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ARTICLE INFO	Ravi Jain and Sonia Wasan (2009). Adoption of antitakeover legislation and R&D expenditure. *Investment Management and Financial Innovations*, *6*(3)
RELEASED ON	Friday, 21 August 2009
JOURNAL	"Investment Management and Financial Innovations"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	**0**	**0**

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Adoption of antitakeover legislation and R&D expenditure

Abstract

We study the effect of the adoption of antitakeover legislation at the state level in the 1980s, on firm R&D expenditure. These laws limit hostile takeovers and hence effectively increase managerial discretion. Prior studies, using adoption of one or a few antitakeover measures report inconsistent evidence on the relation between antitakeover provisions and R&D expenditure. We contribute to this area of inquiry by examining the effect of state-level adoption of antitakeover laws during the 1980's on firm-level R&D expenditure. Adopting a difference-in-difference methodology, we fail to find a significant change in R&D expenditure following the adoption of state antitakeover laws. Since state antitakeover laws are exogenous to managerial discretion, our results suggest that prior evidence documenting a significant association between antitakeover protection and R&D could be attributable to unobservable variables correlated with both antitakeover protection and R&D.

Keywords: antitakeover legislation, R&D expenditure, managerial discretion.
1.**JEL Classificiation:** G30, G34, and G38.

1.Introduction

In this study, we investigate the influence of state-level antitakeover laws on managerial discretion as evidenced in R&D expenditure. Prior studies that have examined the effect of firm-level antitakeover provisions on R&D provide inconsistent results. While some studies find a decline in R&D subsequent to the firm-level adoption of antitakeover measures (Meulbroek, Mitchell, Mulherin, Netter, and Poulsen, 1990; Mahoney, Sundaramurthy, and Mahoney, 1997), others document an increase in R&D expenditure after the adoption of antitakeover amendments (for example, Pugh, Page, and Jahera 1992; Malekzadeh, McWilliams, and Sen, 2005). We contribute to this stream of inquiry by examining the effect of state-level adoption of antitakeover laws on firm-level R&D expenditure. Using a difference-in-difference methodology we find that R&D expenditure is unaffected by the adoption of state antitakeover laws. Since state antitakeover laws are exogenous to managerial discretion, our results suggest that prior evidence documenting a significant association between antitakeover protection and R&D could be attributable to unobservable variables correlated with both antitakeover protection and R&D.

R&D expenditure is "vital to innovation, which is an increasingly important factor in the competitiveness of firms and the main driver of long-term growth in productivity and thus, higher standards of living"[1]. However, interpretation of reported R&D expenditure may not always be straightforward. Since GAAP requires all R&D expenditure to be expensed as incurred, it may undesirably depress reported earnings in the short run. Wahal and McConnell (2000) demonstrate a decline in the reported earnings in the year subsequent to the incurrence of R&D expenditure. Also, since R&D expenditure is not capitalized, firms with large R&D expenditure may appear to be more leveraged, thus, exposing themselves to unduly higher rates of interest (Sougiannis, Chan and Lakonishok, 2001). Additionally, this may also result in inflated price-to-earnings and market-to-book ratios, causing stocks to appear overpriced (Sougiannis, Chan and Lakonishok, 2001). Aboody and Lev (1999) find positive association between R&D expenditure and information asymmetry suggesting that R&D expenditure is heterogeneously interpreted among investors. Hence, it is plausible that R&D expenditure unfavorably distorts reported earnings and assets in the short run.

So long as managers are focused on quick payoffs, they are likely to evade R&D expenditures that are beneficial only in the long run. Hence, while stockholders are likely to view R&D expenditure as an attractive long-term wealth-enhancing strategy, managers who are hard-pressed to report favorable results in the short run, may have the propensity to forego R&D expenditure in favor of myopic gains (Wahal and McConnell 2000).

This study is motivated by two competing hypotheses related to the influence of antitakeover protection on R&D expenditure. The *shareholder welfare hypothesis* contends that takeover threats induce a managerial shortsightedness forcing managers to operate in the short-term interest of the firm in order to circumvent a takeover at an unfavorable price. Hence, heightened antitakeover protection may increase the inclination of managers to act in the long-term benefit of the firm (DeAngelo and Rice, 1983). Since R&D expenditure is generally wealth-enhancing in the long run, the managerial shortsightedness alleviated by the adoption of antitake-

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[1] Guinet and Kamata, Do Tax-Incentives Promote Innovation? The OECD Observer, Oct./No./ 1996, p. 22.

over measures should encourage firms to enhance R&D expenditure. An opposing hypothesis called the *managerial welfare hypothesis* (Mahoney, Sundaramurthy, and Mahoney, 1997) argues that enhanced antitakeover measures reduce the restraining role of takeover threats and boost the freedom of entrenched managers to act in self-serving interests thus, encouraging them to forego R&D projects in favor of ventures that offer quick payoffs.

The above hypotheses assume that takeovers have effect on managerial behavior. However, Grossman and Hart (1980) argue that while costs of imposing takeover discipline are borne by a few shareholders, all shareholders share the benefits. This free-rider problem limits the disciplining role of takeovers.

Prior studies that examine the role of antitakeover measures on R&D expenditure, employ one or more antitakeover provisions, and report inconsistent results. On one hand, Meulbroek, Mitchell, Mulherin, Netter, and Poulsen (1990) and Mahoney, Sundaramurthy, and Mahoney (1997) document a negative association between antitakeover measures and R&D expenditure and on the other hand, Pugh, Page, and Jahera (1992) and Malekzadeh, McWilliams, and Sen (2005) document an increase in R&D with the adoption of antitakeover amendments.

Studies have also examined the influence of state-level antitakeover legislation on various firm specific attributes like takeover premiums (Comment and Schwert, 1995), innovations (Atanassov, 2005), debt (Garvey and Hanka, 1999), cash holdings (Howe, Jain, and Pereira, 2007), managerial remuneration (Bertrand and Mullainathan, 1999), productivity and profitability (Bertrand and Mullainathan, 2003), stock ownership of officers and directors (Cheng, Nagar and Rajan, 2005).

However, the impact of antitakeover state laws on R&D expenditure has generally remained a neglected area of research. We augment this stream of inquiry by examining the influence of state-level implementation of antitakeover laws on managerial behavior as reflected in changes in firm-specific R&D expenditure. A change in the state-level antitakeover laws provides a setting to test managerial discretion in response to an exogenous shock as reflected in changes in R&D expenditure. If takeover threats restrain managerial behavior from indulging in self-serving preferences, an increase in state-level antitakeover legislation should heighten managerial freedom encouraging them to reduce R&D expenditure. On the other hand, if enhanced antitakeover legislation creates a setting that encourages managers to act in the long-run welfare of the firm, increased antitakeover laws should encourage managers to increase R&D expenditure. Using a sample of 30,730 firm-year observations from the time period 1982 to 1995 we divide our sample into protected and unprotected firms, where protected firms are those that are incorporated in states that adopt the antitakeover laws and unprotected firms being those that are incorporated in states that do not initiate these antitakeover statutes. Employing a difference-in-difference (DID) methodology, we find no change in the R&D expenditure incurred by protected firms, as compared to that incurred by unprotected firms, in response to the adoption of second and third generation state antitakeover laws. Our results are robust to different measures of R&D and to the inclusion of firm-specific and year-specific fixed effects.

Our study contributes to the existing literature in two ways. First, prior studies on antitakeover protection and R&D expenditure conduct an *association* test between antitakeover protection and R&D expenditure. However, using a difference-in-difference methodology, we study the effect of adoption of antitakeover statutes by examining the *change* in R&D expenditure specifically, during the period following the adoption of state antitakeover laws. Furthermore, we also test whether the change in R&D expenditure after the adoption of antitakeover legislation is significantly different from firms in states where these antitakeover laws are not passed. Secondly, earlier studies that document a significant association between firm-specific antitakeover measures and R&D expenditure, fail to control for any potential endogeneity between R&D and adoption of firm-level antitakeover protection. Bertrand and Mullainathan (2003) argue that "better and worse governance probably also differs on other, unobservable, dimensions", making it impossible to remove any unobservable factors influencing the association between antitakeover measures and R&D. Since state-level antitakeover laws are exogenous to managerial discretion, they control for any endogeneity associated with the study of firm-level antitakeover measures. Our results suggest that prior evidence documenting a significant association between antitakeover protection and R&D expenditure could be attributable to unobservable variables correlated with both antitakeover protection and R&D expenditure.

The remainder of the paper is organized as follows. Section 1 describes the prior literature. Section 2 describes the data and the empirical methodology. Section 3 discusses the results and the last section concludes the paper.

1. Literature review

1.1. Introduction of anti-takeover laws in US. The history of antitakeover legislation in the US started with the promulgation of the Williams Act of 1968 that required firms to increase disclosure and minimize fraud during the tender offer process. Several states followed suit and pronounced several antitakeover laws in the 1970s commonly referred to as the "first generation" antitakeover laws (Bertrand and Mullainathan, 1999). However, since their jurisdiction extended beyond the legislating state they were ruled as "unconstitutional" during Edgar vs. Mite Corp., 1982. In response, the states started adopting another set of anti-takeover laws that were, finally, pronounced as constitutional by the Supreme Court in CTS vs. Dynamics Corp, 1987[1]. Thereafter, states came up with a third set of antitakeover laws introducing further barriers to the takeover activity (Bertrand and Mullainathan, 1999).

The second and third generation anti-takeover laws are of three kinds: Control Share Acquisition (CSA), Fair Price (FP), and Business Combinations (BC). CSA laws restricts takeover activities by giving target shareholders the prerogative to grant voting rights to the target shares after examining the "identity, intent, and terms of acquisition" of the acquirer (Cheng, Nagar and Rajan 2005). The FP laws make it compulsory for the acquirer pay a "fair price" if the shares being acquired cross a certain threshold, unless this requirement is exempted by the consent of the target firm's board. The FP laws also restrict the usage of two tier offers. The BC laws require the deferment of certain transactions with a shareholder whose stock ownership exceeds a certain limit. The BC laws also impose restrictions on takeovers that involve the liquidation of the target firm's assets to finance the acquisition.

Extant literature acknowledges that antitake-over laws are successful in restraining the takeover activity (Jensen, 1988; Karpoff and Malatesta, 1989; Shleifer and Vishny, 1990; Romano, 1992; and Szewczyk and Tsetsekos, 1992; Bertrand and Mullainanthan, 1999, 2003). Hackl and Testani (1988) find a decline in the takeover activity after the adoption of antitakeover statutes. Comment and Schwert (1995) document an increase in takeover premiums following the adoption of anti-takeover statutes indicating that takeover activity has become costlier than before. Thus, the increased cost of antitakeover activity reasonably allows for these laws to be deemed as an exogenous variable influencing managerial discretion.

1.2. Antitakeover laws and corporate governance. There is considerable anecdotal and empirical evidence in the literature suggesting that antitakeover laws enhance managerial discretion. Bertrand and Mullainathan (2003) explain that business combination laws significantly enhance managerial power as they allow the managers to avert even highly leveraged takeovers making it more difficult for the acquiring firm to finance such takeovers. In Sroufe and Gelband (1990), Justice Schwartz admitted that the business combination law significantly changed the balance of power between the managers and the acquiring entity. Bertrand and Mullainathan (1999) argue that the passage of antitakeover laws provide a suitable setting to study the agency problem by examining an exogenous shock to managerial discretion.

Studies that examine the impact of state antitakeover laws have also documented evidence of heightened managerial discretion and an inclination to a quiet life. Garvey and Hanka (1999) find weak evidence of decline in restructuring activity of protected firms subsequent to the passage of antitakeover legislations, suggesting enhanced managerial "inertia". Bertrand and Mullainathan (1999) find a 1-2% increase in wages after the passing of antitakeover laws. Bertrand and Mullainathan (2003) find an increase in white-collar remuneration, a decline in the construction and destruction of plants and a reduction in general, and decreased plant efficiency and profitability after the passage of antitakeover laws. Cheng, Nagar and Rajan (2005) find that directors and officers (insiders) of Forbes 500 firms reduce their stock ownership by around 12.3% (5%) after the passage of antitakeover laws. However, they find that this result holds only for firms that had not adopted the poison pill antitakeover amendment. They conclude that since stock holding is risky, enhanced antitakeover protection makes it conducive for managers to retain the same level of control over the firm with reduced ownership. Atanassov (2005) documents a decrease in the number of significant innovations (patents) after the passing of antitakeover laws at the state level from 1985 to 1990.

Existing studies that examine the role of antitakeover laws also document evidence of change in managerial financial policies after the adoption of the laws. Garvey and Hanka (1999) find a decrease in the leverage ratio of firms after the passage of antitakeover laws for protected firms whose insider holding is less than 25%. Litov (2005) finds an in-

[1] The Supreme Court ruling held that anti-takeover statutes could be enact subject to the condition that they did not obstruct the provisions of the Williams Act of 1968.

crease in leverage as a result of the adoption of antitakeover state laws. Howe, Jain and Pereira (2007) find a decrease in cash holdings and the rate of cash savings after the passing of state antitakeover laws.

1.3. Antitakeover protection and R&D expenditure. The empirical evidence on the role of firm-level antitakeover measures on R&D expenditure is rather inconsistent. Meulbroek, Mitchell, Mulherin, Netter, and Poulsen (1990) document a significant reduction in the market-adjusted R&D to sales ratio during the three-year window around the adoption of the antitakeover amendment. Mahoney, Sundaramurthy, and Mahoney (1997) find a negative relation between antitakeover measures and industry-adjusted R&D expenditures. They find that their result holds more strongly for firms with relatively lower insider and institutional ownership. Hence, there is some evidence of a decline in R&D expenditure subsequent to the adoption of firm-level antitakeover amendments.

However, another set of studies document a positive association between antitakeover protection and R&D expenditure. Pugh, Page, and Jahera (1992) find that R&D expenditure actually increases after the adoption of antitakeover measures. Johnson and Rao (1997) find an increase that unadjusted R&D expenditure after the passage of antitakeover amendments although, they fail to detect any change in industry-adjusted R&D expenditure after the adoption. Malekzadeh, McWilliams, and Sen (2005) find a significant increase in R&D expenditure subsequent to the adoption of antitakeover measures for a sample of 265 firms over a time period of 1980 and 1990. In the same vein, studies have also documented that firms with stronger corporate governance make higher investments in R&D. Baysinger, Kosnik, and Turk (1991) find a positive relation between the R&D expenditure and insider representation on the board and institutional ownership. Bushee (1998) finds that, in general, institutional ownership tends to discourage firms to reduce R&D expenditure to prevent a reduction in reported earnings. Wahal and McConnell (2000) find a significant positive association between institutional ownership and R&D expenditure. Barker III and Mueller (2002) find that the level of stock ownership of CEOs is positively related to R&D expenditure. Overall, prior literature provides inconsistent evidence on the impact of antitakeover measures on the R&D expenditure choices made by firms. Though several studies have examined the role firm-level adoption of antitakeover measures on R&D expenditure, changes in R&D expenditure in response to state level adoption of antitakeover statutes have not been examined so far. We investigate this issue in our study.

2. Sample and methods

2.1. Sample. Our primary research question is whether the passage of antitakeover laws impacted firms' R&D expenditure. Our sample consists of all firms excluding the foreign firms, financial firms (SICs 6000 to 3999) and regulated firms (SICs 4000 to 4999) in the COMPUSTAT database covering US firms, over the period from 1982 to 1995. We delete firm-years with missing information on any of the variables used in our multivariate analysis. We also delete firm-year observations for which growth in assets or sales exceeded 100 percent, and for which market capitalization is less than $20 million. To avoid the effect of outliers, all variables are winsorized at the one percent level. The final sample consists of 30,730 firm-years.

2.2. Methods. Since our primary research objective is to capture the time-series change in R&D expenditure of firms incorporated in states that passed antitakeover laws, we can calculate it by subtracting post-law change R&D expenditure from pre-law change R&D expenditure. For example, for a firm in Missouri (law passed in 1986) we can subtract R&D expenditure after 1986 from before 1986. However, there may be other economic events happening simultaneously which may affect R&D expenditure. Hence, we need to include firms in a state that did not pass antitakeover laws, for example Oregon, to act as control firms. This methodology is referred to as the difference-in-difference methodology. As the name refers, it involves calculating differences at two levels: time-series change in treatment firms and net change after including control firms.

Several prior studies that have examined the effect of antitakeover laws on firm variables have adopted this methodology. For example, Bertrand and Mullainathan (1999) study change in wages; Bertrand and Mullainathan (2003) study change in plant level productivity; Garvey and Hanka (1999) study change in capital structure; Cheng, Nagar, and Rajan (2004) study change in managerial ownership; Atanassov (2007) studies changes in patent creation; Giroud and Mueller (2007) study change in capital expenditure and operating costs; and Howe, Jain, and Pereira (2007) study change in cash policy.

To examine changes in the level of R&D expenditure, we model R&D expenditure (R&D) as a function of control variables that are likely to affect R&D expenditure. Our sample includes both treatment and control firms, the treatment firms being the ones that are incorporated in the states that pass the antitakeover laws and the control firms being the

ones that are incorporated in the states that do not pass the antitakeover laws.

Next, we introduce a dummy variable PROTECTED that takes the value of 1 if the firm falls in the protected state (state that passes anti-takeover laws) *and* if the year is after the passage of the law. The coefficient estimate of PROTECTED captures the difference in time-series change in R&D expenditure after the passage of antitakeover laws between treatment firms (firms incorporated in the protected state) and control firms (firms incorporated in states that have not passed antitakeover laws). A positive (negative) and significant value of the coefficient of PROTECTED would indicate that the increase (decrease) in R&D expenditure for treatment firms is significantly higher than the increase (decrease) in control firms, after the passage of antitakeover laws.

To control for serial correlation in data, we allow for clustering of observations at the state level (Bertrand, Duflo and Mullainathan, 2004). Consistent with Bertrand and Mullainathan (1999), we also include firm and year specific dummies to control for any unobservable firm or year specific factors. Thus, we specify our model as follows:

$$R\&D_{i,t} = \beta X_{i,t} + \delta\ PROTECTED + \alpha\ FIRM_i + \\ + \gamma\ YEAR_t + \varepsilon_{i,t}, \quad (1)$$

where $X_{i,t}$ is a vector of control variables; $FIRM_i$ is firm fixed effects to control for time-invariant unobservable firm characteristics; and $YEAR_t$ is year fixed effects to control for economy-wide shocks. The coefficient δ captures the impact of the anti-takeover laws on a firm's R&D expenditure.

We use three variants of the dependent variable: R&D expenditure scaled by total assets (RD1), R&D expenditure scaled by sales (RD2), and R&D expenditure scaled by the number of employees (RD3). We control for SIZE (log of total assets) and CASHFLOW (annual operating cash flow scaled by total assets) and predict a negative sign on their coefficients because large and stable firms operating in their maturity stage are likely to spend less on R&D (Bushee, 1998). We also control for LEVERAGE measured as the sum total of short-term and long-term debt scaled by total assets. However, we do not predict the sign of LEVERAGE because total debt may influence the R&D expenditure either way: if the debt-related cash inflows offer additional funds enabling them make new investments then the effect of leverage will be positive, but if the existing debt is so high that it restricts firms from making further long-term investments then the effect of leverage on R&D expenditure will be negative (Stulz, 1990). We include MB (market-to-book ratio) and expect the sign of its coefficient to be positive since firms with higher growth potential are expected to make larger R&D investments. We also include the lag values of our three R&D expenditure variables (LAGRD1, LAGRD2, and LAGRD3) to account for any serial correlation in the R&D expenditure[1].

We calculate the variables as follows:

RD1: R&D expenditure (Compustat # 46[2]) / Total assets (Compustat # 6);

RD2: R&D expenditure (Compustat # 46) / Sales (Compustat # 12);

RD3: R&D expenditure (Compustat # 46) / Number of employees (Compustat # 29);

SIZE: Log of total assets (Compustat # 6);

LEVERAGE: Short-term debt (Compustat # 34) + LT (Compustat # 9) / Total assets;

CASHFLOW: Earnings before interest depreciation and tax (Compustat # 3)/ Total assets;

MB: Market value of assets [(Compustat # 24* Compustat # 25) + Compustat # 9 + Compustat # 34] / Total assets.

2.3. Descriptive statistics.

Table 1. Antitakeover legislations

State	Year	No. of firms	No. of firm-years
Arizona	1987	8	31
Connecticut	1989	19	175
Delaware	1988	2861	15402
Georgia	1988	64	420
Idaho	1988	2	13
Illinois	1989	20	88
Indiana	1986	50	411
Kansas	1989	13	59
Kentucky	1987	5	40
Maine	1988	4	38
Maryland	1989	59	373
Massachusetts	1989	136	818
Michigan	1989	66	460
Minnesota	1987	124	667

[1] We find that there is no change in results if lagged values of R&D are removed from the model.

[2] To minimize the loss of observations, we set R&D investment to 0 if the datum is missing. However, removing these observations yields similar results.

Table 1 (cont.). Antitakeover legislations

Missouri	1986	31	185
Nebraska	1988	2	14
Nevada	1991	103	446
New Jersey	1986	100	594
New York	1985	204	1356
Oklahoma	1991	14	68
Ohio	1990	116	907
Pennsylvania	1989	119	825
Rhode Island	1990	7	49
South Carolina	1988	8	57
South Dakota	1990	2	12
Tennessee	1988	32	197
Virginia	1988	51	381
Washington	1987	46	258
Wisconsin	1987	50	392
Wyoming	1989	1	1
ALL PROTECTED		4317	24737
OTHER STATES		1428	5933

Notes: This table reports the year in which second and third-generation antitakeover laws were passed in different states. It also reports the number of firms and firm-years used in the analysis for each protected state.

Source: Bertrand and Mullainathan (2003).

Table 2. Descriptive statistics

Variables		Full sample	Protected	Others	
	N	30,730	24,737	5,993	
SIZE	Mean	5.389	5.352	5.543	**
	Median	5.156	5.148	5.188	***
LEVERAGE	Mean	0.228	0.229	0.225	***
	Median	0.206	0.205	0.208	
CASHFLOW	Mean	0.126	0.127	0.119	***
	Median	0.139	0.141	0.129	***
MB	Mean	1.555	1.568	1.502	**
	Median	1.108	1.117	1.070	***
RD1	Mean	0.036	0.037	0.033	***
	Median	0.005	0.006	0.002	***
RD2	Mean	0.059	0.061	0.051	***
	Median	0.005	0.006	0.002	***
RD3	Mean	5.391	5.483	5.009	
	Median	0.535	0.615	0.185	***

Notes: This table reports mean and median values for variables used in the analysis. The sample consists of all firms in the COMPUSTAT database, excluding foreign firms, financial firms (SICs 6000 to 3999), and regulated firms (SICs 4000 to 4999). The sample period is from 1982 to 1995. The first column reports values for the full sample of 30,730 firm-years. The second column reports values for firm-years in states that passed anti-takeover legislations (protected states), and the third column reports values for firm years in the remaining states. We use three variants of R&D expenditure: R&D expenditure scaled by total assets (RD1), R&D expenditure scaled by sales (RD2), and R&D expenditure scaled by the number of employees (RD3). Other variables include log of total assets (SIZE), the ratio of book value of short-term and long-term debt to total assets (LEVERAGE), the ratio of operating cash flow to total assets (CASHFLOW), and the ratio of market value of assets to book value of assets (MB). Median values are reported below the mean values. *, **, *** indicate that mean/median values for firm-years in protected states are different from values for firm-years in other states. The significance levels for differences in means are calculated using the t-test, and for differences in medians are calculated using the Wilcoxon Rank Sums test.

Table 1 reports the year in which second and third-generation anti-takeover laws were passed in different states (Bertrand and Mullainathan 2003). The number of firms that belong to states that passed antitakeover laws (4317) is much bigger than the unprotected firms (1428). This observation is consistent with prior studies: for example, in Garvey and Hanka (1999), for a sample period of 1982-90 there are 1084 firms that belong to states that passed the antitakeover laws whereas, only 119 firms were in the sub-sample of firms that belonged to states that did not pass the antitakeover laws.

Table 2 reports the mean and median values of all the variables used in the analysis. The first column provides descriptive statistics for the full sample, the second and third columns provide the descriptive statistics for the protected and unprotected firms, respectively. Our first variable of interest, RD1 (R&D expenditure scaled by total assets) has a mean (median) value of 0.035 (0.005) for the full sample. For protected firms the mean (median) value is 0.037 (0.006), and for the unprotected firms it is 0.033 (0.002). RD2 (R&D expenditure scaled by sales) has a mean (median) of 0.059 (0.005) for the full sample. For protected firms the mean (median) value is 0.061 (0.006), and for the unprotected firms it is 0.051 (0.002). RD3 (R&D expenditure scaled by number of employees) has a mean (median) value of 5.391 (0.535) for the full sample. The mean (median) value for the protected and unprotected firms is 5.483 (0.615) and 5.009 (0.185), respectively.

The mean (median) value of SIZE (log of total assets) for the total sample is 5.389 (5.156). It has a mean (median) of 5.352 (5.148) and 5.543 (5.188) for protected and unprotected firms, respectively. The mean (median) value of LEVERAGE for the full sample is 0.228 (0.206). It has a mean (median) value of 0.229 (0.205) and 0.225 (0.208) for protected and unprotected firms, respectively. CASHFLOW (the ratio of annual cash flow to total assets) has a mean (median) of 0.126 (0.139) for the full sample. The mean (median) values are 0.127 (0.141) and 0.119 (0.129) for the protected and unprotected firms, respectively. MB (market to book ratio) has a mean (median) of 1.555 (1.108) for the total sample. The mean (median) values for the protected and unprotected firms are 1.568 (1.117) and 1.502 (1.070), respectively.

3. Empirical results

Table 3. Univariate analysis: change in R&D

Variables		Protected firms		
		Before	After	
		Law changes	Law changes	
	N	10427	14310	
RD1	Mean	0.030	0.042	***
	Median	0.008	0.006	*
RD2	Mean	0.043	0.075	***
	Median	0.006	0.005	*
RD3	Mean	3.174	7.166	***
	Median	0.580	0.650	***

Notes: This table reports mean and median values for variables used in analysis for a sub-sample of 24,737 firm years in states that passed anti-takeover legislations. The sample period is from 1982 to 1995. The first column reports values for *** firm-years before the passage of laws, and the second column reports values for firm-years after the passage of laws. We use three variants of R&D expenditure: R&D expenditure scaled by total assets (RD1), R&D expenditure scaled by sales (RD2), and R&D expenditure scaled by the number of employees (RD3). Median values are reported below the mean values. *, **, *** indicate that mean/median values for firm years in protected states after the passage of laws are different from values for firm years in protected states before the passage of laws. The significance levels for differences in means are calculated using the t-test, and for differences in medians are calculated using the Wilcoxon Rank Sums test.

Table 3 reports the results of the univariate analysis that compares the mean and median values of the R&D expenditure incurred by the protected firms before and after the adoption of antitakeover laws. The significance levels for differences in means are calculated using the t-test, and for differences in medians are calculated using the Wilcoxon Rank Sums test. The results of the univariate analysis indicate that whereas the mean R&D expenditure increases significantly after the passage of antitakeover laws, the median values of RD1 (R&D expenditure scaled by total assets) and RD2 (R&D expenditure scaled by the sales) experience a significant decline after the passage of antitakeover laws.

An increase in the R&D expenditure after the adoption of antitakeover laws renders support for the shareholder welfare hypothesis suggesting that managers tend to work toward maximizing long-term shareholder wealth when shielded from the threat of hostile takeovers. However, this result may be attributable to other factors influencing R&D expenditure and not solely to the passage of state antitakeover laws. In order to capture the marginal effect of these laws, we do a multivariate analysis by adopting a difference-in-difference methodology and controlling for other factors likely to influence R&D expenditure.

Table 4. Difference-in-difference analysis: change in R&D expenditure

	Dependent variables		
Explanatory variables	**RD1**	**RD2**	**RD3**
LAGRD1	0.495		
	0.0000		
LAGRD2		0.668	
		0.0000	
LAGRD3			0.575
			0.0000
SIZE	-0.003	0.003	0.489
	0.0000	0.0000	0.0000
LEVERAGE	-0.008	-0.021	-1.010
	0.0010	0.0190	0.0000
CASHFLOW	-0.069	-0.193	-6.984
	0.0000	0.0000	0.0000
MB	0.003	0.008	0.214
	0.0000	0.0000	0.0000
PROTECTED	**0.000**	**0.002**	**0.089**
	0.7280	**0.2470**	**0.4700**
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
N	30730	30730	30730
Adj – R square	0.9305	0.9330	0.9356

Notes: This table reports regression results for Equation 1:

$R\&D_{i,t} = \beta X_{i,t} + \delta\ PROTECTED + \alpha\ FIRM_i + \gamma\ YEAR_t + \varepsilon_{i,t}$.

The sample consists of all 30,730 firm-year observations excluding foreign firms, financial firms (SICs 6000 to 3999), and regulated firms (SICs 4000 to 4999) in the COMPUSTAT database over the period from 1982 to 1995. We use three variants of the dependent variable: R&D expenditure scaled by total assets (RD1), R&D expenditure scaled by sales (RD2), and R&D expenditure scaled by the number of employees (RD3). The control variables include the lag value of the R&D variable (LAGRD1, LAGRD2, and LAGRD3), log of total assets (SIZE), the ratio of book value of short-term and long-term debt to total assets (LEVERAGE), the ratio of operating cash flow to total assets (CASHFLOW), the ratio of market value of assets to book value of assets (MB), and PROTECTED is a dummy variable equal to 1 for firm-years where the firm is in a protected state (that passed an anti–takeover laws) and the year is after the passage of laws. All regressions include firm and year fixed effects. P-values calculated using standard errors clustered by state are reported below the coefficients.

Table 4 reports the regression results of Equation 1 in which we regress R&D expenditure on a set of control variables and a dummy variable, PROTECTED, which is equal to 1 if the firm is in a protected state and if the year is after the passage of the law. We also control for firm-specific and year-specific fixed effects. To save space, we do not report the estimated coefficients for these variables. If antitakeover amendments allow entrenched managers to focus on short-term benefits and therefore, reduce R&D expenditure, the coefficient on our test variable, PROTECTED, should to be negative. Alternately, if the enhanced antitakeover protection encourages managers to work in the long-term welfare of the firm and therefore increase R&D expenditure, then the coefficient on our test variable, PROTECTED, should to be positive.

Table 4 reports the regression results. The three columns report the regression results using the three dependent variables RD1, RD2 and RD3 respectively. The coefficient estimates are reported against the explanatory variables along with the respective p-values.

Most of the coefficient estimates are significant at one percent level at the predicted sign. The coefficient estimates on LEVERAGE and CASHFLOW are negative and significant in all three regression models. As predicted, MB is positive and significant in all the three equations. The variable SIZE is positive and significant in two out of the three equations. These results indicate that large firms and firms with relatively more growth opportunities spend more on R&D. However, firms with higher debt level and higher annual cash flow spend less on R&D relative to their asset size, sales, and employee strength.

As for our variable of interest, we find that the coefficient estimates of the PROTECTED dummy are not significant in any of the three equations suggesting that the adoption of antitakeover amendments has no significant influence on firm R&D expenditure. These results imply that the change in R&D expenditure among protected firms after the adoption of antitakeover laws is not significantly different from the change in R&D expenditure for unprotected firms.

Although the univariate analysis documents an increase in R&D expenditure among protected firms after the passage of state antitakeover laws, it is clear from the multivariate analysis that this change may not be attributable to the passage of the laws. Prior studies have demonstrated that firm-specific antitakeover amendments have a significant influence on R&D expenditure. However, since the adoption of antitakeover provisions at firm level may be influenced by other firm-related factors, these studies fail to control for any potential endogeneity between antitakeover protection and R&D expenditure. Since state antitakeover laws are exogenous to a firm, we study the influence of an exogenous shock on managerial discretion as reflected in R&D expenditure. Our results suggest that results of prior studies that find a significant association between antitakeover protection and R&D expenditure could be attributable to unobservable variables, correlated with both antitakeover protection and R&D.

It would be useful to re-examine earlier findings in light of our methodology because our finding suggests that antitakeover protection, after all, may not be a significant factor in determining R&D expenditure.

Conclusion

We study the effect of the adoption of antitakeover legislation at the state level in the 1980s, on firm R&D expenditure. These laws limit hostile takeovers and hence effectively increase managerial discretion. Prior studies, using adoption of one or a few antitakeover measures report inconsistent evidence on the relation between antitakeover provisions and R&D expenditure. While some studies find a decline in R&D subsequent to the firm-level adoption of antitakeover measures (Meulbroek, Mitchell, Mulherin, Netter, and Poulsen, 1990; Mahoney, Sundaramurthy, and Mahoney, 1997), others document an increase in R&D expenditure after the adoption of antitakeover amendments (for example, Pugh Page and Jahera, 1992; Malekzadeh, McWilliams and Sen, 2005). We contribute to this area of inquiry by examining the effect of state-level adoption of antitakeover laws on firm-level

R&D expenditure. For a sample of 30,730 firm-year observations from the time period 1982 to 1995, during which second and third generation antitakeover laws were introduced, we study the effect of state-level antitakeover laws on R&D expenditure. Adopting a difference-in-difference methodology, we fail to find a significant change in R&D expenditure of protected firms following the adoption of state antitakeover laws. Our study differs from prior literature on antitakeover protection and R&D expenditure in two respects. First, instead of an association test we determine whether the change in R&D expenditure for protected firms is significantly different from change in R&D expenditure for unprotected firms, after the adoption of state antitakeover statutes. Secondly, as opposed to firm-level antitakeover protection, we study the influence of state antitakeover laws that are exogenous to the firm, thereby, attempting to insulate the effect of any endogeneity prevailing between antitakeover amendments and R&D expenditure. Our results suggest that prior studies documenting a significant association between antitakeover protection and R&D expenditure could also be attributable to unobservable variables, correlated with both antitakeover protection and R&D.

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