.048	0.107	0.066	0.069	0.019	0.043	0.092	0.005*
TotalPat	1373	2.546	1.796	1.099	2.303	3.828	2.599	1.674	1.386	2.485	3.584	−0.053
Explore	1373	0.591	0.315	0.388	0.600	0.842	0.547	0.301	0.389	0.581	0.804	0.044***
Exploit	1373	0.304	0.281	0.000	0.248	0.473	0.320	0.278	0.087	0.286	0.481	−0.016***
Firm Characteristics												
Sales	1373	7.041	1.715	5.896	6.874	8.029	7.402	1.546	6.304	7.187	8.285	−0.361***
ROA	1373	0.099	0.192	0.071	0.117	0.159	0.103	0.114	0.089	0.142	0.190	−0.004
Leverage	1373	0.250	0.301	0.105	0.238	0.338	0.237	0.165	0.110	0.242	0.332	0.013
Capex	1373	0.052	0.048	0.023	0.039	0.063	0.058	0.050	0.027	0.041	0.062	−0.006***
PPE/Assets	1373	0.253	0.169	0.107	0.202	0.331	0.260	0.167	0.135	0.234	0.340	−0.007
TobinQ	1373	2.364	3.025	1.244	1.645	2.442	2.449	4.499	1.326	1.754	2.538	−0.085
InstOwn	1373	0.606	0.316	0.494	0.694	0.833	0.585	0.284	0.469	0.678	0.792	0.021*
BusDiv	1373	0.636	0.296	0.370	0.552	1.000	0.649	0.307	0.401	0.691	1.000	−0.013
KZ Index	1048	−3.213	6.374	−4.923	−1.154	0.438	−3.538	6.342	−5.553	−2.314	0.144	0.325
Earnings Volatility	1143	0.045	0.068	0.013	0.025	0.046	0.040	0.065	0.010	0.021	0.042	0.005*
Corporate Governance												
Board Size	1184	8.213	3.265	7.000	8.000	10.000	8.640	3.419	7.000	9.000	11.000	−0.427***
Independence	1184	0.691	0.217	0.571	0.750	0.846	0.641	0.229	0.556	0.700	0.778	0.050***
BusyDirector	1184	0.146	0.209	0.000	0.000	0.250	0.121	0.178	0.000	0.000	0.200	0.025***
Cps	1373	0.380	0.130	0.295	0.379	0.454	0.377	0.118	0.296	0.379	0.447	0.003
Log(CEOVega)	1373	2.274	1.806	0.000	2.492	3.672	2.207	1.662	0.446	2.401	3.499	0.067
External Environment												
AnalystCoverage	1373	11.085	10.264	3.000	9.000	17.000	10.526	9.447	3.000	9.000	15.000	0.559
ForecastError	1012	0.012	0.026	0.001	0.003	0.010	0.009	0.023	0.001	0.002	0.006	0.003***
ForecastDispersion	904	0.011	0.016	0.002	0.005	0.011	0.009	0.019	0.001	0.003	0.008	0.002**
HHI	1373	0.222	0.182	0.091	0.155	0.297	0.223	0.143	0.123	0.198	0.295	−0.001

Panel B: Summary Statistics – Post-Restatement Period

		Restating Firms					Matched Non-Restating Firms					Difference
	No. of Obs.	Mean (1)	S.D.	P25	Median	P75	Mean (2)	S.D.	P25	Median	P75	T-test (1)-(2)
Innovation Performance												
R&D	829	0.072	0.071	0.018	0.057	0.105	0.065	0.072	0.022	0.041	0.081	0.007**
TotalPat	829	2.936	1.850	1.475	2.882	4.234	2.937	1.661	1.835	2.833	3.912	−0.001
Explore	829	0.678	0.324	0.500	0.729	1.000	0.609	0.306	0.526	0.800	1.000	0.069***
Exploit	829	0.224	0.281	0.000	0.125	0.371	0.284	0.233	0.000	0.000	0.267	−0.060***
Firm Characteristics												
Sales	829	7.277	1.596	6.151	7.081	8.357	7.390	1.551	6.559	7.501	8.601	−0.113
ROA	829	0.098	0.193	0.072	0.111	0.161	0.132	0.088	0.094	0.126	0.177	−0.034***
Leverage	829	0.231	0.349	0.040	0.182	0.315	0.222	0.148	0.114	0.223	0.313	0.009
Capex	829	0.037	0.029	0.018	0.028	0.048	0.041	0.039	0.020	0.030	0.045	−0.004**
PPE/Assets	829	0.197	0.154	0.089	0.149	0.260	0.211	0.156	0.095	0.183	0.274	−0.014*
TobinQ	829	2.105	2.399	1.237	1.524	2.179	1.957	1.037	1.282	1.648	2.280	0.148
InstOwn	829	0.721	0.293	0.663	0.825	0.924	0.701	0.296	0.636	0.800	0.891	0.020
BusDiv	829	0.618	0.288	0.365	0.547	1.000	0.630	0.316	0.348	0.508	1.000	−0.012
KZ Index	548	−5.370	9.691	−6.600	−2.483	−0.125	−5.085	14.182	−5.647	−2.321	−0.004	−0.285
Earnings Volatility	693	0.036	0.045	0.014	0.023	0.043	0.040	0.072	0.009	0.018	0.041	−0.004
Corporate Governance												
Board Size	690	8.821	2.337	7.000	9.000	10.000	9.072	2.174	8.000	9.000	11.000	−0.251**
Independence	690	0.735	0.141	0.636	0.750	0.846	0.727	0.167	0.625	0.750	0.875	0.008
BusyDirector	690	0.126	0.141	0.000	0.111	0.200	0.141	0.166	0.000	0.100	0.250	−0.015*
Cps	829	0.392	0.105	0.334	0.397	0.446	0.401	0.094	0.342	0.406	0.462	−0.009*
Log(CEOVega)	829	0.950	1.615	0.000	0.000	1.926	1.558	1.963	0.000	0.000	3.418	−0.608***
External Environment												
AnalystCoverage	829	11.738	10.314	5.000	9.000	17.000	12.259	10.471	4.000	10.000	18.000	−0.521
ForecastError	602	0.017	0.083	0.001	0.003	0.008	0.011	0.022	0.001	0.004	0.011	0.003*
ForecastDispersion	527	0.032	0.203	0.003	0.006	0.013	0.011	0.035	0.002	0.004	0.009	0.021**
HHI	829	0.251	0.195	0.106	0.175	0.364	0.263	0.184	0.138	0.212	0.331	−0.012

(*continued on next page*)

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Table 2 (*continued*)

Panel C: Correlation Matrix

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	*Explore*	1														
2	*Exploit*	−0.83***	1													
3	*Sales*	0.02	−0.04**	1												
4	*ROA*	0.08***	−0.06***	0.18***	1											
5	*Leverage*	−0.04**	0.04**	0.14***	−0.11***	1										
6	*Capex*	−0.00	−0.03	−0.02**	0.23***	0.05**	1									
7	*PPE/Assets*	0.03*	−0.06***	0.14***	0.10***	0.30***	0.63***	1								
8	*HHI*	0.02	−0.02	−0.04***	−0.03***	−0.11***	−0.15***	−0.23***	1							
9	HHI^2	0.02	−0.02	−0.03***	−0.04***	−0.07***	−0.11***	−0.14***	0.94***	1						
10	*TobinQ*	−0.05***	0.05***	−0.15***	0.33***	−0.20***	0.06***	−0.21***	0.01	−0.00	1					
11	*InstOwn*	−0.10***	0.08***	0.08***	0.11***	−0.09***	−0.02	−0.15***	0.09***	0.05***	−0.03***	1				
12	*TotalPat*	−0.13***	0.15***	0.13***	0.00	−0.11***	−0.14***	−0.25***	0.13***	0.10***	0.19***	0.00	1			
13	*BusDiv*	−0.01	0.02	−0.20***	0.05***	−0.06***	0.16***	0.08***	−0.07***	−0.06***	0.15***	0.03***	−0.16***	1		
14	*Cps*	0.05***	−0.04**	0.14***	0.06***	0.03***	−0.06***	0.01	0.02	0.01	−0.00	0.11***	0.07***	−0.05***	1	
15	*Log(CEOVega)*	0.06***	−0.07***	0.15***	0.04***	−0.04***	−0.01	−0.06***	−0.03***	−0.03***	0.11***	−0.01	0.19***	−0.03***	0.16***	1

This table reports summary statistics for restating firms and matched non-restating firms in the pre-restatement period (Panel A) and post-restatement period (Panel B). Number of observations are for 3 pre-restatement years and 3 post-restatement years, respectively. Panel C reports the Pearson correlation matrix of variables used in the baseline analyses (including both restating firms and matched non-restating firms). Definitions of variables are provided in Appendix A. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

number of patents produced. A plausible explanation is that breakthrough innovation does not occur as frequently as exploitative innovation and is also more difficult to produce on a massive scale. It therefore has a lower input-to-output conversion rate.

As shown in Panel B, in the post-restatement period, restating firms appear to experience an increase in exploratory intensity (from 0.591 to 0.678, representing a move to further enhance restating firms' prior innovation strategy). Non-restating firms also experience an increase in exploratory intensity (from 0.547 to 0.609), but to a lesser degree.

4.0.2. Basic firm characteristics

In the pre-restatement period, restating firms are smaller on average (measured by the natural logarithm of total revenue) than non-restating firms. Moreover, these firms have higher earnings volatility, consistent with the argument that firms engaging in exploration are associated with higher failure rates and their payoffs are more uncertain. We do not find significant differences in other dimensions (such as profitability and leverage), possibly because we controlled for these dimensions in the propensity-score-matching process. In the post-restatement period, we observe significant differences between restating and non-restating firms in terms of profitability, capital expenditure, and tangible asset intensity.

4.0.3. Corporate governance

In the pre-restatement period, restating firms on average have smaller boards of directors, possibly due to their smaller size. But the board is more independent and is composed of a higher fraction of busy directors, who hold 3 or more directorships at other firms. This is consistent with Faleye et al. (2011)'s finding that too much board monitoring pressures managers towards short-termism and cause them to focus more on exploitative innovation. In the pre-restatement period, we continue to find differences in board size and director busyness, possibly due to stickiness in board composition. Interestingly, we also find that restating firms are associated with lower CEO power and compensation incentives.

4.0.4. External environment

We also compare the external environments in which restating and non-restating firms operate. For the information environment, restating and non-restating firms do not exhibit significant differences in amounts of analyst coverage in the pre-restatement period. Restating firms do, however, experience significantly higher forecast error and greater forecast dispersion, perhaps because they have higher intensity of exploratory innovation which creates higher information and knowledge gap with capital market participants, including financial analysts. We continue to observe similar results in the post-restatement period. In terms of the intensity of market competition as measured by the Herfindial index of the 4-digit SIC industry to which a firm belongs, we do not find significant differences between restating firms and non-restating firms, either before or after restatement.

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4.1. Correlation matrix

Panel C of Table 2 reports correlation among variables used in the main test for the pooled sample. Exploratory intensity *Explore* and exploitative intensity *Exploit* exhibit significant and negative correlation, consistent with the argument that resource-constrained firms face a trade-off in innovation orientation and are rarely able to emphasize both types of innovation (Tushman and O'Reilly, 1996; He and Wong, 2004).

5. Main empirical results

5.1. Restating firms only

We begin by only using the sample of restating firms and examine how their innovation strategies change between the pre- and post-restatement periods (i.e., 3 years before restatement and 3 years after restatement) using the following model:

$$Explore/Exploit_{i,t} = \alpha + \beta_1 Post_{i,t} + \lambda' Control_{i,t} + Year_t + Industry_j + \varepsilon_{i,t} \quad (1)$$

where *i* indexes firm, *j* indexes industry, and *t* indexes time. The dependent variable is firm *i*'s innovation strategy (either *Explore* or *Exploit*, as described in Section 3.2.1) in year *t*. *Post* is a dummy variable that equals 1 in years after the announcement of a restatement, and 0 for years prior to the announcement of a restatement. We exclude the year of restatement to avoid the effect of any confounding factors. *Control* is a vector of firm attributes that could affect a firm's innovation strategy as discussed in Section 3.2.3. *Year* and *Industry* capture year and industry (2-digit SIC) fixed effects, respectively.[10] We cluster standard errors at the firm level.

We conduct tests separately for fraudulent restatements and non-fraudulent restatements and report the results in Panel A and B of Table 3, respectively. Because the dependent variables *Explore* and *Exploit* are non-negative and bounded between 0 and 1, we use both an Ordinary Least Squares (OLS) model specification and a Tobit model specification. In columns (1) and (2) of Panel A, where the dependent variable is *Explore*, the coefficient on *Post* is significantly positive. In contrast, in columns (3) and (4), where the dependent variable is *Exploit*, the coefficient on *Post* is significantly negative. Taken together, these results suggest that fraudulent restatements are associated with an increase in exploratory innovation intensity and a corresponding decrease in exploitative innovation intensity in the post-restatement period.

As for control variables, firms with high leverage, low fixed assets, and high operational complexities are generally associated with lower exploration intensity. Consistent with the finding of Aghion et al. (2005), we also find a nonlinear effect of product market competition on innovation. Consistent with the argument that exploratory innovation requires the presence of a strong leader who supports such high risk initiatives (Mueller et al., 2013), we find some evidence that CEO pay slice, which is a measure of CEO power has a significant and negative impact on exploitative innovation activities.

We document similar findings in Panel B for non-fraudulent restatement firms. In columns (1) and (2), where the dependent variable is exploration intensity, the coefficient on *Post* is significantly positive. In contrast, in columns (3) and (4), where the dependent variable is exploitation intensity, the coefficient on *Post* is significantly negative.

5.2. Restating firms and matched non-restating firms

The results reported in Table 3 are subject to the concern that non-idiosyncratic factors (such as changes in macroeconomic environment) may be driving our findings. In this section, we employ a PSM-matched sample strategy to alleviate this concern. Specifically, we examine changes in restating firms' innovation strategies relative to those of PSM-matched non-restating firms, using the following model:

$$Explore(Exploit)_{i,t} = \alpha + \beta_1 Fraud(Non_F raud)_{i,t} + \beta_2 Post_{i,t} + \beta_3 Fraud(Non_F raud)_{i,t} \times Post_{i,t} + \lambda' Control_{i,t} + Year_t + Industry_j + \varepsilon_{i,t} \quad (2)$$

where *i* indexes firm, *j* indexes industry, and *t* indexes time. *Fraud(Non_Fraud)* is a dummy variable that equals 1 for fraudulent (non-fraudulent) restating firms, and 0 for matched non-restating firms. The matching procedure is described in Section 3.1. The key variable of interest in this analysis is the interaction term *Fraud* × *Post (Non_Fraud* × *Post)*. *Control* is the same vector of firm attributes that could affect a firm's innovation strategy as in model (1). *Year* and *Industry* capture year and industry fixed effects, respectively. We again cluster standard errors at the firm level.

Table 4, Panel A reports the results for fraudulent firms and matched non-restating firms. In columns (1) and (2), where the dependent variable is exploration intensity, the coefficient on *Fraud* × *Post* is positive in both columns, but only significant in column (1) (i.e., using the OLS specification). In columns (3) and (4), where the dependent variable is exploitation intensity, the coefficient on *Fraud* × *Post* is negative in both columns, but only significant in column (3) (i.e., using the OLS specification). These results are weaker than the results in Panel A of Table 3, suggesting that there may be concurrent changes in non-idiosyncratic factors that affect fraudulent firms' innovation orientations. After controlling for these factors,

[10] As a robustness test, we also conducted baseline analyses using 4-digit SIC for industry effects. The results are qualitatively the same.

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Table 3
Accounting restatement and innovation strategy: restating firms.

Panel A: Fraudulent Restatements

Dep Var =	*Explore*		*Exploit*	
	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
Post	0.098**	0.043*	−0.091**	−0.099*
	(0.047)	(0.024)	(0.045)	(0.060)
Sales	0.047	0.038	−0.034	−0.019
	(0.038)	(0.029)	(0.024)	(0.020)
ROA	−0.051	−0.136	−0.286*	0.374
	(0.228)	(0.299)	(0.152)	(0.273)
Leverage	−0.426**	−0.632**	0.163	0.208
	(0.196)	(0.276)	(0.164)	(0.221)
Capex	1.112	1.108	−0.581	−0.347
	(1.304)	(1.929)	(1.086)	(0.158)
PPE/Assets	0.639*	0.978**	−0.342*	−0.664**
	(0.343)	(0.454)	(0.209)	(0.324)
HHI	1.646	2.424**	−0.919	−1.497*
	(1.117)	(1.086)	(0.767)	(0.850)
HHI^2	−3.125*	−4.554***	1.839	2.827**
	(1.626)	(1.723)	(1.181)	(1.423)
TobinQ	0.005	−0.009	−0.007	−0.016
	(0.005)	(0.009)	(0.005)	(0.016)
InstOwn	0.027	0.067	−0.034	−0.020
	(0.068)	(0.093)	(0.047)	(0.069)
TotalPat	−0.043*	−0.048*	0.026	0.038*
	(0.026)	(0.028)	(0.018)	(0.023)
BusDiv	−0.171*	−0.230*	0.025	0.059
	(0.104)	(0.132)	(0.079)	(0.100)
Cps	−0.167	−0.213	−0.210*	−0.334*
	(0.145)	(0.221)	(0.124)	(0.194)
Log(CEOVega)	−0.006	−0.007	−0.003	−0.002
	(0.011)	(0.014)	(0.010)	(0.013)
Constant	0704*	0.739***	0.067	0.147***
	(0.385)	(0.043)	(0.200)	(0.048)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.37	0.28	0.36	0.30
Observations	423	423	423	423

Panel B: Non-Fraudulent Restatements

Dep Var =	*Explore*		*Exploit*	
	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
Post	0.064**	0.043***	−0.063**	−0.053***
	(0.032)	(0.014)	(0.028)	(0.013)
Sales	0.035***	0.041***	−0.035**	−0.046***
	(0.013)	(0.002)	(0.014)	(0.002)
ROA	0.022	0.074***	0.036	−0.087***
	(0.111)	(0.027)	(0.125)	(0.020)
Leverage	−0.100	−0.093***	0.101	0.117***
	(0.071)	(0.016)	(0.072)	(0.013)
Capex	0.029	0.152	0.075	−0.282*
	(0.448)	(0.168)	(0.334)	(0.166)
PPE/Assets	−0.001	0.025	−0.061	−0.116***
	(0.150)	(0.043)	(0.123)	(0.040)
HHI	0.266	0.355***	−0.165	−0.223***
	(0.299)	(0.041)	(0.289)	(0.038)
HHI^2	−0.356	−0.445***	0.252	0.323***
	(0.374)	(0.045)	(0.364)	(0.041)
TobinQ	−0.003	−0.008***	0.004	0.009***
	(0.004)	(0.002)	(0.004)	(0.002)
InstOwn	−0.032	−0.070***	−0.011	0.001
	(0.061)	(0.019)	(0.055)	(0.018)
TotalPat	−0.047***	−0.082***	0.040***	0.093***
	(0.011)	(0.004)	(0.011)	(0.004)
BusDiv	−0.024	−0.050**	0.040	0.074***
	(0.050)	(0.019)	(0.047)	(0.019)

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Table 3 (*continued*)

Panel B: Non-Fraudulent Restatements				
Dep Var =	*Explore*		*Exploit*	
	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
Cps	0.078	0.152***	0.015	0.052
	(0.083)	(0.037)	(0.084)	(0.036)
Log(CEOVega)	0.003	0.001	−0.001	−0.001
	(0.007)	(0.004)	(0.006)	(0.003)
Constant	0.973***	5.611***	0.054	−3.975***
	(0.133)	(0.017)	(0.132)	(0.016)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.26	0.20	0.26	0.26
Observations	1779	1779	1779	1779

This table reports regression estimates of changes in innovation strategy on accounting restatements using restating firms only. Panel A examines 3 pre-restatement years and 3 post-restatement years for fraudulent restatements. Panel B examines 3 pre-restatement years and 3 post-restatement years for non-fraudulent restatements. Definitions of variables are provided in Appendix A. Year and industry fixed effects are included. Robust standard errors clustered by firm are displayed in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

we only find some evidence that fraudulent restating firms experience a greater increase (decrease) in exploratory (exploitative) innovation compared to non-restating firms.

Table 4, Panel B reports the results for non-fraudulent restating firms and matched non-restating firms. In columns (1) and (2), where the dependent variable is exploration intensity, the coefficient on *Non_Fraud* × *Post* is significantly positive in both columns. In columns (3) and (4), where the dependent variable is exploitation intensity, the coefficient on *Non_Fraud* × *Post* is negatively negative in both columns. These results are consistent with the findings in Panel B of Table 3, suggesting that in the post-restatement period, non-fraudulent restating firms experience a greater increase in risk appetite compared to non-restating firms and invest more (less) in exploratory (exploitative) innovation.

Taken together, we see that results for fraudulent firms are statistically less significant than for non-fraudulent firms. However, at the same time, the coefficients are uniformly larger for fraudulent firms, suggesting their results are may be more pronounced than non-fraud firms on average, but with greater variance in behavior. The "attention focus" theory in organizational behavior (discussed in Section 2.3) offers a potential explanation for the different findings for fraudulent and non-fraudulent firms. Again, the idea is that managers shift attention between an aspiration level and a survival point (March and Shapira, 1987, 1992; Desai, 2008). When performance declines below the aspiration level and the focus is upward on exceeding the aspiration level in the future, risk taking will ensue. However, when performance declines and the focus is on the survival point, risk aversion will ensue because riskier actions with uncertain outcomes could yield performance below the threshold for organizational failure. Because fraudulent restatements are more frequently associated with the hiding of poor performance, risk taking by managers of these firms is constrained by concern over the "survival point" (e.g., avoiding financial underperformance).

In contrast, non-fraudulent restating firms may increase risk taking and invest more in exploratory innovation as a reputation-improving strategy to help such firms regain stakeholder trust (i.e., their aspiration level).[11] The strategic management literature on reputation suggests that corporate reputation is multi-dimensional and that "damages to some dimensions of a firm's reputation can be offset by positive reputations achieved in many other dimensions." (p. 157) (Rhee and Valdez, 2009). Fombrun (1996) developed a widely used composite measure of corporate reputation, "reputation quotient," that includes six main categories: vision and leadership, social responsibility, emotional appeal, workplace environment, products and services, and financial performance. In particular, "being innovative, that is, ahead of the times" (which is related to exploratory innovation capability) is an attribute of the "products and services" category of reputation quotient (Fombrun et al., 2000). Because exploratory innovation is associated with higher reputational payoffs than exploitative innovation (Schmidt and Calantone, 1998; Salomo et al., 2008), non-fraudulent restating firms with damaged reputations on financial performance may therefore increase the intensity of their exploratory innovation in order to highlight areas in which they enjoy a favorable reputation as a way to influence stakeholders' perceptions of which reputational dimensions are important (Elsbach and Kramer, 1996).[12]

[11] Non-fraudulent restating firms also suffer material consequences from the fallout of a restatement. Palmrose et al. (2004) report a −6% market reaction to non-fraudulent restatements. Amel-Zadeh and Zhang (2015) note that, regardless of the motivation of the misstatements, restatements signal unreliable financial information that leads to a loss of credibility.

[12] We acknowledge that restating firms may also focus on improving other dimensions such as workplace environment or social responsibility, which is beyond the scope of this study.

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Table 4
Accounting restatement and innovation strategy: restating firms and matched non-restating firms.

Panel A: Fraudulent Restatements

Dep Var =	*Explore*		*Exploit*	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Post	−0.100	−0.052	0.150*	0.082
	(0.091)	(0.124)	(0.083)	(0.107)
Fraud	−0.029	0.051	0.053	−0.079
	(0.092)	(0.127)	(0.066)	(0.104)
*Post*Fraud*	0.153*	0.107	−0.131*	−0.128
	(0.085)	(0.123)	(0.075)	(0.071)
Sales	0.043	0.001	−0.030	−0.012
	(0.030)	(0.024)	(0.019)	(0.017)
ROA	0.154	0.268	0.199	−0.385*
	(0.207)	(0.286)	(0.132)	(0.231)
Leverage	−0.220	−0.364*	0.054	0.079
	(0.150)	(0.201)	(0.112)	(0.153)
Capex	0.143	−0.646	−0.696	−0.780
	(0.731)	(1.232)	(0.756)	(1.089)
PPE/Assets	0.485*	0.374	−0.132	0.003
	(0.287)	(0.379)	(0.169)	(0.289)
HHI	−0.362	−0.214	−0.129	−0.149
	(0.728)	(0.797)	(0.487)	(0.633)
HHI^2	0.216	0.073	0.397	0.400
	(0.866)	(0.981)	(0.591)	(0.744)
TobinQ	−0.009**	0.012	0.009*	0.029**
	(0.004)	(0.008)	(0.005)	(0.014)
InstOwn	−0.007	0.024	−0.047	−0.082
	(0.071)	(0.106)	(0.045)	(0.067)
TotalPat	−0.043**	−0.031	0.029	0.023
	(0.021)	(0.022)	(0.019)	(0.017)
BusDiv	−0.084	−0.187*	−0.018	−0.009
	(0.088)	(0.113)	(0.061)	(0.084)
Cps	−0.001	−0.038	0.104	0.177
	(0.139)	(0.211)	(0.107)	(0.162)
Log(CEOVega)	0.017**	0.021*	0.007	0.012
	(0.008)	(0.012)	(0.007)	(0.009)
Constant	0.223	0.565***	0.227	−0.271***
	(0.392)	(0.019)	(0.149)	(0.015)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.43	0.41	0.46	0.56
Observations	846	846	846	846

Panel B: Non-Fraudulent Restatements

Dep Var =	*Explore*		*Exploit*	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Post	−0.043	−0.062***	0.039*	0.061***
	(0.027)	(0.011)	(0.022)	(0.009)
Non_Fraud	−0.032	−0.046***	0.036	0.054***
	(0.027)	(0.009)	(0.023)	(0.008)
*Post*Non_Fraud*	0.047**	0.058***	−0.049*	−0.082***
	(0.023)	(0.011)	(0.027)	(0.010)
Sales	0.022**	0.027***	−0.020**	−0.027***
	(0.009)	(0.002)	(0.009)	(0.001)
ROA	0.129	0.203***	−0.095	−0.120***
	(0.086)	(0.027)	(0.088)	(0.021)
Leverage	−0.025	−0.017	0.018	−0.002
	(0.053)	(0.017)	(0.048)	(0.014)
Capex	−0.617**	−1.017***	0.493*	0.769***
	(0.291)	(0.111)	(0.276)	(0.100)
PPE/Assets	0.040	0.099***	−0.039	−0.083***
	(0.113)	(0.031)	(0.096)	(0.027)
HHI	−0.116	−0.181***	0.062	0.097***
	(0.212)	(0.031)	(0.176)	(0.028)
HHI^2	0.151	0.245***	−0.087	−0.133***
	(0.266)	(0.034)	(0.224)	(0.029)
TobinQ	−0.002	−0.006***	0.003	0.007***

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Table 4 (*continued*)

Panel B: Non-Fraudulent Restatements				
Dep Var =	*Explore*		*Exploit*	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
	(0.003)	(0.001)	(0.002)	(0.001)
InstOwn	−0.038	−0.037***	0.009	−0.006
	(0.037)	(0.013)	(0.033)	(0.012)
TotalPat	−0.043***	−0.075***	0.040***	0.092***
	(0.008)	(0.003)	(0.008)	(0.003)
BusDiv	−0.024	−0.035***	0.051	0.086***
	(0.036)	(0.013)	(0.033)	(0.012)
Cps	−0.008	−0.008	−0.004	−0.012
	(0.070)	(0.027)	(0.060)	(0.024)
Log(CEOVega)	0.010**	0.013***	−0.006	−0.009***
	(0.005)	(0.025)	(0.004)	(0.002)
Constant	0.945***	3.572***	−0.047	−2.439***
	(0.120)	(0.012)	(0.087)	(0.011)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.22	0.18	0.24	0.25
Observations	3558	3558	3558	3558

This table reports regression estimates of changes in innovation strategy on accounting restatements using restating firms and PSM-matched non-restating firms. Panel A examines 3 pre-restatement years and 3 post-restatement years for fraudulent restatements and matched non-restating firms. Panel B examines 3 pre-restatement years and 3 post-restatement years for non-fraudulent restatements and matched non-restating firms. Definitions of variables are provided in Appendix A. Year and industry fixed effects are included. Robust standard errors clustered by firm are displayed in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

6. Additional analyses

6.1. Innovation strategy and future payoffs

6.1.1. Financial payoffs

In this section, we perform several additional analyses for our conjecture that increasing investment in exploratory innovation helps restating firms recover from the fallout of a restatement (financially and/or non-financially).

First, we examine the association between a firm's performance (i.e., return-on-assets and Tobin's q) and innovation strategy, using our sample of restating firms and matched firms. Specifically, we examine the effect of corporate innovation strategy in year t on firm performance in year $t+1$ and $t+3$, respectively. We report the results in Table 5. Interestingly, we find that exploratory innovation has no significant impact on firm performance in $t+1$, but it does have a significant and positive impact on firm performance in $t+3$. Our finding is the opposite for exploitative innovation.[13] These results are consistent with the argument that the financial payoffs associated with exploitation (exploration) are more proximate (distant). We also find, however, that the payoffs associated with exploration are more significant. Increasing exploratory innovation therefore enables restating firms to have a better chance of meeting performance targets in the future.

6.1.2. Non-financial payoffs

In this section, we test the conjecture that restating firms increase the intensity of their exploration as a reputation-repairing strategy, that is, exploratory innovations have stronger effects on a firm's reputation than exploitative innovation. Specifically, we examine stock-market reactions to the announcement of exploratory and exploitative projects by restating firms and matched non-restating firms respectively, in the post-restatement period.

To carry out this test, we first identify a list of exploratory and exploitative projects by reading through the content of patents filed by our sample firms in the post-restatement period. Again, each patent can be classified into either exploratory or exploitative (as discussed in Section 3.2.1). We then read through the content of each patent to identify the focal invention. Next we search the LexisNexis News Wires for the first public disclosure of the invention and examine the stock market reaction to that announcement. We calculate the 3-day cumulative abnormal return surrounding the announcement (i.e., day −1, 0 and 1) and partition the results into a 2x2 matrix by firm type (restating firms vs. non-restating firms) and by innovation type (exploration vs. exploitation).

We report the results in Table 6. For both restating firms and matched non-restating firms, stock market investors appear to react more positively to the announcement of exploratory projects, which supports our conjecture that investors perceive

[13] We also examined whether the impact is different between restating and non-restating firms by including interaction terms between innovation strategy and firm type, but did not observe significant coefficients on the interaction terms. These findings suggest that the impact of innovations strategy on future firm performance is not affected by restatements.

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Table 5
Innovation strategy and future performance.

Dep Var =	ROA_{t+1} (1)	ROA_{t+3} (2)	$TobinQ_{t+1}$ (3)	$TobinQ_{t+3}$ (4)
$Explore_t$	−0.007	0.041**	0.143	0.271**
	(0.025)	(0.020)	(0.217)	(0.126)
$Exploit_t$	−0.011*	−0.016	0.316	−0.026
	(0.006)	(0.027)	(0.224)	(0.336)
$Sales_t$	0.038***	0.052**	−0.212**	−0.321*
	(0.008)	(0.020)	(0.103)	(0.190)
$Leverage_t$	−0.295***	−0.193***	−2.888**	−2.990***
	(0.058)	(0.029)	(1.355)	(0.985)
$Capex_t$	−0.271	0.001	−9.174***	−6.551***
	(0.223)	(0.113)	(3.180)	(2.273)
$PPE/Assets_t$	0.044	−0.049	−2.721***	−1.323
	(0.049)	(0.110)	(0.527)	(0.937)
HHI_t	−0.051	−0.071	−2.521*	−2.009
	(0.076)	(0.088)	(1.332)	(1.373)
HHI_t^2	0.013	0.047	2.642*	2.158
	(0.082)	(0.091)	(1.494)	(1.537)
$InstOwn_t$	0.095***	0.117***	−0.211	−0.208
	(0.030)	(0.060)	(0.272)	(0.307)
$TotalPat_t$	0.012***	0.018**	0.146***	0.185**
	(0.004)	(0.009)	(0.052)	(0.087)
$BusDiv_t$	0.030**	0.024*	0.549***	0.357**
	(0.015)	(0.014)	(0.182)	(0.181)
Cps_t	−0.025	−0.024	0.330	0.714
	(0.040)	(0.054)	(0.408)	(0.645)
$Log(CEOVega)_t$	−0.004	−0.004	0.004	−0.007
	(0.003)	(0.003)	(0.037)	(0.033)
Constant	−0.079*	−0.162	2.514***	3.759***
	(0.048)	(0.123)	(0.652)	(1.104)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2	0.47	0.34	0.31	0.33
Observations	6,895	6,486	6,553	5,883

This table reports regression estimates of innovation strategy on firm future performance. The sample includes restating firms and matched non-restating firms over the period 2002–2009. Definitions of variables are provided in Appendix A. Year and industry fixed effects are included. Robust standard errors clustered by firm are displayed in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 6
Stock market reaction to innovation projects.

	Restating Firms (1)	Non-Restating Firms (2)	Diff (1)-(2)
Exploratory Projects	0.073	0.054	0.019***
	[N = 152]	[N = 192]	
Exploitative Projects	0.040	0.038	0.002
	[N = 105]	[N = 153]	
Diff	0.033***	0.016**	

This table reports stock market announcement of innovation projects by firm type (restating firms vs. non-restating firms) and by innovation type (exploration vs. exploitation). N is the number of announcements for each firm and project type. The dependent variable is three-day abnormal returns around the announcement of innovation projects. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

exploratory innovation as more value-enhancing than exploitative innovation. Moreover, a comparison of market reaction to exploratory projects between restating firms and non-restating firms suggests that investors respond more positively to the exploratory projects of restating firms. Taken together, these results support our conjecture that restating firms reshape their innovation strategies and focus more on exploratory innovation as a reputation-repairing strategy.

6.2. Robustness tests

6.2.1. Alternative measures of innovation strategy

Our main measurement of exploration and exploitation intensity, although commonly used in prior studies, involves an arbitrary cutoff (i.e., 60%). To ensure the robustness of our findings, we also use two alternative measures of innovation type. The first measure is to use 80% as a cutoff, which is also used in prior studies (e.g., Custódio et al., 2019; and Jia and Tian, 2018). The second measure is *SearchDistance*, which is calculated as the technological search distance between a firm's new patents and its patent portfolio. Following Custódio et al. (2019), we take the current distribution of the number of a

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Table 7
Robustness test – alternative measures of innovation strategy.

Panel A: Alternative Measure of Innovation Strategy – 80% Cutoffs				
Fraudulent Restatements and Control Firms	*Explore80*		*Exploit80*	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Post	−0.077	0.000	0.101	0.022
	(0.093)	(0.119)	(0.082)	(0.109)
Fraud	−0.054	0.016	0.085	−0.038
	(0.090)	(0.128)	(0.057)	(0.100)
*Post*Fraud*	0.175*	0.139	−0.188**	−0.141
	(0.090)	(0.117)	(0.074)	(0.104)
Controls	Included	Included	Included	Included
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.43	0.36	0.41	0.47
Observations	846	846	846	846
Non-fraudulent Restatements and Control Firms	*Explore80*		*Exploit80*	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Post	−0.039	−0.055***	0.038*	0.061***
	(0.027)	(0.010)	(0.022)	(0.009)
Non_Fraud	−0.018	−0.021**	0.028	0.040***
	(0.027)	(0.009)	(0.023)	(0.008)
*Post*Non_Fraud*	0.035*	0.036***	−0.045*	−0.074***
	(0.021)	(0.010)	(0.026)	(0.010)
Controls	Included	Included	Included	Included
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.21	0.19	0.24	0.26
Observations	3558	3558	3558	3558

Panel B: Alternative Measure of Innovation Strategy – Search Distance	
Fraudulent Restatements and Control Firms	*SearchDistance*
Post	0.141
	(0.095)
Fraud	−0.084
	(0.054)
*Post*Fraud*	−0.108
	(0.082)
Controls	Included
Year and Industry Fixed Effects	Included
R^2	0.39
Observations	716
Non-fraudulent Restatements and Control Firms	*SearchDistance*
Post	−0.035*
	(0.018)
Non_Fraud	−0.011
	(0.018)
*Post*Non_Fraud*	0.037*
	(0.021)
Controls	Included
Year and Industry Fixed Effects	Included
R^2	0.43
Observations	2958

This table reports the main results using two alternative measures of innovation strategy. Panel A uses 80% as an alternative cutoff for exploratory/exploitative innovation. Panel B uses search distance, which is calculated as the technological search distance between a firm's new patents and its patent portfolio. Panel The sample in each table includes 3 pre-restatement years and 3 post-restatement years for fraudulent (non-fraudulent) restatements and matched non-restating firms. Definitions of variables are provided in Appendix A. Year and industry fixed effects are included. Robust standard errors clustered by firm are displayed in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

firm's patents across two digit technological classes and then measure the degree of difference between this distribution and the analogous distribution calculated for new patents and adjusted for the expected degree of knowledge spillovers between patent classes (i.e., adjusted for the "closeness" of patent classes). A higher *SearchDistance* indicates a higher degree of innovation novelty, which is more exploratory in nature.

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Table 8
Robustness test – alternative measure of restatement severity.

Dep Var =	***Explore***		***Exploit***	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Post	−0.087	−0.121***	0.031	0.040**
	(0.069)	(0.017)	(0.052)	(0.017)
Less Severe Restatement	−0.033**	−0.053***	0.012	0.021***
	(0.014)	(0.005)	(0.013)	(0.045)
*Post*Less Severe Restatement*	0.037*	0.051***	−0.020*	−0.029***
	(0.021)	(0.005)	(0.012)	(−0.005)
Year and Industry Fixed Effects	Included	Included	Included	Included
R^2/*Pseudo* R^2	0.26	0.21	0.26	0.24
Observations	4404	4404	4404	4404

This table reports regression estimates of innovation strategy on the severity of accounting statement. *Less Severe Restatement* is measured by announcement period market reaction quintile, which equals 1 for most severe restatement and 5 for least severe restatement. The sample includes 3 pre-restatement years and 3 post-restatement years for restating firms and matched non-restating firms. Definitions of variables are provided in Appendix A. Year and industry fixed effects are included. Robust standard errors clustered by firm are displayed in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

We reconducted the main analyses using these two alternative measures and report the results in Table 7 of the revised manuscript. As shown, our main findings remain qualitatively unchanged.

6.2.2. Alternative of restatement severity

In addition to classifying restatements into fraudulent vs. non-fraudulent, we also use announcement-period market reactions as an alternative measure of the severity of restatements. Specifically, we calculate the 3-day announcement period (−1, 1) market reaction to the restatement and rank the restatement firms into quintiles (groups 1–5) accordingly. The control firms serve as the benchmark group (group 0).

We reconduct our main test and report the results in Table 8. The variable of interest in this analysis is the interaction term between *Post* and *LessSevereRestatement*, where *LessSevereRestatement* equals 1 (5) for firms having the most (least) negative market reaction. As shown, the coefficient on the interaction term is positive and significant in columns (1) and (2), where the dependent variable is *Explore*. We obtain the opposite results in columns (3) and (4), where the dependent variable is *Exploit*. Together, these results are consistent with our findings that changes in innovation strategy are more pronounced for less severe restatements.

7. Concluding remarks

In this paper, we explore a previously undocumented consequence of accounting restatements for corporate innovation strategy. Using a sample of restating firms and propensity-score-matched non-restating firms from the years 2000–2009, we find that after restatements, restating firms experience a greater increase in exploratory innovation and a greater reduction in exploitative innovation compared to non-restating firms. The results are different for non-fraudulent restatements and less severe restatements.

The results of this study provide new insights into the economic consequences of accounting restatements. In particular, we show that the revelation of financial misreporting has real impact on a firm's business strategy, which complements prior research on the economic consequences of restatements for corporate investments. We highlight the finding that restatements not only affect level of investment, but also the strategic orientation of these investments. Finally, our results complement prior research on restating firms' reputation-repairing strategies and suggest that reshaping corporate innovation orientation toward exploration appears to be a long-term reputation-repairing strategy.

Appendix A. Variable definition

Variable	Definition
Innovation Variables	
Explore	Number of exploratory patents filed in a given year divided by the number of all patents filed by the firm in the same year; a patent is classified as exploratory if at least 60% of its citations are based on new knowledge;
Exploit	Number of exploitative patents filed in a given year divided by the number of all patents filed by the firm in the same year; a patent is classified as exploitive if at least 60% of its citations are based on current knowledge;

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Appendix A (*continued*)

Variable	Definition
R&D	Research and development expenditure divided by book value of total assets measured at the end of fiscal year;
TotalPat	Natural logarithm of one plus a firm's total number of patents filed (and eventually granted) in a year;
Explore80	Number of exploratory patents filed in a given year divided by the number of all patents filed by the firm in the same year; a patent is classified as exploratory if at least 80% of its citations are based on new knowledge;
Exploit80	Number of exploitative patents filed in a given year divided by the number of all patents filed by the firm in the same year; a patent is classified as exploitive if at least 80% of its citations are based on current knowledge;
Other Variables	
Post	An indicator variable that equals one if post-restatement years, and zero otherwise;
Fraud	An indicator variable that equals one for fraudulent restatement, and zero otherwise;
Non_Fraud	An indicator variable that equals one for non-fraudulent restatement, and zero otherwise;
LessSevereRestatement	Calculated based on 3-day announcement period (-1,1) market reaction to the restatement and rank the restatement firms into quintiles (groups 1–5). Group 1 consists of firms having the most negative market reaction (most severe restatement). The control firms serve as the benchmark group (group 0);
Sales	Firm size, defined as the natural logarithm of revenue measured at the end of fiscal year;
ROA	Return on assets ratio, defined as operating income before depreciation divided by total assets, measured at the end of fiscal year;
Leverage	Leverage ratio, defined as book value of debt divided by book value of total assets measured at the end of fiscal year;
Capex	Capital expenditure scaled by book value of total assets measured at the end of fiscal year;
PPE/Assets	Property, Plant & Equipment (net) divided by book value of total assets measured at the end of fiscal year;
TobinQ	Firm's market-to-book ratio in a year, calculated as [market value of equity plus book value of assets minus book value of equity minus balance sheet deferred taxes (set to 0 if missing)] divided by book value of assets;
InstOwn	Firm's institutional holdings (%) in a year, calculated as the arithmetic mean of the four quarterly institutional holdings reported through form 13F;
BusDiv	Business diversification, calculated as (1- sum of (squared business segment sales/total firm sales)) in a year;
KZ Index	Kaplan and Zingales index measured at the end of fiscal year, calculated as $-1.002 \times$ Cash Flow plus $0.283 \times$ Q plus $3.139 \times$ Leverage minus $39.368 \times$ Dividends minus $1.315 \times$ Cash holdings;
Earnings Volatility	Standard deviation of quarterly earnings for the last five years;
BoardSize	Natural logarithm of number of board of directors in a given year;
Independence	Percentage of independent directors on board in a given year;
BusyDirector	Percentage of directors holding 3 or more directorships in a given year;
Cps	Proportion of total annual compensation of the five highest paid executives in a firm captured by the CEO in a given year;
Log(CEOVega)	Natural logarithm of the CEO's dollar increase in wealth for a 1% standard deviation increase in the firm's return volatility in a given year;
AnalystCoverage	Natural logarithm of one plus the number of analysts issuing at least one earnings forecast for the firm in a given year;
ForecastError	Analyst forecast error, defined as the 12-month average of the absolute values of analyst forecast error, calculated as actual earnings minus median forecast for a firm, deflated by stock price at the end of the previous fiscal year. We multiply forecast error by 100 for expositional purposes;
ForecastDispersion	Analyst forecast dispersion, defined as the 12-month average of standard deviation of analyst forecasts for a firm scaled by the stock price at the end of the previous fiscal year. We multiply forecast dispersion by 100 for expositional purposes;
HHI	Herfindahl index of 4-digit SIC industry where firm belongs, measured at the end of fiscal year;
HHI^2	The square term of *HHI*;

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