Does Conditional Accounting Conservatism Impede Corporate Innovation?*

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ABSTRACT: We examine the impact of conditional accounting conservatism on corporate innovation. We find that firms that exhibit a higher degree of conditional conservatism generate fewer patents. Their patents also generate fewer citations and lower economic benefits. The effects of conditional conservatism on innovation are more pronounced when firms' need for innovation is higher, when the product development cycle is longer, when managerial compensation is more dependent on accounting performance, or when managers are more myopic. Overall, our findings suggest that conditional conservatism curbs corporate innovation by exacerbating the effects of managerial myopia.

Key words: conditional conservatism; corporate innovation; managerial myopia

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I. INTRODUCTION

Corporate innovation has become an increasingly important element of corporate strategy that drives firms' long-term growth and competitiveness, but this topic has received relatively limited attention in the accounting literature. We study how accounting affects corporate innovation by examining the role of conditional conservatism in corporate innovation¹. The principle of conditional conservatism is to recognize losses as they become probable but delay the recognition of profits until there is a legal claim to the revenues generating them and that the revenues are verifiable. This accounting practice can help mitigate problems caused by moral hazard. Watts (2003a), for example, shows that conditional conservatism can act as an important governance mechanism that deters managers from undertaking negative net present value (NPV) projects by accelerating future investment losses into current earnings.

However, we argue that conditional conservatism can curb corporate innovation by exacerbating the effects of managerial myopia. Prior research shows that managers are under pressure to meet certain short-term accounting objectives (e.g., positive or increasing income or a certain level of earnings per share) and cut their R&D effort if R&D spending jeopardizes their ability to achieve these goals². Conditional accounting conservatism exacerbates the effects of this managerial myopia because the asymmetric treatment of good and bad news increases the likelihood of missing these targets and thus raises the propensity to reduce R&D effort. In the absence of conditional conservatism, managers who are under pressure to achieve short-term

accounting-based objectives may delay the recognition of bad news, and thus be able to avoid cutting investment in R&D for accounting reasons. Realizing the possibility that they may have to interrupt their effort (ex post), managers of firms with conservative accounting may decide (ex ante) to avoid multi-stage long-term innovative research projects with potentially large pay-offs if there is a risk that these projects will be discontinued or delayed due to negative economic shocks that are unrelated to R&D activities.³ This reasoning also suggests that the effect of conditional conservatism on innovation is exacerbated in firms where managers or shareholders are more myopic, such as those where managers' pay is more sensitive to accounting performance or where pressure from short-term institutional investors is greater.

Consistent with our predictions that conditional conservatism curbs corporate innovation (both quantitatively and qualitatively) when the typical manager is myopic, we find that it is negatively associated with the number of patents and patent citations. Firms with a greater degree of conditional conservatism also engage less in R&D activities but our main results hold after controlling for the level of R&D activities. These results are both economically and statistically significant, and robust to a variety of model specifications. We also perform a battery of tests to mitigate potential endogeneity concerns about the relation between conditional conservatism and innovation, and find that our conclusion remains unaffected. Among these tests, we estimate the time-series variation of conditional conservatism at the economy level exclusively for firms operating in industries in which there is no innovation (e.g., retail). This measure is by construction exogenous with respect to firm-level innovation decisions. We then use it in time-series tests for firms engaged in innovation. Our results do not change.

Further supporting our argument, we find that the negative effects of conditional conservatism on innovation are more pronounced when: 1) the product development cycle is longer (and thus more likely to be interrupted by a negative shock), 2) managers are subject to higher accounting performance pressure (i.e., CEO compensation is strongly linked to accounting performance), 3) managers or shareholders have shorter investment horizons (i.e., the distance to CEO retirement is shorter or short-term institutional ownership is larger), 4) managers have a higher degree of myopia, 5) it is more difficult for firms to manipulate their accruals, or 6) firms' need for innovation is higher (i.e., firms operating in innovative industries).

Finally, we find that inventions made by conservative firms are of lower quality than those made by "liberal" firms. Aside from generating fewer citations, we find that patents of firms with conservative accounting generate lower and more short-term cash-flows, trigger less positive stock market reaction to the news that they have been granted, and are less likely to be "blockbusters".

Our study contributes to the literature by considering how accounting properties affect investment decisions, particularly those related to intangible assets. Prior research such as Biddle and Hilary (2006) and Biddle, Hilary, and Verdi (2009) shows that high-quality reporting improves the investment process. In particular, as argued by Watts (2003a), conditional conservatism can reduce managerial incentives to invest in negative NPV projects. We extend this research by showing that a reporting property that is often desirable can also have a negative effect on the innovative nature of investment by setting a perverse incentive for managers, particularly at firms that are subject to high short-term performance pressure and those that rely heavily on innovation. Given that prior literature has already documented many positive attributes associated with

conditional conservatism (e.g., Watts, 2003a, b), we do not conclude that conditional conservatism is on balance a negative attribute. Rather, like most constructs, conditional conservatism is likely to have both positive and negative attributes. Thus, economic agents, such as regulators or firms, should optimize the level of conservatism to maximize their objective function. In most cases, this optimization yields an interior rather than a corner solution. In other words, it is unlikely that the optimal level of conservatism in most cases is either zero or the highest level possible allowed by the accounting technology. Instead, it is likely to be determined based on various trade-offs between the benefits and the costs of conservative accounting, which varies across firms and across periods. This optimization naturally requires a good understanding of the various trade-offs. We contribute to this understanding by considering a possible detrimental effect of conditional conservatism on innovation. Thus, our study is related to Roychowdhury (2010) who raises the issue regarding whether accounting conservatism leads managers to underinvesting in certain risky projects and to Kravet (2014) who provides empirical support for this possibility in mergers and acquisitions.

More specifically, we take both ex ante and ex post views. Previous research on real earnings management shows that managers behave opportunistically by cutting their expenditure on R&D to avoid missing certain accounting benchmarks. We extend this research by showing that opportunistic managerial behavior is aggravated when the level of conditional conservatism is high. In particular, we find that firms are more likely to cut R&D to reverse an earnings decline when their accounting is more conservative. More importantly, we find that this ex post behavior has consequences on the amount and the type of innovation projects that the firm elects to invest in ex ante, suggesting that conditionally conservative accounting leads to conservative innovation. The remainder of the paper proceeds as follows. We develop our main hypothesis in Section II. In Section III, we present our sample, summary statistics, and the construction of key variables. We discuss our main empirical results in Section IV and conduct further analyses in Section V. Section VI summarizes our findings and draws conclusions.

II. HYPOTHESIS DEVELOPMENT

Watts (2003a) defines conditional accounting conservatism as the differential verifiability required for recognition of losses versus profits. He also reasons that firms practice conservative accounting in response to economic demand for verifiable and timely information that mitigates agency problems in contracting, and in response to changes in the regulatory and litigation environments. Watts (2003a) further shows that conditional conservatism serves as an important governance mechanism in deterring managers from overinvesting in negative NPV projects.

We depart from this line of literature by considering whether conditional conservatism has an effect on managerial incentives to underinvest in R&D projects and whether it curbs innovation. It is important to note that the mechanism whereby conditional conservatism affects corporate innovation is not an asymmetric accounting treatment of R&D spending, but a combination of asymmetric accounting treatment of non-R&D activities and managerial myopia. Under the US Generally Accepted Accounting Principles (GAAP), R&D costs are typically expensed,⁴ and hence it is unlikely that conditional conservatism directly affects firms' accounting treatment of R&D costs.

We start with the premise that innovative projects are risky and multi-stage, and typically take years of continuous effort to deliver positive results (e.g., Holmstrom, 1989).⁵ To the extent

that her principal is well-informed and sufficiently patient (willing to wait for long-term benefits to materialize), a manager who is properly compensated for taking risk may decide to invest in projects with a large, albeit uncertain, pay-off. If equity can be viewed as a call option on the firm's assets, investing in such projects may be valuable for shareholders. However, if the firm's reporting system and incentive policy put pressure on managers to deliver minimum profitability in the short run, managers facing bad news that is unrelated to innovative activities may be tempted to cut investment in innovation when earnings would otherwise fall short of this minimum requirement.

In our setting, such managerial myopia does not arise from a cognitive bias; rather, the manager who tries to maximize the long-term value of the firm is subject to constraints that lead her "to focus more heavily on short-term profits rather than on long-term objectives" (Stein,1988). The existing analytical literature proposes several models built on this intuition and shows that myopia can be consistent with optimal contracting (e.g., von Thadden, 1995). This literature suggests the risk of losing employment (Fudenberg and Tirole, 1995), managerial compensation (Narayanan, 1985; Noe and Rebello, 1997), stock price pressure (Stein, 1988), and the need to cater to the short-term demands of transient investors (Bolton, Scheinkman, and Xiong, 2006) as the major sources of myopia. Although the origin of constraints that lead to managerial myopia is largely outside the scope of our study, we examine several settings in which it is more likely to be present in Section V.B.

The empirical literature suggests that corporate managers on average tend to be myopic and this myopia affects firms' innovation activities. For example, Graham, Harvey, and Rajgopal (2005) who survey a large number of CFOs in the US find that a majority of CFOs are willing to sacrifice long-term firm value to meet the desired short-term earnings targets. In particular, 80% of survey participants report that they would cut R&D as well as other discretionary expenditure to meet earnings targets. Baber, Fairfield, and Haggard (1991) find that R&D spending is significantly lower when it jeopardizes the ability to report positive or increasing income in the current period. Dechow and Sloan (1991) show that CEOs spend relatively less on R&D in their final years in office. Bens et al. (2003) show that managers cut R&D when earnings per share is diluted by managers' stock option exercises. Garcia Osma and Young (2009) find that the pressure to report positive levels and changes of earnings in a large sample of R&D-active UK firms leads to contemporaneous cuts in R&D expenditure.

From an accounting perspective, cutting R&D is different from cutting capital expenditures as reducing R&D increases pre-tax earnings immediately while the effect of reducing tangible investment is spread over the useful life of the assets. In addition, the benefits associated with innovation generally take longer to realize than those associated with capital expenditures, and thus are less likely to increase earnings above managers' short-term targets. This difference in accounting treatment and the lag in cash-flows make R&D spending a prime candidate for real earnings management.

The above mentioned evidence suggests that managers may decide (ex post) to cut investment in innovation to avoid missing an accounting benchmark, even if this means forgoing the benefits of prior investment in innovation. Such a decision would be economically costly but would improve reported earnings, at least in the short run. Realizing this possibility, rational but myopic managers may decide (ex ante) to avoid multi-stage innovative research projects if there

is a risk that these projects will be affected by an economic shock (unrelated to the R&D activity).

Empirically, it is also consistent with the survey results of Graham, Harvey, and Rajgopal (2005) that the accounting effect of an investment affects executives' decision to engage in that investment. The pressure on myopic managers to deliver short-term performance can be harmful for corporate innovation. Conditional accounting conservatism adds to this pressure by encouraging the early recognition of bad news, thus making it more likely that a firm misses certain pre-determined targets (e.g., earnings growth). In contrast, firms with more "liberal" accounting have greater leeway in avoiding the recognition of probable losses, and thus are better able to avoid cutting investment in R&D in a given period. In other words, while conditional accounting conservatism may not affect the extent of managerial myopia per se, it affects corporate innovation by making the short-term earnings targets more binding for managers, and thus pressuring myopic managers to deliver short-term performance.

Our analysis, like most empirical work outside macro-economics, is not couched in a general equilibrium framework. However, a general equilibrium analysis is consistent with market incompleteness. For example, in the model proposed by Aghion et al. (2005b), entrepreneurs can invest in either short-term or long-term productivity-enhancing projects (e.g., R&D): when financial markets are sufficiently incomplete, long-term investments are disrupted by an (idiosyncratic) shock ex post, which reduces entrepreneurs' willingness to engage in long-term investments ex ante.⁶ Our approach is similar to their analysis (i.e., R&D being one example of "long-term productivity-enhancing projects") but we focus on a within-firm transmission mechanism rather than the across-firm mechanism.

The arguments above suggest that firms with conservative accounting should be less innovative than firms with "liberal" accounting, leading to the following main hypothesis:⁷ H: Under the average condition of myopia, firms with a greater degree of conditional conservatism are less innovative than those with a lower degree of conditional conservatism.

Although we consider the effect of conditional conservatism on R&D expenditure in Section IV.B. we operationalize our analysis using patents (and patent citations) as the measure of innovation in our baseline specifications. Mansfield (1984) notes that the total R&D figures are hard to interpret because they include a heterogeneous mixture of activities. Specifically, he argues that "longterm projects are mixed up with short-term projects. Projects aimed at small product and process improvements are mixed up with projects aimed at major new processes and products. Process R&D is mixed up with product R&D."⁸ He further adds that "many firms tend to concentrate on short-term, technically safe R&D." For the reasons discussed above, we posit that firms with more conditionally conservative accounting focus on development activities associated with small product and process improvements, while their more "liberal" counterparts focus on R&D projects involving major new processes and products. Given the costs associated with obtaining a patent (Horstmann, MacDonald, and Slivinski, 1985).⁹ we would expect the former type of R&D activities to generate fewer patents for a given level of R&D expenditure. Consistent with this view, the prior literature (e.g., Moser, 2009; de Rassenfosse, 2010) suggests that the propensity to patent (for a given R&D effort) increases with the value of the patent. In essence, firms are more likely to patent an invention when the benefits exceed the costs. To the extent that inventions of conservative firms are less influential than those of "liberal" firms, we further expect the patents of

such firms to have a lower impact on citations, future cash flows, and stock prices.

Finally, it should be noted that in our hypothesis, the mechanism through which conditional conservatism affects innovation is the short-term pressure faced by the managers to meet earnings targets or some other forms of managerial myopia. We thus expect the effect to be more pronounced when the product development cycle is longer, when short-term accounting pressure is greater, or when managers are more myopic. We discuss these testable predictions in greater detail in Section V.B.

III. SAMPLE, VARIABLE DEFINITIONS, AND SUMMARY STATISTICS

A. Sample

We obtain information on patents from the NBER Patent and Citation Database. This database was developed by Hall, Jaffe, and Trajtenberg (2001) and contains detailed information on all US patents granted by the US Patent and Trademark Office (USPTO) from 1976 to 2006. According to Hall, Jaffe, and Trajtenberg (2001), the average length between the day the patent is filed and the day the patent is granted is approximately two years. Since the NBER Patent and Citation Database only covers patents granted, the coverage of the patents filed in 2004 and 2005 is partial. To minimize the potential effect of incomplete coverage, we follow Hall, Jaffe, and Trajtenberg (2001) and stop our sample period in 2003. We obtain accounting data from the Compustat database and stock price and return data from the CRSP database. Following previous studies, we use the application year to merge the Compustat and the NBER Patent and Citation databases, since the grant year is likely to be distant from the actual planning of the R&D associated with the patent (e.g., Griliches, Pakes, and Hall, 1988). We exclude firms in financial (SIC codes 6000-6999) and utility (SIC codes 4900-4999) industries from the sample (e.g., Atanassov, 2013). Also excluded are firms operating in industries without any registered patents in any year in the entire NBER Patent and Citation Database, although our results are not sensitive to this exclusion. These restrictions result in a final sample of 70,871 firm-year observations between 1976 and 2003.

B. Measures of Innovation

We employ three measures of innovation. The first measure is the number of patents applied for by a firm in a given year (Patent). Patent counts, however, imperfectly capture innovation success because patents vary drastically in their technological and economic significance. We therefore follow Hall, Jaffe, and Trajtenberg (2001, 2005) and use forward citations of a patent to measure its quality (importance). However, the raw citation counts suffer from truncation bias due to the finite length of the sample. As patents receive citations from other patents over a long period of time, patents in the later years of the sample have less time to accumulate citations. We thus use two methods to deal with this truncation bias. First, we adjust each patent's raw citation counts by multiplying it with the weighting index of Hall, Jaffe, and Traitenberg (2001, 2005) provided in the NBER database. We then define Qcitation as the sum of the adjusted citations across all patents applied for during each firm-year. Second, we adjust the raw citation counts using the fixed-effect approach, which involves scaling the raw citation counts by the average citation counts of all patents applied for in the same year and in the same technology class. The fixed-effect approach accounts for the differing propensity of patents in different years and in different technology classes to cite other patents. We use Tcitation to denote the sum of the adjusted citations during each firm-year under this alternative adjustment

approach.

C. Measures of Conditional Accounting Conservatism

We use Khan and Watts' (2009) C_Score as our baseline measure of conditional conservatism because it is fairly common in the literature and because it provides firm-year estimates. Khan and Watts (2009) show that C_Score captures the timing of conditional conservatism changes and the variation of conditional conservatism across firms with different determinants of conditional conservatism, such as the probability of litigation and information asymmetry among investors. A higher value of C_Score corresponds to a greater degree of conservatism. However, as any empirical proxy, C_Score is potentially subject to measurement errors. Thus, as robustness checks, we follow Patatoukas and Thomas (2011) and consider multiple alternative measures in Section IV.B to mitigate the concern that our results are driven by potential measurement errors. Note that some of these measures are defined at the economy- level and are not subject to cross-sectional variations. This mitigates the risk that our results are driven by firm-specific omitted variables or by firm-specific reverse causality. For the sake of brevity, we define all the conditional conservatism measures in Appendix A1 and describe their results in Section IV.B.

D. Control Variables

To isolate the effect of conditional conservatism on innovation, we control for an array of firm characteristics that have been shown by previous studies to influence innovation. The first control variable is R&D expenses scaled by total assets (R&D/Assets), which serves as an important input to innovation (Atanassov, 2013).¹⁰ We also control for firm size measured as the log of total assets, Ln(Assets). To control for the effect of a firm's life cycle on its innovation ability, we employ Ln(Firm age), the natural log of firm age, which is the number of years elapsed since a firm enters the CRSP database. Following Hall and Ziedonis (2001), we control for capital intensity measured as the log of property, plant, and equipment divided by the number of employees (Ln(PPE/#Employees)). Return on assets (ROA) is included to capture operating profitability. Also included are Sales growth and the market-to-book ratio (MB) as proxies for growth opportunities. The cash-to-assets ratio (Cash/Assets) and the leverage ratio (Leverage) are added to account for the effects of cash holdings and capital structure on innovation. Chan, Lakonishok, and Sougiannis (2001) show that R&D intensive firms are associated with higher stock return volatility. Therefore, we include the standard deviation of daily stock returns over the past fiscal year (Stock volatility) as an additional control variable. Since He and Tian (2013) document a negative impact of analyst coverage on innovation, we also control for analyst coverage using the number of analysts making earnings forecast in a given year. Finally, Aghion et al. (2005a) document an inverted-U relationship between product market competition and innovation. Accordingly, we include the Herfindahl index calculated at the three-digit SIC industry (Herfindahl) and its squared term (Herfindahl²) in the regressions. All control variables are winsorized at the 1% level at both tails of their distributions and measured at t-1 in the regressions. Dollar values are converted into 2000 constant dollars using the GDP deflator.

E. Summary Statistics

Table I presents summary statistics for variables used in the regression analyses. Panel A indicates that, on average, firms in our sample register slightly less than 6 patents per year but the median is zero. The skewness also exists when we consider the number of citations. The average number of citations across all firms in our sample is greater than 107, while the median

is zero. Untabulated results indicate that the autocorrelation of the C_Score is 0.5, suggesting that conditional conservatism displays some temporal variation but remains fairly stable for a given firm. Panel B presents descriptive statistics of C_Score and the control variables used in the regressions. The statistics are generally consistent with the prior literature (e.g., Atanassov, 2013; Cornaggia et al., 2013).

The sample consists of firm-years covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. C_Score is Khan and Watts' (2009) measure of conditional conservatism defined in Appendix A1. Patent is the number of patents applied for. Citation is total number of citations summed across all patents applied by the firm during the year Qcitation and Tcitation are patent citations adjusted using the weighting index of Hall, Jaffe, and Trajtenberg (2001, 2005) and the method of time-technology class fixed effect, respectively. R&D/Assets is R&D expenses scaled by the book value of total assets. Assets is the book value of total assets. Firm age is the number of years elapsed since a firm enters the CRSP database. PPE/#employees is net Property, Plant, and Equipment (PPE) scaled by the number of employees. ROA is EBITDA/Assets. Sales growth is the log value of one plus the change in net sales scaled by lagged net sales. MB is the ratio of market value of equity over book value of equity. Cash/Assets is the cash-to-assets ratio. Leverage is (Short-term debt + Long-term debt)/Assets. Stock volatility is the standard deviation of daily stock returns over the fiscal year. Analyst coverage is one plus the number of analysts making earnings forecast in a given year. Herfindahl index is computed based on the three-digit SIC code. All variables are winsorized at the 1% level at both tails of the distribution. Dollar values are converted into 2000 constant dollars using the GDP deflator.

Variables		Deviation	x -		x -
	(1)	(2)	(3)	(4)	(5)
Panel A: Innovation measures					
Patent (raw)	5.71	18.13	0.00	0.00	1.00
Citation (raw)	107.50	810.56	0.00	0.00	7.00
Qcitation	180.76	1495.95	0.00	0.00	13.17
Tcitation	14.00	99.36	0.00	0.00	1.19
Panel B: Firm characteristics					
C_Score	0.10	0.12	0.04	0.10	0.17
R&D/Assets	0.04	0.08	0.00	0.00	0.05
Assets (\$millions)	1,965.78	6,456.80	60.27	213.12	916.16
Firm age (Years)	15.69	14.71	5.0	11.0	20.0
PPE/#Employees (\$thousands)	112.27	319.40	18.01	32.54	69.05
ROA	0.06	0.18	0.03	0.09	0.14
Sales growth	0.14	0.34	0.00	0.11	0.23
MB	2.86	4.00	1.04	1.73	3.02
Cash/Assets	0.15	0.18	0.02	0.07	0.20
Leverage	0.22	0.18	0.06	0.20	0.34
Stock volatility	0.03	0.02	0.02	0.03	0.04
Analyst coverage	4.86	6.75	0.00	2.00	7.00
Herfindahl	0.20	0.17	0.09	0.14	0.24

Table I. Summary statistics

Panel C: Mean C_Score and patent/citation counts for different C_Score groups						
C_Score groups	C_Score	Patent	Citation	Qcitation	Tcitation	
Lowest	-0.03	18.89	419.58	735.37	55.64	
2	0.04	5.17	64.32	94.14	7.88	
3	0.10	2.37	27.18	39.79	3.35	
4	0.15	1.42	18.31	24.12	2.14	
Highest	0.24	0.70	7.84	9.94	0.96	
Lowest - Highest	0.27	18.2	411.7	725.4	54.7	
(p-value of t-test)	(< 0.01)	(< 0.01)	(< 0.01)	(< 0.01)	(< 0.01)	

In Panel C we split the sample into five groups according to the value of C_Score. Results indicate that the numbers of patents and patent citations increase monotonically as C_Score decreases. For example, the mean number of patents in the most conservative group is close to zero but approaches 20 in the least conservative group. Similarly, as we move from the most conservative to the least conservative group, the mean number of citations increases from about 8 to 420. The results using Qcitation and Tcitation are similar. In all cases, the difference between the two extreme quintiles is statistically significant with a p-value below 0.01. These preliminary univariate results are consistent with our main hypothesis.

The sample consists of firm-years covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. C_Score is Khan and Watts' (2009) measure of conditional conservatism defined in Appendix A1. Patent is the number of patents applied for. Qcitation and Tcitation are patent citations adjusted using the weighting index of Hall, Jaffe, and Trajtenberg (2001, 2005) and the method of time-technology class fixed effect, respectively. R&D/Assets is R&D expenses scaled by the book value of total assets. Assets is the book value of total assets. Firm age is the number of years elapsed since a firm enters the CRSP database. PPE/#employees is net Property, Plant, and Equipment (PPE) scaled by the number of employees. ROA is EBITDA/Assets. Sales growth is the log value of one plus the change in net sales scaled by lagged net sales. MB is the ratio of market value of equity over book value of equity. Cash/Assets is the cash-to-assets ratio. Leverage is (Short-term debt + Long-term debt)/Assets. Stock volatility is the standard deviation of daily stock returns over the fiscal year. Analyst coverage is one plus the number of analysts making earnings forecast in a given year. Herfindahl index is computed based on the three-digit SIC code. All variables are winsorized at the 1% level at both tails of the distribution. Correlations significant at the 5% level are in bold.

Table II. Pearson correlation matrix

Variable	Ln(1+ Patent)	Ln(1+ Ocitation)	Ln(1+ Tcitation)	C_Score	R&D/ Assets	Ln(PPE/ #Employees)	Leverage	Cash/Assets	Ln(Assets)	ΜВ	Sales growth	Stock volatility	ROA	Ln(Analyst coverage)	Ln(Firm age)
Ln(1+Qcitation)	0.940														
Ln(1+Tcitation)	0.964	0.966													
C_Score	-0.315	-0.308	-0.313												
R&D/Assets	0.151	0.165	0.140	0.044											
Ln(PPE/#Employees)	0.103	0.072	0.091	-0.172	-0.096										
Leverage	-0.064	-0.081	-0.063	0.103	-0.265	0.247									
Cash/Assets	0.012	0.024	0.008	0.040	0.472	-0.122	-0.442								
Ln(Assets)	0.445	0.376	0.419	-0.493	-0.254	0.364	0.212	-0.269							
MB	0.032	0.034	0.031	-0.141	0.298	-0.006	0.011	0.212	-0.140						
Sales growth	-0.035	-0.020	-0.026	-0.051	0.037	-0.010	-0.003	0.073	-0.061	0.154					
Stock volatility	-0.183	-0.183	-0.181	0.395	0.329	-0.135	-0.066	0.290	-0.486	0.174	0.040				
ROA	0.068	0.070	0.074	-0.208	-0.547	-0.011	0.007	-0.306	0.290	-0.261	0.066	-0.458			
Ln(Analyst coverage)	0.375	0.349	0.366	-0.407	-0.002	0.209	-0.026	-0.040	0.652	0.038	0.007	-0.250	0.176		
Ln(Firm age)	0.294	0.257	0.275	-0.197	-0.187	0.074	0.056	-0.261	0.441	-0.163	-0.222	-0.365	0.187	0.246	
Herfindahl	-0.005	0.004	-0.002	-0.018	-0.152	-0.008	0.043	-0.121	0.021	-0.057	-0.038	-0.104	0.078	-0.046	0.087

Table II reports the correlations among C_Score, innovation measures, and control variables. Most pair-wise correlations are significantly different from zero at the 1% level. As expected, our three measures of innovations, (Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation)), are highly correlated with each other. Consistent with our hypothesis, C_Score is negatively correlated with all three measures of innovations (correlation coefficients of approximately -0.3). The correlation between C_Score and R&D intensity is positive but its magnitude is relatively small at 0.04. In addition, as discussed below, we observe an opposite relation once we control for other firm characteristics such as firm size and performance. Not surprisingly, R&D intensity is positively correlated with our measures of innovation but, consistent with Mansfield (1984), the relation is relatively modest (correlation coefficients of approximately 0.15). Although interesting, these unconditional relations require more refined multivariate tests, which we turn to next.

IV. MAIN EMPIRICAL RESULTS A. Baseline Results

We start our multivariate analysis by estimating the following model:

 $Ln(1+Innov_{i,t}) = \alpha + \beta C_Score_{i,t-1} + \gamma X_{i,t-1} + \delta Industry_{i,t} + \theta Year_{t} + \varepsilon_{i,t}, \quad (1)$

where Innov_{i,t} refers to our innovation measures (Patent, Qcitation, and Tcitation) of firm i in year t. To reduce the skewness of our innovation measures, we use the log of one plus these variables in the regression analyses. We measure C_Score at the end of year t-1. X represents the set of control variables defined in Section III.D. We also include two-digit SIC industry and year fixed effects in the model. The standard errors of the estimated coefficients allow for clustering of observations by firm but our conclusions are not affected if we allow clustering by both firm and year.

We present our baseline results in Table III. We find that C_Score is negatively and significantly related to all three measures of innovations, Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation), with t-statistics of -5.4, -6.3, and -6.6, respectively. These results are consistent with our hypothesis that when managers are myopic on average, firms with a greater degree of conditional conservatism are less innovative than those with a lower degree of conditional

conservatism. In terms of economic significance, increasing C_Score from the 1st quartile (0.04) to the 3rd quartile (0.17) decreases the values of Patent, Qcitation, and Tcitation by 5%, 8%, and 5% from their respective means.¹¹ The mean Variance Inflation Factor (VIF) is below 2, suggesting that multicollinearity is not an issue in our setting.¹²

The sample consists of firm-years jointly covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. C_Score is Khan and Watts' (2009) measure of conditional conservatism defined in Appendix A1. Patent is the number of patents applied for. Qcitation and Tcitation are patent citations adjusted using the weighting index of Hall, Jaffe, and Trajtenberg (2001, 2005) and the method of time- technology class fixed effect, respectively. R&D/Assets is R&D expenses scaled by the book value of total assets. Assets is the book value of total assets. Firm age is the number of years elapsed since a firm enters the CRSP database. PPE/#employees is net Property, Plant, and Equipment (PPE) scaled by the number of employees. ROA is EBITDA/Assets. Sales growth is the log value of one plus the change in net sales scaled by lagged net sales. MB is the ratio of market value of equity over book value of equity. Cash/Assets is the cash-to-assets ratio. Leverage is (Short-term debt + Long-term debt)/Assets. Stock volatility is the standard deviation of daily stock returns over the fiscal year. Analyst coverage is one plus the number of analysts making earnings forecast in a given year. Herfindahl index is computed based on the three-digit SIC code. Constant terms are included but not reported. The t-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Stock volatility	+	4.181***	5.087***	4.376***
		(9.5)	(6.6)	(9.5)
Ln(Analyst coverage)	-	0.071***	0.191***	0.096***
		(3.8)	(6.3)	(4.9)
Herfindahl	+	0.144	0.406	0.166
-		(0.8)	(1.3)	(0.9)
Herfindahl ²	-	-0.019	-0.181	-0.042
		(-0.1)	(-0.5)	(-0.2)
Industry and year fixed effects		Yes	Yes	Yes
N/ Adjusted R ²		70,871/0.43	70,871/0.40	70,871/0.40
Ln(Firm age)	+	0.140***	0.215***	0.134***
		(10.3)	(9.7)	(9.6)
Ln(PPE/#Employees)	+	0.006	0.014	0.006
		(0.5)	(0.6)	(0.5)
ROA	+	0.180***	0.432***	0.193***
		(3.8)	(4.8)	(3.8)
MB	+	0.017***	0.026***	0.017***
		(10.1)	(8.6)	(9.4)
Sales growth	+	0.006	0.037*	0.017
		(0.5)	(1.7)	(1.4)
Leverage	-	-0.395***	-0.673***	-0.394***
-		(-7.5)	(-7.4)	(-7.2)
Cash/Assets	+	0.156***	0.347***	0.154***
		(3.1)	(3.7)	(2.8)

Table III. Effect of C_Score on innovation outputs

Turning to the control variables, we find that most of their coefficients have the expected

signs. For example, firms that engage in more R&D activities innovate more. Firms with more resources (high cash holdings and high ROA), higher market-to-book ratio, or greater stock volatility are also more innovative.¹³

B. Robustness Checks

We perform a number of additional tests to ensure that our baseline results are robust to alternative model specifications and different variable definitions.

First, we show our results are robust to alternative measures of conditional conservatism. For the sake of brevity, we only tabulate the coefficients of key variables in Appendix B. Specifically, our results hold when (A) using the modified C_Score estimated with pre-R&D earnings in Khan and Watts' (2009) model to mitigate the concern that the estimated C_Score is influenced by R&D intensity; (B) using the modified C_Score proposed by Banker et al. (2012) to account for the effect of cost stickiness on conditional conservatism; (C) using Basu's (1997) measure; (D) using the conditional conservatism measure proposed by Callen, Segal, and Hope (2010); (E) using the negative non-operating accruals as an alternative measure of conservatism (as in Givoly and Hayn, 2000 and Ahmed and Duellman, 2007); (F) using the modified model of Basu (1997) proposed by Francis and Martin (2010); (G) using the modified model of Basu (1997) proposed by Ball, Kothari, and Nikolaev (2013); (H) using the model of Ball and Shivakumar (2006). It should be noted that the measures in Panels D and H do not rely on stock market prices, thus are less subject to the concern of inefficient capital markets.

Second, we consider a host of specification checks. For the sake of brevity, we only tabulate the coefficients of key variables in Appendix C. We find that our results hold when (A) running negative binomial regressions (instead of OLS regressions) to address the issue that patent and citation counts are non-negative and discrete;¹⁴ (B) using R&D/Assets as the dependent variable to measure R&D intensity in order to obtain a measure independent of the patent database;¹⁵ (C) using as the dependent variable, the average citations per patent (rather than total citations of all patents); (D) excluding firm-years with zero patents and citations; (E) excluding firms engaging in mergers and acquisitions (identified using the SDC M&A database) in the previous two years and those with acquired R&D and software development costs;¹⁶ (F) removing firms with high R&D intensity (defined as firms with a ratio of R&D expenditures to sales greater than 33%) because they may not have significant non-R&D activities (potentially subject to asymmetric accounting treatment) and thus their innovation is less likely to be affected by conditional conservatism. Furthermore, in untabulated tests, we address the potential non-linearity effect or the "scale effect" (i.e., the fact that several independent variables are scaled by total assets but not the dependent variables), and find that our main results are unaffected.¹⁷

C. Endogeneity

While we document a strong negative association between conditional conservatism and innovation output, the results are potentially subject to two types of endogeneity, omitted variable and reverse causality running from innovation to conservatism. We perform a battery of tests to alleviate these concerns. In performing these tests, we note that the degree of conditional conservatism can be affected by 1) firm-specific factors other than innovation (e.g., the desire to minimize the cost of capital (Garcia Lara, Garcia Osma, and Penalva, 2011) and 2) the need to deal with the constraints coming from the regulatory and litigation environment. These factors provide sources of exogeneity that we exploit below.

The sample consists of firms jointly covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. Patent is the number of patents applied for. Qcitation and Tcitation are patent citations adjusted using the weighting index of Hall, Jaffe, and Trajtenberg (2001, 2005) and the method of time-technology class fixed effect, respectively. Basu_NoPAT and Basu_NoRD are Basu's (1997) yearly measures of conservatism constructed respectively using only industries that have no registered patent during the entire sample period and only firms that report no R&D expenses. R&D/Assets is R&D expenses scaled by the book value of total assets. Other control variables are defined in Table III of the manuscript. The regressions in Panel B include several additional macroeconomic variables that measure economy-wide performance and risk aversion in the regressions in Panel A. Per capita GDP growth is the growth rate of per capita GDP from year t to t-1. Corporate profits growth is the growth rate of corporate profits from year t to t-1. Stock market risk premium is the annual stock market return less risk-free rate. Debt market default spread is the difference in default spreads for bonds with Moody's Baa rating and Aaa rating. Constant terms are included but not reported. The t-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table IV. Reestimation of regressions using aggregate value of conditional conservatism for noninnovative firms

Dependent variables	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)
Basu_NoPAT	-0.095***	-0.111***	-0.105***			
	(-6.5)	(-4.0)	(-6.8)			
Basu_NoRD				-0.224***	-0.614***	-0.287***
				(-7.1)	(-9.7)	(-8.3)
R&D/Assets	2.122***	4.164***	2.048***	2.183***	4.270***	2.116***
	(15.6)	(16.1)	(13.8)	(15.9)	(16.4)	(14.2)
Ln(Assets)	0.293***	0.409***	0.274***	0.300***	0.424***	0.283***
	(22.4)	(20.5)	(20.1)	(23.8)	(22.0)	(21.5)
Ln(Firm age)	0.136***	0.207***	0.130***	0.132***	0.199***	0.125***
	(10.1)	(9.3)	(9.3)	(9.8)	(8.9)	(9.0)
Ln(PPE/#Employees)	-0.001	-0.001	-0.002	-0.007	-0.015	-0.010
	(-0.1)	(-0.1)	(-0.2)	(-0.6)	(-0.7)	(-0.8)
ROA	0.213***	0.517***	0.234***	0.238***	0.559***	0.263***
	(4.5)	(5.8)	(4.6)	(5.0)	(6.2)	(5.1)
MB	0.018***	0.028***	0.018***	0.018***	0.028***	0.018***
	(10.6)	(9.3)	(10.0)	(10.6)	(9.4)	(10.0)
Sales growth	0.029**	0.114***	0.050***	0.024**	0.106***	0.045***
	(2.6)	(5.2)	(4.1)	(2.2)	(4.9)	(3.7)

Panel A: Using Basu's (1997) yearly measures of conservatism constructed using a subsample of firms with no patenting activities or R&D.

Leverage	-0.410***	-0.662***	-0.402***	-0.405***	-0.651***	-0.397***
	(-8.0)	(-7.3)	(-7.4)	(-7.9)	(-7.2)	(-7.4)
Cash/Assets	0.127**	0.240**	0.110**	0.112**	0.211**	0.094*
	(2.5)	(2.6)	(2.0)	(2.2)	(2.2)	(1.7)
Stock volatility	1.684***	-1.992***	0.939**	1.528***	-2.094***	0.800**
	(4.8)	(-3.0)	(2.5)	(4.4)	(-3.2)	(2.1)
Ln(Analyst coverage)	0.070***	0.212***	0.100***	0.050***	0.175***	0.077***
	(3.8)	(7.1)	(5.2)	(3.0)	(6.4)	(4.4)
Herfindahl	0.208	0.715**	0.277	0.195	0.674**	0.264
2	(1.2)	(2.3)	(1.5)	(1.1)	(2.2)	(1.4)
Herfindahl	-0.074	-0.481	-0.148	-0.092	-0.494	-0.165
	(-0.3)	(-1.3)	(-0.6)	(-0.4)	(-1.3)	(-0.7)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N/Adjusted R-squared	68,778/0.43	08,778/0.38	68,778/0.39	70,744/0.42	70,744/0.38	70,744/0.38
Dependent variables	Ln(1+Patent) Ln(1+Qcitatio	n) Ln(1+Tcitatio	n) Ln(1+Paten	t) Ln(1+Qcitatio	n) Ln(1+Tcitation)
Basu_NoPAT	-0.039***	-0.065**	-0.043***			
	(-3.0)	(-2.6)	(-3.1)			
Basu_NoRD				-0.193***	-0.715***	-0.282***
				(-6.3)	(-10.9)	(-8.3)
R&D/Assets	2.156***	4.234***	2.090***	2.192***	4.302***	2.131***
	(15.7)	(16.3)	(14.0)	(15.9)	(16.5)	(14.3)
Ln(Assets)	0.294***	0.411***	0.276***	0.302***	0.430***	0.286***
	(22.3)	(20.4)	(20.0)	(23.7)	(22.2)	(21.6)
Ln(Firm age)	0.134	0.205	0.127	0.132	0.200	0.125
	(9.9)	(9.1)	(9.1)	(9.6)	(9.0)	(9.0)
Ln(PPE/#Employees)	-0.001	-0.006	-0.004	-0.004	-0.011	-0.006
	(-0.1)	(-0.3)	(-0.3)	(-0.3)	(-0.5)	(-0.5)
ROA	0.226***	0.548***	0.250***	0.234***	0.568***	0.261***
	(4.8)	(6.1)	(4.9)	(5.0)	(6.3)	(5.1)
MB	0.018***	0.027***	0.018***	0.018***	0.028***	0.019***
	(10.7)	(9.0)	(10.0)	(10.9)	(9.3)	(10.3)
Sales growth	0.028**	0.111***	0.049***	0.027**	0.108***	0.047***
	(2.5)	(5.1)	(4.0)	(2.4)	(4.9)	(3.9)
Leverage	-0.409***	-0.648***	-0.401***	-0.419***	-0.671***	-0.414***
	(-7.8)	(-7.1)	(-7.3)	(-8.1)	(-7.4)	(-7.7)
Cash/Assets	0.123**	0.233**	0.106*	0.114**	0.213**	0.096*
	(2.4)	(2.5)	(1.9)	(2.2)	(2.3)	(1.8)
Stock volatility	2.026***	-1.492**	1.350***	2.129***	-1.118*	1.510***
	(5.6)	(-2.2)	(3.5)	(5.9)	(-1.7)	(3.9)
Ln(Analyst coverage)	0.070***	0.208***	0.099***	0.056***	0.177***	0.082***
	(3.8)	(7.0)	(5.1)	(3.3)	(6.4)	(4.6)

Herfindahl	0.209	0.731**	0.282	0.193	0.672**	0.260
	(1.2)	(2.3)	(1.5)	(1.1)	(2.2)	(1.4)
Herfindahl ²	-0.091	-0.529	-0.170	-0.086	-0.489	-0.158
	(-0.4)	(-1.4)	(-0.7)	(-0.4)	(-1.3)	(-0.7)
Per capita GDP growth	1.174***	2.447***	1.445***	1.882***	3.836***	2.242***
	(3.9)	(4.3)	(4.6)	(6.4)	(7.0)	(7.3)
Corporate profits growth	0.108***	0.033	0.117***	0.146***	0.117**	0.162***
	(4.3)	(0.6)	(4.3)	(5.9)	(2.3)	(5.9)
Stock market risk	-0.029**	-0.242***	-0.066***	-0.001	-0.206***	-0.039**
	(-2.3)	(-9.5)	(-4.7)	(-0.1)	(-7.1)	(-2.4)
Debt market default	0.081***	0.043	0.087***	0.115***	0.115***	0.127***
	(4.4)	(1.3)	(4.5)	(6.5)	(3.5)	(6.8)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N/Adjusted R-squared	68,778/0.43	68,778/0.38	68,778/0.39	70,744/0.43	70,744/0.38	70,744/0.39

We first estimate Basu's (1997) yearly measure of conditional conservatism using only noninnovative firms that are defined as either 1) firms in the industries that have no registered patent during the entire sampling period or 2) firms that report no R&D expenses. We then replace C_Score with these two modified Basu's (1997) measures (Basu_NoPAT or Basu_NoRD) in equation (1), and report the regression results in Panel A of Table IV. Since this measure is constant across firms per year, the reverse causality would have to come from an aggregate relation at the economy level in time series (running from aggregate innovation to aggregate conservatism). However, since this measure of conditional conservatism is estimated using only non-innovative firms, the relation running from innovation to conservatism cannot be causal. At worst, these results can only be explained by omitted macro-economic variables that affect both conservatism of non-innovative firms and innovation of innovative firms. However, the results reported in Panel B of Table IV indicate that further controlling for the macro-economic conditions does not alter our conclusion, suggesting that this bias is unlikely to drive our results.¹⁸

All regressions include the same control variables as those used in Table III, but their coefficients are not tabulated. The detailed definitions for additional control variables in Panels E-G are defined in Appendix A2. In Panel M, the high litigation risk indicator equals one if the year belongs to the 1983-1990 period and zero if the year belongs to 1976-1982 period. The t-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table V. Further tests for endogeneity

Dependent variables	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)
(A): Estimating a pure cross-section	nal specification (i.e.,	, one observation per firm): N = 10,588	
C_Score	-0.475***	-1.458***	-0.665***
	(-5.1)	(-8.3)	(-6.9)
(B): Controlling for firm fixed effect	rts: N = 70,871		
C_Score	-0.049*	-0.173***	-0.094***
	(-1.7)	(-2.8)	(-2.9)
(C): Controlling for CEO fixed effe	cts: N = 11,290		
C_Score	-0.302**	-0.560*	-0.290*
	(-2.1)	(-1.8)	(-1.7)
(D): Excluding the tech bubble (19)	98-2000) and the post	t-SOX (2002-2003) periods: N = 53,597	
C_Score	-0.338***	-0.581***	-0.394***
	(-5.8)	(-5.6)	(-6.6)
(E): Controlling for proxies for risk	t aversion: N = 10,18	4	
C_Score	-1.079***	-3.691***	-1.511***
	(-4.7)	(-8.9)	(-6.2)
(F): Controlling for proxies for bac	l news: N = 15,818		
C_Score	-0.851***	-2.865***	-1.282***
	(-5.1)	(-9.4)	(-7.2)
(G): Controlling for other variable.	s that are potentially	correlated with conservatism: N = 7,04	9
C_Score	-0.722**	-1.341**	-0.942**
	(-2.0)	(-2.2)	(-2.5)
(H): Controlling for all additional	variables in (E) (F) a	nd (G): $N = 3,449$	
C_Score	-0.785*	-1.938***	-0.863**
	(-1.9)	(-2.7)	(-2.0)
(I): Using C_Score lagged four yea	rs rather than one ye	ar: N = 45,011	
C_Score	-0.148*	-0.265**	-0.184**
	(-2.0)	(-2.0)	(-2.3)
(J): Using a panel vector autoregre	ssive (pVAR) approa	ch: N = 27,655	
Effect of	past C_Score on inno	vation measures (a_2 in equation (2))	
C_Score_{t-1}	-0.092*	-0.321**	-0.168***
500	(-1.9)	(-2.8)	(-2.9)
Effect of j	past innovation meas	ures on C_Score (β_1 in equation (3))	
Innov _{t-1}	-0.002	-0.001	-0.002
	(-1.3)	(-1.5)	(-1.3)
(K): Using C_Score instrumented u	sing the distance bet	ween firms and SEC regional offices: N	= 38,494
C_Score	-0.283****	-0.577***	-0.343***
	(-0.1)	(-0.9)	(-7.0)
(L): Using SAB 101 as a natural ex	periment: $N = 70,871$	0.11.1000	0 117+++
SAB 101	-0.052***	-0.414***	-0.11/***
// // · · · · · · · · · · · · · · · · ·	(-5.4)	(-15.5)	(-7.4)
(M): Using an indicator to denote h	ugn litigation risk ass	sociated with accounting conservatism:	N = 51,081
Fign intigation indicator	-0.099***	-0.15 /***	-0.112***
	(-).6)	(-3.2)	(-0.4)

Panels A-I of Table V show the results from additional tests that address the issues related to omitted variables that may affect both innovation and conditional conservatism. In Panel A, we use the time-series averages of all the variables over our sample period in estimating equation (1) (i.e., estimate a pure cross-sectional specification using one observation per firm) to mitigate the concern in time series. We note that the fact that our results hold with Basu's (1997) conservatism measure (Panel C of Appendix B), which is constant across firms in a given year, rules out the possibility that our results are driven by a purely cross-sectional omitted variable.

We include as the measures of macro-economic conditions the annual per capita GDP growth rates, the aggregate corporate profits growth rates compiled by the Bureau of Economic Analysis, the stock market risk premium, and the debt market default spread. Estimating Basu's (1997) metrics or C_Score at the industry-year level does not affect our conclusions (untabulated). In Panels B and C, we include firm and CEO fixed effects in the regressions, respectively, to account for time-invariant omitted firm- and CEO-specific characteristics.¹⁹ In Panel D, we remove the tech

bubble (1998-2000) and the post-SOX (2002-2003) periods to mitigate the risk that any regime shifts over these periods affect both innovation and conditional conservatism.

In Panel E, we control in equation (1) for 7 additional variables that measure managers' "risk aversion." In Panel F, we control for 7 additional variables that capture firms' "bad news." In Panel G, we include 10 additional control variables that proxy for financial constraints, corporate governance, CEO incentives and overconfidence, and tax incentives, respectively. In Panel H, we include all these variables in the same regression. Due to missing variable problems, the analyses in these panels are conducted with a smaller sample of 3,449 firm-year observations. We find that results are qualitatively similar. In untabulated tests, we also find that results are robust to controlling for alternative measures of financial constraints such as Kaplan and Zingales' (1997) index, Whited and Wu's (2006) index, and a dividend payer indicator, and other firm characteristics such as the market leverage ratio, board size, the percentage of independent directors, the percentage of institutional ownership, operating cash flows scaled by assets, aggregate corporate profit growth rates compiled by the Bureau of Economic Analysis, asymmetric sensitivity of R&D to bad news, stock market risk premiums, and debt market default spreads. In Panel I, we use C_Scoret-4, instead of C_Scoret-1, as the key explanatory variable, because more distantly lagged values of C_Score should be less correlated with current omitted firm characteristics. Appendix A2 describes the detailed definitions of these variables. Similar results are obtained.20

Panels J-M of Table V show the results from tests that address issues related to reverse causality. First, we include our innovation measures (Innov) lagged one period as an additional control to account for the impact of past innovation on conditional conservatism, and find similar results (untabulated).²¹ In addition, we use a panel vector autoregressive (pVAR) approach that estimates the following two-equation reduced-form model with the General Method of Moments (GMM) approach.²²

$$Inmov_{i,t} = \alpha_0 + \alpha_1 Inmov_{i,t-1} + \alpha_2 C _Score_{i,t-1} + \alpha_3 Controls_{i,t-1} + f_i + x_t + \varepsilon_{i,t}$$
(2)

$$C_Score_{i,t} = \beta_0 + \beta_1 Innov_{i,t-1} + \beta_2 C_Score_{i,t-1} + \beta_3 Controls_{i,t-1} + g_i + y_t + \omega_{i,t}$$
(3)

The model investigates the causal relation between innovation and conditional conservatism, allowing innovation to affect conservatism over time and vice versa, and accounting for firm fixed effects (f and g) and time trends (x and y). The results, reported in Panel J of Table V, show that the effects of innovation on C_Score (i.e., reverse causality) are negative but statistically insignificant, while the negative effect of C_Score on innovation remain statistically significant.

Second, we augment Khan and Watts' (2009) model by including the log of the geographical distance between a firm's headquarter and the corresponding SEC regional office with jurisdiction (Ln(Distance)) as an additional determinant of conditional conservatism. Kedia and Rajgopal (2011) indicate that the SEC is more likely to investigate firms located closer to its offices, suggesting that regulation is most effective when it is local. Since regulation is one of the major determinants of conditional conservatism, we expect that the distance between firm headquarters and the SEC regional offices has a significant and negative impact on conditional conservatism.²³ We do not see an a priori reason to expect that closeness to an SEC office would reduce firm innovation. We estimate C_Score using Ln(Distance) as a quasi-instrument.

Panel K of Table V shows that our results still hold.

Third, we use a change in regulatory regime, the enactment of the SEC's Staff Accounting Bulletin (SAB) No. 101 in 1999, as an exogenous shock to the increase in a firm's conditional conservatism. Previous research documents that SAB 101 reduces the timeliness of revenue recognition, resulting in an exogenous increase in conditional conservatism for a broad cross-section of listed firms. Specifically, Crawford, Price, and Rountree (2010) show that "the asymmetry between the recognition of gains and losses, measured using the Basu (1997) framework, increases in the post-SAB 101 period."²⁴ Crawford, Price, and Rountree (2010) also note that the enactment of SAB 101 is driven purely by regulatory reasons rather than by the desire to improve the contracting environment.²⁵ Specifically, we replace C_Score in equation (1) with the SAB 101 indicator (a binary variable that equals one after the enactment of SAB 101 and zero otherwise) and drop year indicators from equation (1), while keeping other variables including firm-fixed effects. The results reported in Panel L of Table V show that the SAB 101 indicator is negatively and significantly related to Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation), suggesting that a positive shock to conditional conservatism causes firms to be less innovative.

In addition, we create an indicator that takes the value of one if the industry in which a firm operates is affected by SAB 101 and zero otherwise (Altamuro, Beatty, and Weber, 2005), and replace C_Score with an interaction term between this indicator and the SAB 101 indicator in equation (1), while keeping other variables including firm-fixed effects in the regressions.²⁶ We do this because there may be a concern that SAB 101 indicator primarily captures the bursting of the internet bubble. However, Altamuro, Beatty, and Weber (2005) report that the industry affected the most by SAB 101 in their sample is "Pharmaceutical and Chemicals", which is relatively immune to this phenomenon. Untabulated results show that this interaction term is negatively and significantly related to innovation (with t-statistics of -2.8, -9.4, and -5.7, respectively).

Finally, we consider intertemporal variations in litigation risk. Basu (1997) indicates that years 1976-1982 and 1983-1990 are low and high legal liability periods, respectively. This change in litigation risk affects conditional conservatism for exogenous reasons. Therefore, we construct an indicator that is equal to one if the year belongs to the 1983-1990 period and zero if the year belongs to 1976-1982. We then replace C_Score with this indicator in the regressions. The results reported in Panel M of Table V show that the coefficient estimates on the indicator variable are significantly negative (t-statistics of -5.8, -5.2, and -6.4, respectively). We also estimate the coefficients associated with different yearly indicator variables (after dropping C_Score from the regressions) since prior research documents an increase in conditional conservatism over time (e.g., Basu, 1997; Ryan and Zarowin, 2003). The coefficients of yearly indicators become increasingly negative and the effects are statistically significant (untabulated).

To summarize, although endogeneity is a perennial issue that no empirical test can probably entirely rule out, we conduct a large number of tests to mitigate the concerns of omitted variables and reverse causality and find that our results are robust to these concerns. Among them, the results based on conservatism measures estimated with non-innovative firms, lead-lag structures, quasi-instruments, or quasi-natural experiments, all suggest that endogeneity does not drive our results. Although each test can be subject to criticism, the totality of evidence points to a causal relation between conditional conservatism and an impediment to innovation.

V. ADDITIONAL TESTS

To further examine the validity of our main hypothesis, in this section, we conduct a battery of additional tests.

A. Profitability of Innovation

First, we examine whether the degree of conditional conservatism affects the properties of innovation projects. Our argument in Section II suggests that innovation of conservative firms should have a weaker impact on firm profitability and stock prices.

The sample consists of firms covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. Qcitation and Tcitation are adjusted using the weighting index of Hall, Jaffe, and Trajtenberg (2001) and the method of time-technology class fixed effect, respectively. A high (low) C_Score firm is the one whose C_Score is above (below) the sample median of C_Score in a certain year. Operating cash flows in year t+1, t+3, and t+5 are regressed against innovation measures and control variables (R&D expenditure over assets, log value of total assets, the ratio of market equity to book equity, leverage ratio, beta estimated from the CAPM using CRSP daily stock returns in each year, and industry indicators), but for the sake of brevity, the regression estimates for control variables are not reported. All variables are winsorized at the 1% level at both tails of the distribution. Dollar values are converted into 2000 constant dollars using the GDP deflator. The t-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	OCF_{t+1}	OCF_{t+3}	OCF_{t+5}	Test of equal
	OLS	OLS	OLS	coefficients between year t+5 and t+1
	(1)	(2)	(3)	(4)
Panel A: Effect of Pa	atent on future oper	ating cash flows		
	A1	: Low C_Score sub.	sample	
$Ln(1+Patent)_t$	0.009***	0.011***	0.014***	$\chi^2 = 3.13$
	(6.1)	(4.8)	(4.0)	p-value = 0.08
	A2	: High C_Score sub	sample	
$Ln(1+Patent)_t$	0.007**	0.005	0.002	$\chi^2 = 0.72$
	(2.2)	(1.0)	(0.2)	p-value = 0.40
Panel B: Effect of Q	citation on future of	perating cash flows		
	B1	: Low C Score sub.	sample	
$Ln(1+Qcitation)_t$	0.005***	0.008***	0.010***	$\chi^2 = 5.16$
	(6.6)	(5.6)	(4.5)	p-value = 0.02
	B2	: High C Score sub	sample	-
$Ln(1+Qcitation)_t$	0.003**	0.002	0.002	$\chi^2 = 0.38$
	(2.5)	(0.8)	(0.5)	p-value = 0.54

Table VI. Effect of C_Score on innovation horizon

Panel C: Effect of Tcitation on future operating cash flows						
	C1	: Low C_Score sub.	sample			
$Ln(1+Tcitation)_t$	0.008***	0.012***	0.015***	$\chi^2 = 5.82$		
	(6.2)	(5.6)	(4.4)	<i>p</i> -value = 0.02		
	C2	: High C_Score sub	sample			
$Ln(1+Tcitation)_t$	0.006*	0.006	0.008	$\chi^2 = 0.10$		
	(1.9)	(1.3)	(1.0)	<i>p</i> -value = 0.75		

We first consider the horizon of the innovative activities. We expect firms with conservative accounting to engage in R&D projects that deliver outcomes faster. To test our prediction, we follow Hilary and Hui (2012) and regress operating cash-flows in year t+1, t+3, and t+5 on the number of patents and citations, controlling for R&D intensity in period t-1, Ln(Assets), MB, Leverage, Beta, and industry fixed effects.²⁷ We estimate the regression separately for firms with high and low C Score (using the sample median as a cut-off point). Results are reported in Table VI. For the sake of brevity, the regression estimates for control variables are not reported. As shown in Panels A, B, and C, the coefficient estimates on Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation) for the low C_Score subsample increase as the horizon increases, while the corresponding coefficient estimates for the high C_Score subsample decrease or remain stable.²⁸ The increase in the magnitude of the coefficients in the low C Score group is statistically significant (with p-values of 0.08, 0.02, and 0.02, respectively) but not in the high C_Score Thus, firms with more conservative accounting not only generate fewer patents and group. citations, but also, after controlling for the "productivity" of the innovation process as measured by the number of patents and citations, have lower cash-flows from innovation in the more distant future. In addition, even for the first year the point estimates of the coefficients are higher for firms displaying a lower conservatism, suggesting that the patents generated by conservative firms are associated with lower cash-flows. In sum, these results are inconsistent with the view that conditional conservatism leads firms to prune projects with low profitability.

To reinforce this finding, we regress the market reaction to the announcement of patent granting on C_Score and the control variables reported in Table III. Untabulated results indicate that C_Score is significantly negatively related to the cumulative abnormal return from one day before to one day after the announcement date, CAR(-1, 1), with a t-statistic of -4.4. Using CARs measured over other windows, (-1, 0), (-2, 2), and (-5, 5), does not change the results.²⁹

We then turn our attention to the presence of lottery-like features of a firm's innovation. Firms could engage in either marginal innovations or "ground-breaking" innovations that are highly uncertain but potentially capable of generating huge returns. We expect conditional conservatism to impede the second type of innovation more than the first type. To investigate this possibility, we construct a measure of lottery-type firms following the steps similar to those proposed by Kumar (2009). Specifically, we form a binary variable (Lottery) that equals one if the stock return in a given year exhibits both above-median idiosyncratic volatilities and above- median idiosyncratic skewness, and zero otherwise. We then partition the sample according to the sample median of C_Score and use a probit model to separately regress Lottery on each of our three measures of innovation, (Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation)), controlling for the variables used in equation (1).³⁰

Firms are divided into high and low C_Score groups according to the sample median of C_Score. According to Kumar (2009), Lottery is a binary variable that equals one if a stock has

both above-median idiosyncratic volatilities and above-median idiosyncratic skewness in a given year and zero otherwise. Coefficients are estimated using probit models and capture the marginal effects that measure the effect of a one unit change in continuous explanatory variables (moving from 0 to 1 for dummy variables) on the dependent variable. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. X² and p-values are reported for the tests on equal coefficients for innovative measures between high and low C_Score groups.

Dependent variable:	Low C_Score	High C_Score	Low C_Score	High C_Score	Low C_Score	High C_Score
Lottery	(1)	(2)	(3)	(4)	(5)	(6)
Ln(1+Patent)	0.004**	-0.013**				
	(2.2)	(-2.3)				
Ln(1+Qcitation)			0.003***	-0.002		
_			(2.8)	(-0.9)		
Ln(1+Tcitation)					0.005**	-0.005
					(2.6)	(-0.9)
R&D/Assets	0.056*	0.155***	0.053	0.142***	0.056*	0.142***
	(1.7)	(2.8)	(1.6)	(2.6)	(1.7)	(2.6)
Ln(Assets)	-0.049***	-0.076***	-0.049***	-0.077***	-0.049***	-0.077***
	(-25.2)	(-19.0)	(-25.9)	(-19.5)	(-25.6)	(-19.4)
Ln(Firm age)	-0.022***	-0.049***	-0.022***	-0.049***	-0.022***	-0.049***
-	(-8.8)	(-10.0)	(-8.8)	(-10.1)	(-8.8)	(-10.1)
Ln(PPE/#Employees)	0.003	-0.014***	0.003	-0.014***	0.003	-0.014***
	(1.4)	(-3.8)	(1.4)	(-3.8)	(1.4)	(-3.8)
ROA	-0.216***	-0.478***	-0.216***	-0.478***	-0.216***	-0.478***
	(-12.0)	(-17.4)	(-12.0)	(-17.4)	(-12.0)	(-17.4)
MB	-0.003***	-0.010***	-0.003***	-0.010***	-0.003***	-0.010***
	(-7.4)	(-9.2)	(-7.4)	(-9.2)	(-7.4)	(-9.2)
Sales growth	0.010*	-0.028***	0.010*	-0.028***	0.010*	-0.028***
	(1.8)	(-3.4)	(1.8)	(-3.4)	(1.8)	(-3.4)
Leverage	0.175***	0.367***	0.175***	0.369***	0.175***	0.369***
	(12.6)	(16.1)	(12.6)	(16.2)	(12.6)	(16.2)
Cash/Assets	0.061***	0.051**	0.060***	0.049**	0.061***	0.049**
	(4.8)	(2.3)	(4.7)	(2.3)	(4.8)	(2.3)
Ln(Analyst coverage)	-0.009***	-0.014**	-0.009***	-0.015**	-0.009***	-0.015**
	(-3.5)	(-2.4)	(-3.6)	(-2.5)	(-3.5)	(-2.5)
Herfindahl	-0.136***	-0.281***	-0.135***	-0.281***	-0.135***	-0.281***
	(-3.5)	(-4.4)	(-3.5)	(-4.4)	(-3.5)	(-4.4)
Herfindahl ²	0.129**	0.280***	0.128**	0.279***	0.128**	0.279***
	(2.6)	(3.5)	(2.6)	(3.5)	(2.6)	(3.5)
Sample size/ Pseudo R ²	35,359/0.24	35,373/0.15	35,359/0.24	35,373/0.15	35,359/0.24	35,373/0.15
Test of equal coefficients	$\chi^2 = 1$	10.95	$\chi^2 =$	6.71	$\chi^2 =$	5.51
of innovation measures	<i>p</i> -value	e = 0.00	<i>p</i> -value	e = 0.01	p-value	e = 0.02

Table VII. Effect of C_Score on lottery-like feature of innovation

Results are presented in Table VII. We find that the coefficient estimates are positive and significant for firms in the low C_Score subsample, suggesting that innovation in these firms is associated with a higher likelihood of exhibiting lottery-like features. On the other hand, the coefficient estimates are negative (despite insignificant in most cases) for firms in the high C_Score subsample. The coefficient estimates on our three measures of innovation are statistically different across the two subsamples, with a p-value of 0.02 or lower in each of the three specifications. Thus, the adverse effect of conditional conservatism on innovations is particularly severe for innovations that generate higher uncertainty but greater upside potentials.

B. Cross-sectional Heterogeneity

To better understand the mechanism through which conditional conservatism affects corporate innovation, we examine whether our results vary across manager-, shareholder-, and other firm-specific characteristics. We also examine whether our results are more evident in

industries in which innovation is a more important consideration. As discussed in the hypothesis development section, we expect the results reported in Table III to be more pronounced when the product development cycle is longer, when the accounting performance pressure is greater, or when managers or shareholders have shorter investment horizons.

To measure the length of product development cycle, we employ the industry-level R&D amortizable life, which reflects the commercial life of the products that emerge from R&D.³¹

We classify the industries into three categories: those with an amortizable life shorter than 5 years, those with a life of 5 years, and those with a life longer than 5 years. We then interact C_Score with the last two indicators associated with an amortizable life of at least 5 years and include these interaction terms as additional explanatory variables in equation (1).

To measure the extent of accounting performance pressure on managers, we use CEO payaccounting-performance sensitivity. Following Leone, Wu, and Zimmerman (2006), we first estimate the sensitivity of CEO pay to accounting performance over the 1992-1997 period by conducting firm-level time-series regressions.³² We then create an indicator to denote high or low sensitivity of CEO pay to accounting performance (PAPS) using the top and bottom 30th percentile of the sample as cut-off points, and interact it with C_Score over the 1998-2003 period.³³

To measure managers' and shareholders' investment horizon, we use the distance to CEO retirement age and short-term institutional ownership, respectively. Following Yim (2013), the distance to CEO retirement age is measured by three indicators for different CEO age groups: 1) young or middle age CEOs (less than 59); 2) old CEOs (age 59-65), and 3) CEOs whose age exceeds the statutory retirement age of 65. We then include C_Score, the first two indicators, their interaction terms, and CEO tenure in equation (1) and reestimate it. To measure a firm's short-term institutional ownership, we classify firms into two subgroups according to the difference in shares held by short-term (transient) and long-term (dedicated) institutional investors (STIO).³⁴ Specifically, we construct a binary variable (STIO indicator) equal to one if in a given year STIO is above the top 30th percentile of the sample, and zero if it is below the bottom 30th percentile of the sample.³⁵ We then include the STIO indicator and its interaction with C_Score in equation (1) and reestimate it.

To examine whether conditional conservatism has a more debilitating effect on innovation when firms have greater need for innovation, we divide our sample into firms operating in innovative and non-innovative industries according to whether the average Qcitation per patent is above the sample median across all two-digit SIC industries for a given year. We then reestimate equation (1) by adding an indicator (InnovInd) that takes the value of one if the industry is innovative and zero otherwise and its interaction with C_Score.

All regressions include the same control variables as those used in the Table III regressions except for Panel C where Ln(CEO tenure) is included as an additional control variable. An industry is classified as a mid (long) R&D cycle industry if its amortizable life is 5 years (longer than 5 years). PAPS indicator equals one for high PAPS (pay-accounting-performance sensitivity) firms and zero for low PAPS firms. A CEO is classified as a young or mid (old) age CEO if her age is below or equal to 58 (between 58 and 65). STIO indicator equals one (zero) for high (low) short-term institutional ownership firms. InnovInd equals one if the industry is innovative and zero otherwise. The t-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations

for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10 % levels, respectively.

Dependent variables	Ln(1+Patent)	Ln(1+Ocitation)	Ln(1+Tcitation)
Panel A: Effect of R&D cycle: $N = 70.039$			
C Score	1 201***	1 752***	1 184***
<u></u>	(10.0)	(8.5)	(9.4)
C Score × Mid R&D cycle indicator	-1.451***	-2.344***	-1.525***
	(-7.6)	(-7.5)	(-7.6)
C Score × Long R&D cycle indicator	-3.056***	-4.767***	-3.172***
	(-14.9)	(-14.5)	(-14.7)
Mid R&D cycle indicator	0.124	0.254	0.164
	(0.8)	(1.0)	(1.0)
Long R&D cycle indicator	0.225	0.262	0.186
	(1.4)	(1.1)	(1.1)
Panel B: Effect of sensitivity of CEO pay to acco	unting performance: N	V = 3.252	()
C Score	0.047	-0.264	-0.117
	(0.1)	(-0.3)	(-0.2)
C Score × PAPS	-1.348**	-2.728**	-1.813**
	(-2.0)	(-2.6)	(-2.6)
PAPS	0.103	0.244	0.167
	(0.9)	(1.4)	(1.4)
Panel C: Effect of distance to CEO retirement ag	e: N = 11.258		
C Score	0.100	0.083	0.068
-	(0.2)	(0.1)	(0.1)
C Score × Young or mid age CEO indicator	-0.875	-1.646	-1.032
	(-1.4)	(-1.6)	(-1.6)
C Score × Old CEO indicator	-1.674***	-2.615**	-1.666**
-	(-2.6)	(-2.4)	(-2.4)
Young or mid-age CEO indicator	ò.128	0.22 4	ò.139
0 0	(1.4)	(1.5)	(1.4)
Old CEO indicator	0.263***	0.435***	0.248***
	(2.9)	(2.9)	(2.6)
Panel D: Effect of short-term institutional owner	ship: N = 37,215		
C Score	-0.118	-0.315	-0.152
-	(-0.9)	(-1.3)	(-1.1)
C_Score × STIO	-0.519***	-0.957***	-0.692***
	(-2.8)	(-3.1)	(-3.5)
STIO	-0.039	0.031	-0.002
	(-1.2)	(0.6)	(-0.1)
Panel E: Effect of industry innovation: $N = 70.8$	71		
C Score	0.246*	0.363*	0.340***
-	(1.9)	(1.7)	(2.6)
C Score × InnovInd	-0.916***	-1.615***	-1.134***
	(-5.8)	(-6.4)	(-7.1)
InnovInd	0.364***	0.784***	0.454***
	(10.8)	(14.3)	(13.4)
	((****)	(12.1)

Table VIII. Cross-sectional variations in the effect of C_Score

The results are presented in Table VIII. The regressions control for the same variables used in equation (1). Again, to save space, we only tabulate the coefficients on the main variables. We find that the results are generally consistent with our expectations. In Panel A, we observe that the effect of conditional conservatism is stronger when the innovation development cycle is around 5 years, and even more so when it is longer than 5 years. In Panel B, we find that the negative effect is exacerbated when CEO compensation is more tied to accounting performance. In Panels C and D, we find that the effect is exacerbated when CEOs approach retirement (59-65 years) and when transient institutional ownership is more dominant, respectively. In Panel E, we find that conditional conservatism has a debilitating effect on innovation for firms in innovative industries. The t-statistics for the coefficient estimates on relevant interaction terms in the Table VIII regressions range from -2.0 to -14.9. As additional proxies for managerial myopia, we also consider industry homogeneity (Parrino, 1997), CEO ownership (Ma, 2010), and firm transparency (Chowdhury and Fink, 2012). We then interact C_Score with high industry homogeneity, low CEO ownership, and low transparency indicators (defined in Appendix A3). Untabulated results indicate that the coefficient estimates on all three interactions are negative and significant.³⁶

C. Ex Post Decision to Cut R&D

Most of our tests so far have taken an ex ante perspective by showing that conditional conservatism leads managers to eschew innovative projects. To further show that conditional conservatism induces managers to be more short-term oriented and thus encourages them to invest less in innovative projects, we consider two additional tests.

First, we take an ex post view. We divide our sample firms into three subgroups according to performance pressure that managers face and examine whether our results are more pronounced when performance pressure is higher. Following Bushee (1998), we define Cut_R&D as a binary variable that takes a value of one if the change of R&D expenses per share is negative and zero otherwise. We then partition the sample into three subsamples based on the change in earnings per share: 1) the small decline subsample (SD), where earnings before R&D and taxes decline relative to the prior year, but by an amount that can be reversed by a reduction in R&D; 2) the growth subsample (IN), where firms have positive changes in pre-tax, pre-R&D earnings; these firms could maintain last year's R&D and would still have an increase in pre-tax earnings; 3) the large decline subsample (LD), where firms experience a decline in pre-tax, pre-R&D earnings greater than the amount of the prior year's R&D; these firms could eliminate R&D spending but still report a decrease in pre-tax earnings. Finally, we estimate the probit regressions separately for these three subsamples in which the dependent variable is Cut_R&D and our key independent variable of interest is C_Score. The inclusion of other control variables follows Bushee (1998).³⁷

The sample consists of firms covered by both Compustat and the NBER Patent and Citation Database between 1976 and 2003. Following Bushee (1998), the sample is partitioned into three subsamples based on the change in earnings per share: 1) the small decline subsample (SD), where earnings before R&D and taxes decline relative to the prior year, but by an amount that can be reversed by a reduction in R&D; 2) the growth subsample (IN), where firms have positive changes in pre-tax, pre-R&D earnings; 3) the large decline subsample (LD), where firms experience a decline in pre-tax, pre-R&D earnings greater than the amount of prior year's R&D. Cut R&D is a binary variable that equals one if R&D per share is cut relative to the prior

year and zero otherwise. Institutional ownership is the number of shares owned by institutional investors scaled by total shares outstanding from CDA/Spectrum Institutional (13f) Holdings. Prior ΔR&D is the change in log value of R&D per share from year t-1 to year t-2. ΔIndustry R&D-toassets ratio is the change in log value of total R&D expenditures of other firms i¹n the same 4-digit SIC industry scaled by total sales of other firms in the same four-digit SIC industry from year t to year t-1. Δ GDP is the change in log value of GDP from year t to year t-1. Δ Capex is the change in log value of capital expenditure per share from year t to year t-1. ΔSales is the change in log value of sales per share from year t to year t-1. ΔNo. of shares outstanding is the change in log value of total shares outstanding from year t to year t-1. Leverage is (Short-term debt + Longterm debt)/Assets. Free cash flow/Current assets is (Operating cash flowst - Average Capext-1 to t-3)/Current assetst-1. Assets is the book value of total assets. MB is the ratio of market value of equity over book value of equity. Coefficient are estimated using probit models and capture the marginal effects that measure the effect of a one unit change in continuous explanatory variables (moving from 0 to 1 for dummy variables) on the dependent variable. Year fixed effects are included. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable = Cut R&D		
	SD sample	IN sample	LD sample
	(1)	(2)	(3)
C_Score	0.274**	-0.016	-0.038
	(2.5)	(-0.4)	(-0.9)
Institutional ownership	-0.090**	-0.023	0.002
	(-2.6)	(-1.5)	(0.1)
Prior ⊿R&D	0.013	-0.021	0.085***
	(0.3)	(-1.0)	(2.7)
∆Industry R&D-to-assets ratio	-0.967*	-0.342	0.349
	(-1.9)	(-1.5)	(1.1)
⊿GDP	1.063	0.158	-0.001
	(1.2)	(0.5)	(-0.0)
∆Capex	-0.143***	-0.070***	-0.015**
	(-6.5)	(-11.5)	(-2.4)
∆Sales	-0.227***	-0.162***	-0.240***
	(-8.1)	(-15.7)	(-18.3)
∆No. of shares outstanding	0.860***	0.176***	0.068***
	(16.7)	(10.2)	(4.4)
Leverage	0.135**	-0.220***	-0.186***
	(2.6)	(-10.5)	(-7.7)
Free cash flow/Current assets	-0.069***	-0.048***	0.027***
	(-3.0)	(-6.2)	(3.2)
Ln(Assets)	0.007	-0.011***	0.009***
	(1.3)	(-4.0)	(2.8)
MB	-0.004	0.005***	0.006***
	(-1.6)	(6.1)	(4.7)
Sample size/Pseudo R ²	6,050/0.11	30,060/0.06	22,110/0.08

Table IX. Effect of C_Score on Ex Post decision to cut R&D

The results presented in Table IX indicate that the effect of conditional conservatism on the decision to cut R&D is evident only for the SD subsample (column (1)) in which managers' short-term accounting performance pressure is the greatest, supporting the argument that conditional conservatism strengthens managers' incentives to meet short-term earnings goal and thus discourages them to invest in innovative projects. The negative sign of the coefficient on institutional ownership in column (1) is consistent with Bushee (1998).

Second, since cutting R&D is costly, firms may prefer to manipulate accruals and resort to cutting R&D only when accrual manipulation becomes difficult. To test this possibility, we form four binary indicators that measure the propensity to manipulate accruals based on Zang (2012) and create an index variable, Easy, that measures the easiness to manipulate accruals by summing up these indicators.³⁸ Easy ranges from zero (easy to manipulate accruals) to four (difficult to manipulate accruals). We add this variable and its interaction with C_Score in equation (1). Untabulated results indicate that the coefficient estimates on the interaction term are significantly negative, consistent with the notion that firms cut R&D when other options such as accrual manipulations are difficult to implement.

D. Effect of R&D Volatility on Its Productivity

Our main hypothesis is based on the idea that managers who try to maximize firm value but are subject to constraints that force them to cut R&D in response to idiosyncratic shocks will eschew long-term and complex projects. An assumption implicit in our hypothesis is that the timing of the R&D effort is important, and hence the delay in R&D will reduce the productivity of the innovation process. To test the validity of this assumption, we regress Ln(1+Patent), Ln(1+Qcitation), and Ln(1+Tcitation) on R&D volatility (measured as the standard deviation of R&D/Assets during the past five years), the level of R&D effort (measured as the average R&D/Assets during the past five years), and a vector of control variables used in equation (1) that are also measured as the average over the last five years.³⁹ Consistent with our intuition, we find that the volatility of the R&D investment has a negative and significant impact on innovation performance. The t-statistics of the coefficients on R&D volatility are -9.3, -8.8, and -8.8, respectively. Economically, increasing R&D volatility by one standard deviation (0.05) reduces the values of Patent, Qcitation, and Tcitation by 19%, 28%, and 17%, respectively.

VI. SUMMARY AND CONCLUSION

We contribute to the existing literature by examining real effects of conditional accounting conservatism on corporate innovation. We hypothesize that conditional conservatism curbs innovation through the combination of asymmetric accounting treatment of the non-R&D activities and pre-existing managerial myopia. Our empirical results show that conditional conservatism is negatively associated with the number of patents and patent citations, suggesting that conditional conservatism hinders corporate innovation. Moreover, the cash-flows generated by innovations in firms with more conservative accounting are lower and have shorter horizons, and these more conservative firms experience less positive market reactions to the announcement of patent granting. The negative effects of conditional conservatism on innovative activities are more pronounced when the industry-level R&D amortizable life is longer, when CEO compensation is more strongly tied to accounting performance, when managers are more likely to be myopic, when firms operate in innovative industries, and when accrual manipulation is more difficult. Overall, these results suggest that conditional conservatism curbs corporate innovation by

pressuring myopic managers to deliver short-term performance.

To address the issue of mismeasurement of conservatism and innovation, we use a multiplicity of proxies for these variables and find that our results do not change. We also take a multi-pronged approach to address endogeneity concerns. To address the possibility of an omitted variable, we estimate the specifications using a variable that has only time series variation, a pure cross-sectional approach (one observation per firm), and a firm-fixed effect approach. We also control for a long list of potential confounds. To address potential reverse causality and joint determination, we use several approaches. In particular, we estimate the time- series variation of conditional conservatism among non-innovative industries and use this value as a proxy for conservatism among firms that engage in innovative practices. All evidence points to a causal relation between conditional conservatism and an impediment to innovation.

Prior research has shown that conditional conservatism deters managers from undertaking negative NPV projects. As such, our results in this paper do not suggest that conditional conservatism is on balance problematic. Rather, our results suggest that like most constructs, conditional accounting conservatism generates both benefits and costs. The optimal level of conditional conservatism is likely to be based on various trade-offs. Our study contributes to the understanding of these trade-offs.

Appendix A: Detailed description of variables and models used in supplementary analyses A1: Alternative models of conditional conservatism

□ Khan and Watts' (2009) C_Score (Table III): C_Score is constructed based on Basu's (1997) model as follows.

$$X_{i} = \beta_{i} + \beta_{2}D_{i} + \beta_{3}R_{i} + \beta_{4}D_{i}R_{i} + e_{i}$$

where X is earnings over the market value of equity at the prior fiscal year end, R is the annual stock return, D is a dummy variable that is equal to one when R < 0, and zero otherwise.

 β_4 measures the incremental timeliness for bad news over good news, namely, conditional conservatism. Khan and Watts (2009) assume that both β_3 (G_Score) and β_4 (C_Score) are linear functions of firm-specific characteristics each year.

$\beta_{i} = \mu_{i} + \mu_{i}Ln(E)_{i} + \mu_{i}M / B_{i} + \mu_{i}Lev_{i}; \beta_{i} = \lambda_{i} + \lambda_{i}Ln(E)_{i} + \lambda_{i}M / B_{i} + \lambda_{i}Lev_{i}$

where Ln(E) is the log of is of the market value of equity, MB is the ratio of market value of equity to book value of equity, and Lev is total debt divided by the market value of equity. Thus, the annual cross-sectional regression model used to estimate C_Score can be written as

$$\begin{split} X_i &= \beta_1 + \beta_2 D_i + R_i (\mu_1 + \mu_2 Ln(E)_i + \mu_3 M / B_i + \mu_4 Lev_i) + D_i R_i (\lambda_1 + \lambda_2 Ln(E)_i + \lambda_3 M / B_i + \lambda_4 Lev_i) + (\delta_1 Ln(E)_i + \delta_2 M / B_i + \delta_4 Lev_i + \delta_4 D_i Ln(E)_i + \delta_5 D_i M / B_i + \delta_6 D_i Lev_i + \varepsilon_i, \\ \text{where coefficients } \delta_1 - \delta_6 \text{ capture the independent effects of firm specific variables and their interactions with D on earnings, while coefficients <math>\lambda_1 - \lambda_4$$
 are used to constructed C_Score.

C_Score estimated using pre-R&D earnings (C_Score_RD in Panel A of Appendix B): C_Score is re- estimated after adding tax-adjusted R&D expenses back to earnings (X) in Khan and Watts' (2009) model.

The modified C_Score proposed by Banker et al. (2012) (C_Score_BBBC in Panel B of Appendix B): $\frac{27}{27}$

Banker et al. (2012) modify Khan and Watts' (2009) model by adding a dummy for sale increase and a dummy for sales decrease to account for the confounding effect related to cost stickiness. Our estimation follows equation (6) in Banker et al. (2012).

Basu's (1997) measure (AC_Basu in Panel C of Appendix B): The measure is obtained by estimating Basu's model each year across all firms.

Callen, Segal, and Hope's (2010) measure (AC_CSH in Panel D of Appendix B): This measure is defined as the ratio of current earnings shocks to earnings news. Current earnings shocks and earnings news are estimated based on a parsimonious vector autoregressive (VAR) model with three state variables consisting of log of stock returns, log of one plus return on equity, and log of book-to-market ratio.

Negative non-operating accruals (NOA in Panel E of Appendix B): NOA is measured as non-operating accruals divided by the average total assets, which is then averaged over a 3-year periods and multiplied by negative one. Non-operating accruals = (Net income + Depreciation) - Operating cash flows - (Δ Accounts receivable + Δ Inventories + Δ Prepaid expenses - Δ Accounts payable – Δ Taxes payable).

Modified Basu's (1997) model proposed by Francis and Martin (2010) (Panel F of Appendix B): We add our innovation measures and control for R&D/Assets in the model proposed by Francis and Martin (2010). Specifically, we estimate the following model:

$$\begin{split} X_{i-1} &= \alpha_0 + \alpha_1 D_{i-1} + \alpha_2 R_{i-1} + \alpha_3 D_{i-1} R_{i-1} + \alpha_4 Innov_i + \alpha_5 Innov_i D_{i-1} + \alpha_6 Innov_i R_{i-1} + \alpha_7 Innov_i D_{i-1} R_{i-1} + \alpha_8 R \& D \ / \ Assets_{i-1} + \alpha_9 R \& D \ / \ Assets_{i-1} D_{i-1} + \alpha_{10} R \& D \ / \ Assets_{i-1} R_{i-1} + \alpha_{11} R \& D \ / \ Assets_{i-1} D_{i-1} R_{i-1} + Controls_{i-1} + \varepsilon_i, \end{split}$$

where Innov represents our innovation measures (Patent, Qcitation, and Tcitation). Controls include Ln(E), MB, Lev, and an indicator for high litigation risk industries and their interactions with D, R and D×R as well as year and industry fixed effects. We only report in Appendix B the coefficient α_7 , which captures the impact of conditional conservatism on innovation.

Modified Basu's (1997) model proposed by Ball, Kothari, and Nikolaev (2013) (Panel G of Appendix B): We adopt Approach 1 of Ball, Kothari, and Nikolaev (2013). The model is similar to that of Francis and Martin (2010) except that Controls include Ln(E), MB, Lev, Ln(Price), stock volatilities, and year and industry fixed effects.

Ball and Shivakumar's (2006) model (Panel H of Appendix B): We add our innovation measures and control for R&D/Assets in the model proposed by Ball and Shivakumar (2006). Specifically, we estimate the following model:

 $ACC_{i-1} = \beta_0 + \beta_1 Neg_{i-1} + \beta_2 \Delta CF_{i-1} + \beta_3 Neg_{i-1} \Delta CF_{i-1} + \beta_4 Innov_i + \beta_5 Innov_i Neg_{i-1} + \beta_6 Inno_i \Delta CF_{i-1} + \beta_7 Innov_i Neg_{i-1} \Delta CF_{i-1} + \beta_8 R \& D / Assets_{i-1} + \beta_9 R \& D / Assets_{i-1} Neg_{i-1} + \beta_{10} R \& D / Assets_{i-1} \Delta CF_{i-1} + \beta_{11} R \& D / Assets_{i-1} Neg_{i-1} \Delta CF_{i-1} + controls_{i-1} + \varepsilon_{i-1} Assets_{i-1} Assets_{i-1$

where Innov represents our innovation measures (Patent, Qcitation, and Tcitation). Controls include Ln(E), MB, Lev, and an indicator for high litigation risk industries and their interactions with Neg, ΔCF and Neg× ΔCF as well as year and industry fixed effects. We only report in Appendix B the coefficient β 7, which captures the impact of conditional conservatism on innovation.

A2: Additional control variables used for Panels E-G of Table V.

Proxies for risk aversion:

Market return volatility: volatility of monthly market returns during the past year.

Religiosity: proportion of religious adherents in a county as in Hilary and Hui (2009).

% of female executives: fraction of female executives in a firm's senior management.

CEO delta: dollar change in CEO stock and option portfolio for 1% change in stock price, in thousands following Core and Guay (2002).

CEO vega: dollar change in CEO option holdings for a 1% change in stock return volatility, in thousands following Core and Guay (2002).

Ln(CEO tenure): log value of the number of years a CEO resides in the office.

Management quality: difference between the average monthly return on the firm's equity over the past 3 years and the average monthly return on an equally weighted portfolio for the firm's twodigit SIC industry over the past 3 years, scaled by the standard deviation of the average monthly industry returns over the same period (Milbourn (2003)).

Proxies for bad news:

Missing analyst consensus forecast: difference between median analyst consensus forecast of EPS and actual EPS scaled by lagged stock price following Francis and Ke (2006).

Breaking a streak of good news: binary variable that equals one if a firm meets or beats analysts' earnings estimates over the past 3 consecutive quarters but misses the consensus forecast in the current quarter in the fiscal year, and zero otherwise.

Aggregate downgrade indicator: binary variable that equals one if there are more credit rating downgrades than upgrades in a year, and zero otherwise.

Net sales by insiders: Sum of insider sales scaled by the number of shares outstanding less sum of insider purchases scaled by the number of shares outstanding over the fiscal year t (Beneish and Vargus (2002)).

Stock returns: stock returns during the past year.

Z-Score: (3.3×pretax income + sales + 1.4×retained earnings + 1.2×(current assets - current liabilities))/Assets.

Per capita GDP growth: growth rate of per capita GDP from year t to t-1.

Variables that are potentially correlated with conservatism:

Hadlock and Pierce (2010) index: -0.737×Size + 0.043×Size² + 0.04×Firm age.

G-index: governance index compiled by Gompers, Ishii, and Metrick (2003) from RiskMetrics.

CEO overconfidence: binary variable that equals one for all years after the CEO holds options that are at least 67% in-the-money and zero otherwise.

Tax effect: residual of a regression of marginal tax rate of Graham and Mills (2008) on net income according to Garcia Lara, Garcia Osma, and Penalva (2009).

Ln(#Segments): log value of the number of segments of a firm.

G_Score: timeliness of good news according to Khan and Watts (2009).

Operating leverage: costs of goods sold divided by selling, general and administrative expenses.

Profit margin: annual net income divided by annual sales.

Litigation risk: binary variable that equals one if a firm falls in high litigation risk industry as identified by SIC codes: 2833-2836, 3570-3577, 3600-3674, 5200-5961, and 7370-7379 according to Francis, Philbrick, and Schipper (1994).

Union: percentage of workforce in an industry covered by unions according to Hirsch and

Macpherson (2003).

Additional variables:

Kaplan and Zingales' (1997) index: -1.002×Cash flow/Assets - 39.368×Dividend/Assets - 1.315×Cash/Assets +3.139×Total debt/Assets + 0.283×Tobin's q.

Whited and Wu's (2006) index: -0.091×Cash flow/Assets - 0.062×Dividend payer indicator + 0.021×Long-term debt/Assets - 0.044×Size + 0.102×Industry sales growth - 0.035×Sales growth.

Dividend payer indicator: binary variable that equals one if a firm pays cash dividend in a given year, and zero otherwise.

Market leverage ratio: (Short-term debt + Long-term debt)/Market value assets.

Board size: number of board members from RiskMetrics.

% of independent directors: number of independent directors scaled by board size from RiskMetrics.

Institutional ownership: shares owned by institutional investors over total shares outstanding from CDA/Spectrum Institutional (13f) Holdings.

Operating cash flows scaled by assets: Operating cash flows/Assets.

Aggregate corporate profit growth rates: growth rate of corporate profits from year t to t-1.

Asymmetric sensitivity of R&D to bad news: estimated based on the model as follows:

$$R \& D / Assets_i = \beta_i + \beta_2 D_i + \beta_3 R_i + \beta_4 D_i R_i + e_i$$

where R&D/Assets is R&D expenses over total assets at the prior fiscal year end, R is the annual stock return, D is a dummy variable that is equal to one when R < 0, and zero otherwise.

Stock market risk premium: annual stock market return less risk-free rate.

Debt market default spread: difference in default spreads for bonds with Moody's Baa rating and Aaa rating.

A3: Alternative measures of managerial myopia

Industry homogeneity indicator: binary variable that equals one if industry homogeneity is above the top 30th percentile of the sample each year and zero if it is below the bottom 30th percentile of the sample each year. Industry homogeneity is defined based on the following procedure. First, an equally weighted return index is estimated for each industry (2-digit SIC) using the firms for which monthly returns are reported in CRSP. The monthly return for each firm in each index is then regressed against an equally weighted market return index and the industry return index. Finally, the coefficients for the industry return index in this regression is averaged across all firms in each industry to obtain a proxy for the similarity of firms within each industry.

CEO ownership indicator: binary variable that equals one if CEO ownership is below the bottom 30th percentile of the sample each year and zero if it is above the top 30th percentile of the sample each year. CEO ownership is defined as the number of CEO stock holdings over the number of shares outstanding multiplied by 100.

Transparency indicator: binary variable that equals one if the standard deviation of long-term growth analyst forecast scaled by the mean forecast is above the top 30th percentile of the sample each year and zero if it is below the bottom 30th percentile of the sample each year.

A4: Measures for the easiness of accrual manipulation.

Easy is an index that measures the easiness to manipulate accrual-based earnings. The index is constructed as the sum of four indicators: (1) Big8 audit: an indicator that equals one if the firm's auditor is one of the Big 8, and zero otherwise; (2) Audit tenure: an indicator that equals one if the number of years the auditors has audited the client is above 6 years, and zero otherwise; (3) Net operating assets (NOA): an indicator that equals one if a firm's NOA is above the sample median of the corresponding industry-year (3-digit SIC), and zero otherwise; NOA is defined as the shareholders' equity less cash and marketable securities and plus total debt scaled by lagged sales; (4) Operating cycle: an indicator that equals one if a firm's operating cycle is below the sample median of the corresponding industry-year, and zero otherwise. Operating cycle is defined as the days receivable plus the days inventory less the days payable.

Appendix B: Robustness checks on alternative variable definitions

All regressions include the same control variables as those used in Table III, but their coefficients are not tabulated. The detailed definitions for variables and models regarding

(A): Using C_Score adjusted for R&D as an alternative measure of conservatism: N = 70,860						
_	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)			
C Score RD	-0.306***	-0.666***	-0.393***			
	(-5.4)	(-6.7)	(-6.7)			
(B): Using the modify	ed C. Score proposed by Banker et a	1 (2012) as an alternative measure	of conservatism: N = 70 733			
(-)	Ln(1+Patent)	Ln(1+Ocitation)	In(1+Tcitation)			
C Score BBBC	0.169***	0.268***	0.202***			
C_SCORE_BBBC	-0.108	-0.208	-0.203			
	(-4.5)	(-4.0)	(-3.2)			
(C): Using the Basu's	(1007) measure as an alternative m	easure of conservatism: $N = 70.744$	1			
(c). Comp the Daste of	In(1+Patent)	In(1+Ocitation)	$I_n(1+T_{citation})$			
AC Dame	0.005***	0.000***	0.005***			
AC_Basu	-0.003***	-0.008	-0.003			
	(-3.0)	(-3.1)	(-3.0)			
(D): Using the measu	re of Callen Segal and Hope (2010)	an alternative measure of concern	atiem: N = 60 325			
(D). Using the measu	Lu(1+ Detent)	In alternative measure of conserva	$L_{\mu}(1+T_{\rm effection})$			
	Ln(1+Fatent)	Ln(1+Qcitation)	Ln(1+1citation)			
AC_CSH	-0.00/**	-0.014**	-0.009**			
	(-2.3)	(-2.1)	(-2.6)			
(E): Using negative i	non-operating accruals as an alternat	ive measure of conservatism: N = 5	01,825			
_	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)			
NOA	-0.254**	-0.428*	-0.254*			
	(-2.0)	(-1.8)	(-1.8)			
(F): Using the modifi	ed model of Basu (1997) proposed b	y Francis and Martin (2010): N = 7	70,744			
	Innov = Ln(1+Patent)	Innov = Ln(1+Qcitation)	Innov = Ln(1+Tcitation)			
D×R×Innov	-0.022***	-0.012***	-0.019***			
	(-4.0)	(-4.1)	(-3.9)			
(G): Using the modified model of Basy (1997) proposed by Ball, Kothari, and Nikolaev (2013): N = 70.744						
(0). 001115 110 110011	Innov = In(1+Patent)	Innov = In(1+Ocitation)	Innov = Ln(1+Tcitation)			
D×R×Innov	-0.020***	_0.010***	-0.017***			
Don Annov	(4.2)	(2.0)	(41)			
	(-+.3)	(-3.9)	(-4.1)			
(H): Using the model of Ball and Shivakumar (2006): N = 69.388						
., .	Innov = Ln(1+Patent)	Innov = Ln(1+Ocitation)	Innov = Ln(1+Tcitation)			
Neg×4CF×Innov	-0.046***	-0.019**	-0.034**			
0	(-2.8)	(-2.3)	(-2 3)			
	(-2.0)	(-2.2)	(-2.3)			

conditional conservatism are in Appendix A1. The t- or z- statistics in parentheses are calculated 31

from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix C: Robustness checks on alternative model specifications

All regressions include the same control variables as those used in Table III, but their coefficients are not tabulated. The t- orz-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

(A): Negative bin	omial regressions without log-transform	ming the dependent variables: N =	70,871	
	Patent	Qcitation	Tcitation	
C Score	-0.752***	-1.114***	-1.183***	
-	(-3.8)	(-4.2)	(-4.9)	
(B): Using R&D/2	<i>Assets</i> as the dependent variable: N = 7	0,013 (42,272)		
	R&D/Assets (full sample)	R&D/Assets (subsample with non-missing R&D)		
C_Score	-0.028***	-0.029*** (-5.4)		
	(-8.0)			
(C): Using averag	e citations per patent as dependent var	iables: N = 70,871		
		$Ln(1+\overline{Qcitations})$	$Ln(1+\overline{Tcitations})$	
C Score	-	-0.314***	-0.091***	
-	-	(-5.6)	(-5.2)	
(D): Excluding fin	ms with zero patents or zero citations:	N _{Patent} = 23,429; N _{Qcitation, Tcitation} =	= 21,873	
	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)	
C_Score	-0.489***	-0.984***	-0.747***	
	(-5.0)	(-6.9)	(-6.4)	
(E): Excluding fir	ms engaged in M&As and those with a	acquired R&D and software devel	opment cost: N = 44,008	
	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)	
C_Score	-0.300***	-0.567***	-0.374***	
	(-5.3)	(-5.5)	(-6.3)	
(F): Removing firms with higher R&D intensity (R&D/Sales > 33%): N = 67,806				
	Ln(1+Patent)	Ln(1+Qcitation)	Ln(1+Tcitation)	
C_Score	-0.330***	-0.663***	-0.408***	
	(-5.8)	(-6.6)	(-6.9)	

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¹ Innovation can come from various different sources and does not necessarily involve a structured R&D process. Strictly speaking, our study focuses more on "invention" rather than on "innovation" (Schumpeter, 1947). However, to be consistent with the recent literature (e.g., Acharya and Subramanian, 2009; Atanassov, 2013), we maintain this terminology.

² See among others, Baber, Fairfield, and Haggard (1991), Bushee (1998), Bens et al. (2003), and Garcia Osma and Young (2009). We review this literature in greater detail in Section II.

³ Our results reported in Section V validate that volatility in the R&D effort reduces its productivity, making delays in its exertion economically costly.

⁴ SFAS 2 prohibits the capitalization of R&D costs for fiscal years beginning on or after January 1, 1975. However, there are some exceptions to this general rule such as purchased R&D or certain software development costs. We address these possibilities in our robustness checks described in Section IV.

⁵ Holmstrom (1989) argues that the principal should rely on compensation schemes that are less sensitive to immediate performance to encourage innovation. In the same vein, Manso (2011) shows theoretically that optimal innovation-motivating incentive scheme should exhibit substantial tolerance for early failure and reward for long-term success, implying that continuous effort is crucial for the success of innovative projects.

⁶ It should be noted that it is not the *ex post* realization of the shock but the *ex ante* expectation of this shock that drives the results in Aghion et al. (2005b). Similarly, it is not the *ex post* bad news but the *ex ante* expectation that bad news would interrupt the innovation process that drives our results.

⁷ The results from the test of our main hypothesis are likely to be particularly relevant to a regulator who has to set a consistent degree of conditional conservatism across all firms in the economy (unless regulators want to set the degree of conservatism conditioning on the degree of firm myopia, which strikes us as unlikely).

⁸ Mansfield (1984) also notes that "to answer many important analytical and policy questions, it is essential to disaggregate R&D. Unfortunately, little work has been done on this score."

⁹ Aside from legal monetary costs, Horstmann, MacDonald, and Slivinski (1985) stress the economic

costs associated with revealing information to the competitors.

¹⁰Following prior literature (e.g., Chemmanur and Tian, 2011; Hirshleifer, Low, and Teoh, 2012), missing R&D expenses are treated as zero. Our results are qualitatively the same if we include in the regressions an R&D indicator that equals one if R&D expenses are missing and zero otherwise.

¹¹ For instance, to calculate the effect of *C_Score* on the change in the number of patents from its mean value, we first multiply the change of *C_Score* from the 1st quartile (0.04) to the 3rd quartile (0.17) by the coefficient on *C_Score* (-0.306), and then by the mean number of patents (5.71) plus one. It is so because dLn(1+y)/dx = (dy/dx)/(1+y). An increase in *C_Score* from the 1st quartile to the 3rd quartile can be translated into a 0.27 decrease in the number of patents. Given that the average number of patents is 5.71, a decrease of 0.27 patents represents a 5% decrease from the mean value.

¹² The *C_Score* is a fitted value based on size, market-to-book, and leverage, which are also in equation (1). To ensure that the inclusion of the three proxies does not drive our results, we remove Ln(Assets), *MB*, and *Leverage* from the regression. Our results are not affected.

¹³ Unlike He and Tian (2013) but consistent with Chen et al. (2014), we find that analyst coverage has a positive effect on the number of patents and citations. Although we are able to replicate He and Tian (2013) using their sample, variable definitions, and specification, we find that the effect of analyst coverage on innovation is often unstable depending on the specifications used. For example, He and Tian (2013) include firm fixed effects in their regressions. In addition, unlike our study's sample period that ends in 2003, He and Tian (2013) use the NBER Patent and Citation data up to 2005, which makes their analysis be subject to the truncation bias pointed out by Hall, Jaffe, and Trajtenberg (2001). In sum, the effect of analyst coverage on innovation seems to be quite sensitive to empirical specifications. In contrast, the results for the effect of conditional conservatism are highly robust.

¹⁴ For this test, the dependent variables are the numbers of patents and adjusted citations, rather than their log values.

¹⁵ For this test, we remove R&D from the right hand side of equation (1). The regressions are performed separately for the full sample where we treat missing R&D as zero, and for the subsample of firms with non-missing R&D.

Increasing *C_Score* by one standard deviation reduces R&D intensity by approximately 8%. We obtain similar results when we scale R&D expenditures by sales or by the number of employees (untabulated).

¹⁶ Although in most cases, R&D costs are immediately expensed, there are a limited number of exceptions to this rule (e.g., acquired R&D and software development costs). Thus, to ensure that our results are not affected by the conservative treatment of these assets, we remove firms engaged in M&As and those with software development cost from the analysis.

¹⁷ To ensure that our results are not driven by non-linearity in size, market-to-book ratio, or financial leverage, for each variable we first implement a "quasi Fama-MacBeth" approach by splitting the firms into 20 groups according to each variable, running 20 pooled regressions, and calculating the *t*-statistics using the Fama-MacBeth (1973)

approach. Furthermore, we also replace Ln(Assets) with nine indicator variables that are constructed based on 10 portfolios formed according to Ln(Assets). To ensure that our results are not driven by the "scale effect", we regress *Innov* on *C_Score* without any additional controls, or use a probit model with the dependent variables being three binary variables that are equal to one if the number of *Patent*, *Qcitation*, or *Tcitation* is greater than zero, and zero otherwise.

¹⁸ We include as the measures of macro-economic conditions the annual per capita GDP growth rates, the aggregate corporate profits growth rates compiled by the Bureau of Economic Analysis, the stock market risk premium, and the debt market default spread.

¹⁹ Due to the coverage of *ExecuComp* database, the CEO fixed-effect analysis can only be performed on a small sample with 11,290 observations.

²⁰ In an untabulated test, we replace one-year lagged *C_Score* with *C_Score* lagged for industry-specific R&D amortizable lives for firms in different industries, and find that the results are not affected. The amortizable life measures the number of years between the time a firm conducts R&D and the time commercial products emerge from R&D.

²¹ The only exception is the firm-fixed effect regression using Ln(1+Patent) as the dependent variable.

²² The pVAR approach has been used by previous studies (e.g., Grinsten and Michaely, 2005) to investigate the causal effects and intertemporal interactions between endogenous variables. The approach combines the conventional vector autoregression technique, which allows a vector of variables to be endogenously determined in the system, with the panel-data approach, which controls for unobserved heterogeneity.

²³ Consistent with this view, the coefficient (untabulated) on *D×R×Ln*(*Distance*) has a *t*-statistic of -2.1 in Khan and Watts' (2009) model.

²⁴ Consistent with this finding, we observe that the correlation coefficient between the SAB 101 indicator and

C_Score is 0.24 in our sample.

²⁵ Crawford, Price and Rountree (2010) note that "given that the contracting benefits of SAB 101 are not clear, *ex post*, the primary benefits of the guidance appear to be related to the reputation of the SEC as a conservative regulatory body protecting the interests of investors."

²⁶ Since we already control for firm and year fixed effects, the industry and *SAB 101* indicators are not included in these regressions.

²⁷ We estimate *Beta* with the Capital Asset Pricing Model (CAPM) using CRSP daily stock returns in each year.

²⁸ We find, however, that the coefficient estimate on Ln(1+Tcitation) for the high *C_Score* subsample slightly increases in year *t+*5 but the increase is statistically insignificant.

²⁹ To estimate *CAR* with the market model using daily stock returns, we use 260 trading days, beginning 390 days and ending 131 days before the patent granting date. We use as the market return the CRSP value-weighted return. Using the CRSP equally-weighted return yields qualitatively similar results.

³⁰ We exclude *stock volatility* for this test as it is highly correlated with the dependent variable, i.e., *Lottery*.

³¹ The amortizable life of R&D varies across firms. For example, R&D at a pharmaceutical company should have a fairly long amortizable life because both the approval process and the patent protection granted for products that emerge from R&D are long. In contrast, R&D expenses at a software company should have a shorter amortizable life since software products emerge from research more quickly. The data on amortizable lives are downloaded from Aswath Damodaran's website

(http://people.stern.nyu.edu/adamodar/New_Home_Page/spreadsh.htm).

³² We start the sampling period in 1992 because the *ExecuComp* database is not available before 1992.

³³ PAPS indicator takes a value of one if PAPS is above the top 30th percentile of the sample firms and zero if

PAPS is below the bottom 30th percentile of the sample firms. Firms with *PAPS* between the top 30th and the bottom 30th percentiles of the sample are dropped when we define the *PAPS* indicator.

³⁴ Following Bushee (1998), we classify institutional investors into two groups according to their past investment behavior. Transient institutions are those that have high portfolio turnover and high diversified portfolio holdings. They tend to be short-term oriented with interest in firms' short-term trading profits. In contrast, dedicated

institutions are those that have low portfolio turnovers and long-term and stable holdings, and engage less in active trading activities. We obtain the information on the types of institutions from Brian Bushee's website http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html).

³⁵ Firms between the top 30th and the bottom 30th percentiles of the sample are dropped from the regression

analysis.

³⁶The *t*-statistics for the interactions involving the high industry homogeneity indicator are -4.0, -3.0, and -3.3; those for the interactions involving the low ownership indicator are -3.6, -2.5, and -3.0; those for the interactions involving the low transparency indicator are -2.5, -1.9 and -2.3.

³⁷ Specifically, we include as controls variables institutional ownership, the change in log R&D per share in prior year, the change in log industry R&D-to-asset ratio (4-digit SIC), the change in log GDP, the change in log capital expenditure per share, the change in log sales per share, the change in log shares outstanding, leverage ratio, free cash flow over current assets, total assets, and *MB*. See Bushee (1998) for detailed definitions of these variables.

³⁸ Specifically, we use the presence of a large auditor, the auditor tenure, the amount of net operating assets, and the length of operating cycle to measure the easiness of accrual manipulation. These variables are defined in greater details in Appendix A4.

³⁹ Since the analyst following data starts in 1976, the sample period for this test is from 1981 to 2003.