

Financial Constraints, Antitakeover Protection, and Corporate Innovation: An Empirical Analysis using Antitakeover Legislation

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Abstract: We examine the impact of financial constraints on the relation between antitakeover protection and corporate innovation. On one hand, potential information asymmetry problems in financially constrained firms can exacerbate the entrenchment effect associated with increased antitakeover protection. On the other hand, the disciplinary role of financial constraints in the deployment of corporate resources can mitigate the entrenchment effect, allowing the shareholder interest effect to dominate.

Using the passage of business combination (BC) laws to identify an exogenous variation in antitakeover protection, we find that corporate innovative activities significantly increase in the post-adoption periods for financially constrained firms incorporated in states that adopted the laws, evidence that is consistent with the mitigating effect hypothesis. Our results are robust to controlling for firm and year fixed effects, and are not subject to potential reverse causality in the passage of antitakeover laws.

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1. Introduction

The relation between antitakeover protection and shareholder wealth has been a topic of intense debate over the last two decades. Academic researchers have developed two competing hypotheses to explain the effect of antitakeover protection on shareholder value. The management entrenchment hypothesis argues that antitakeover protection shields managers from the disciplinary force of the market for corporate control and thus induces them to engage in value-destroying behaviors such as shirking managerial responsibilities, distorting investments toward short-term projects, or wasting corporate resources on organizational inefficiencies (Shleifer and Vishny, 1989; Jensen, 1988). In contrast, the shareholder interest hypothesis suggests that antitakeover protection benefits shareholders by encouraging managers to invest in long-term value-adding investments and firm-specific human capital, or by enabling managers to negotiate better deals for shareholders in takeover contests (Stein, 1988; Grossman and Hart, 1980). While recent empirical evidence documents a dominating negative effect of antitakeover protection on various measures of firm performance (e.g., Gompers et al., 2003; Bebchuk and Cohen, 2005; Faleye, 2007; Bebchuk et al., 2009; Cohen and Wang, 2013), research focus is shifting gradually from examining *whether* toward exploring *when* antitakeover protection enhances or detracts shareholder wealth. Accordingly, a

strand of literature has emerged to question the traditional “one-size-fits-all” framework for antitakeover protection and shareholder value (Straska and Waller, 2010; Duru et al., 2013; Ahn and Shrestha, 2013). In this paper, we extend this literature by focusing on subsamples of firms that are financially constrained, and we investigate the effect of financial constraints on the relation between antitakeover protection and firm performance through the channel of corporate innovation.

Having long been considered as a major driver of economic growth (Solow, 1957; Romer, 1990), corporate innovation is long-term, high-risky, and unpredictable (Holmstrom, 1989), characteristics that make investments in innovations more susceptible to agency problems. The entrenchment hypothesis predicts that antitakeover protection has a negative effect on corporate innovation because less-monitored managers tend to waste resources on uneconomic projects with negative NPVs and other value-destroying, inefficient activities (Jensen, 1986 and 1988). In contrast, the shareholder interest hypothesis suggests a positive effect of antitakeover protection on corporate innovation because more-protected managers are less prone to managerial myopia and more incentivized to invest in long-term innovative projects (Stein, 1988; Shleifer and Summer, 1988). Considering these contradictory arguments, we directly investigate whether antitakeover protection potentially benefits financially constrained firms by examining the effect of financial constraints on the relation between antitakeover protection and corporate innovative activities.

Based on prior literature, we develop two competing hypotheses: the exacerbating (mitigating) effect hypothesis predicts a negative (positive) effect of financial constraints on the relation between antitakeover protection and corporate innovation. We test these hypotheses using a large sample of US firms from the period 1976 to 2000. Our primary measure of antitakeover protection is based on state-level business combination (BC) laws which were adopted by 30 states from 1985 to 1991. Applying a difference-in-differences estimation method, we find that the number of adjusted patents and citations significantly increase in the post-adoption periods for financially constrained firms incorporated in states that adopted the laws. More importantly, our results are not subject to potential reverse causality bias and thus are not outcomes of lobbying activities at the state of incorporation level. Our findings are consistent with the hypothesis that financial constraints effectively mitigate the entrenchment costs associated with enhanced antitakeover protection and enable managers to focus on long-term value-creating investments.

Our study contributes to two strands of literature. First, our paper represents a unique addition to a growing body of literature that challenges the universally detrimental effect of antitakeover protection on shareholder value by demonstrating that antitakeover protection can be beneficial to firms with certain characteristics. Specifically, Straska and Waller (2010) find that firms with low bargaining power in takeovers benefit when they have more antitakeover provisions. Duru et al. (2013) document a positive impact of staggered boards on firm value as corporate opacity increases. Ahn and Shrestha (2013) provide evidence that staggered boards benefit firms with greater advising needs. By documenting that corporate innovation activities increase significantly in financially constrained firms following the passage of state antitakeover laws, we show that financial constraints play an important role in determining the effects of antitakeover protection on corporate innovation.

Second, our study contributes to a line of recent research on the bright side of financial constraints in mitigating agency conflicts between management and shareholders (Luo, 2011; Almeida et al., 2013). Luo (2011) documents a disciplinary role of financial constraints in the deployment of available corporate resources. Similarly, Almeida et al. (2013) demonstrate that financial constraints mitigate free cash flow problems that lead to inefficient corporate investments. Despite of above evidence, financially constrained firms are nonetheless associated with characteristics that imply high agency costs. We develop two competing hypotheses regarding the

impact of financial constraints on the relation between antitakeover protection and corporate innovation, and extend the literature by documenting a general mitigating effect of financial constraints on the entrenchment costs associated with enhanced antitakeover protection.

The remainder of this paper proceeds as follows. Section 2 presents a brief overview of the state antitakeover laws and develops hypotheses. Section 3 describes data sources and sample selection procedures, discusses empirical methodology, and presents summary statistics. Section 4 reports empirical results, and Section 5 concludes.

2. State Antitakeover Legislation and Hypothesis Development

2.1. A Brief Overview of the State Antitakeover Laws

U.S. corporate law system has a long history passing legislations to regulate hostile takeovers. The first generation antitakeover statutes were initially adopted in Virginia, and then followed in 36 other states during the 1970s. In 1982, the Supreme Court declared a first generation antitakeover statute, the Illinois antitakeover law, to be unconstitutional. As a result, many states responded by enacting second generation antitakeover laws, which include five standard types of statutes, i.e. control share acquisition statutes, fair price statutes, business combination, poison pills, and constituencies. Among the five types of state antitakeover laws, business combination (BC) laws are considered the most stringent since they impose a moratorium on certain transactions such as mergers and assets sales for a period of up to five years. This moratorium hinders corporate raiders from gaining access to the target firm's assets for the purpose of paying down acquisition debt, thus making hostile takeovers more difficult and often impossible (Bertrand and Mullainathan, 2003).

Meanwhile, event study evidence shows that business combination (BC) laws result in the biggest stock price drop. In contrast, fair price laws result in negative but insignificant stock price changes, while control share acquisition laws cause some movements in stock prices (Karpoff and Malatesta, 1989). Therefore, we use the passage of state-level business combination (BC) laws to identify an exogenous shock to antitakeover protection and employ a difference-in-differences estimation method to examine how financial constraints impact the relation between antitakeover protection and corporate innovation. Our methodology has been employed by many prior studies to investigate the effect of antitakeover protection on corporate investment (Bertrand and Mullainathan, 2003), operating performance and product market competition (Giroud and Mueller, 2010), corporate liquidity policies (Yun, 2009), dividend payouts (Francis et al., 2011), the cost of debt (Qiu and Yu, 2009), and corporate innovation (Atanassov, 2013).

2.2. Hypothesis Development

Though empirical evidence shows that antitakeover protection is negatively associated with corporate innovation (Atanassov, 2013), it is possible for antitakeover protection to positively affect innovation in a subset of firms with characteristics that allow the shareholder interest effect to dominate. Based on the disciplinary role played by financial constraints in the deployment of available corporate resources (Luo, 2011), we propose financially constrained firms as one such subset. Prior studies demonstrate that firms with high levels of cash holdings tend to engage in value-destroying projects (Harford, 1999; Harford et al., 2008). However, by investigating the operating performance for a subsample of small, low-leveraged, and high-growth firms that hold large amount of cash persistently, Mikkelsen and Partch (2003) find that the substantial holdings of cash are actually associated with higher firm performance, evidence that is inconsistent with value-decreasing dissipation of cash. Further, Luo (2011) shows that cash spending by managers in financially constrained firms leads to higher future ROAs and stock returns compared with cash spending in financially unconstrained firms, suggesting that financial constraints have a disciplinary

effect on cash dissipation and can effectively prevent managers from investing in negative NPV projects. The empirical evidence documented in Luo (2011) points to a substitute effect of financial constraints among other conventional governance mechanisms in the presence of agency problems. Therefore, we hypothesize that financial constraints can mitigate the entrenchment effect by reducing value-decreasing activities that are associated with increased antitakeover protection and thus allow the shareholder interest effect to dominate the relation between antitakeover protection and corporate innovation.

However, financially constrained firms are usually small, young firms with high growth opportunities but low free cash flow, characteristics that give rise to potential severe information asymmetry problems, which could lead to high agency costs. Thus, a competing hypothesis suggests that financial constraints can exacerbate the entrenchment effect by increasing value-decreasing activities that are associated with increased antitakeover protection. We thereby summarize the following hypotheses:

Hypothesis 1a. Through mitigating the entrenchment effect, financial constraints positively impact the relation between antitakeover protection and corporate innovation.

Hypothesis 1b. Through exacerbating the entrenchment effect, financial constraints negatively impact the relation between antitakeover protection and corporate innovation.

3. Data, Empirical Methodology, and Summary Statistics

3.1. Data and Sample Selection

We obtain accounting data from Compustat and patent citation data from the NBER patent citation database. We begin with all U.S. publicly traded firms listed on Compustat files from 1976 to 2000 and exclude all financial firms (SIC codes 6000-6999) and utilities (SIC codes 4900-4999). We require a firm to be located and incorporated in the United States. We delete all firm-year observations where total assets or sales are either missing or non-positive. We then merge this dataset with the patent citation dataset to yield an unbalanced panel of 98,453 firm-year observations corresponding to 11,300 unique firms. For firms that do not have patents, we set *Adj_Patent* and *Adj_Citation* to zero. The sizes of our final samples vary with the specific measure of financial constraints.

3.2. Empirical Methodology

3.2.1. Measures of financial constraints

Previous literature has vigorously debated on the merits of various financial constraint measures. Developed by Fazzari et al. (1988) under the rationale that the substantial cost disadvantage of external financing drives the sensitivity of firm's investment to the fluctuations in cash flow, the methodology of investment-cash flow sensitivities is adopted by a large size of earlier research to identify financially constrained firms. However, Kaplan and Zingales (1997) question the fundamental assumption in Fazzari et al. (1988) that investment-cash flow sensitivities are monotonically related to financial constraints, and they propose a classification scheme that utilizes both qualitative information in annual reports and quantitative information in financial statements and notes to classify firms into ordered financial constraint groups. Kaplan and Zingales (1988) also model this classification as a function of five accounting variables (leverage, Tobin's Q, cash flow, levels of cash holdings, and dividends), and the regression coefficient estimates are used by Lamont et al. (2001) to construct the original KZ index. Despite its popularity, the KZ index has been criticized by more recent literature. For example, Whited and Wu (2006) question the KZ index's stability across firms and over time as well as its inclusion of Tobin's Q as one of the five variables, which contains a non-negligible amount of measurement error. In addition, Hadlock and

Pierce (2010) point out that the KZ index has potential endogeneity issues since the procedure used to estimate this index builds the same information into both the dependent and independent variables. In light of these arguments, we employ two most recent measures of financial constraints in our empirical analysis: the SA index (Hadlock and Pierce, 2010) and the WW index (Whited and Wu, 2006). Relying solely on two relatively exogenous firm characteristics to identify financially constrained firms, the SA index is intuitively appealing and independent from various theoretical assumptions (Hadlock and Pierce, 2010). The WW index is constructed via a generalized method of moments (GMM) estimation of an investment Euler equation, and is not associated with serious sample selection, simultaneity, and measurement-error problems (Whited and Wu, 2006). The SA index is calculated based on the following equation:

$$\text{SA index} = -0.737 * \text{SIZE} + 0.043 * \text{SIZE}^2 - 0.040 * \text{AGE} \quad (1)$$

where *SIZE* is the natural log of book assets deflated to the 2004 dollars, and *AGE* is the number of years the firm has been on Compustat with a non-missing stock price. In calculating this index, we follow Hadlock and Pierce (2010) and replace *SIZE* by the natural log of \$4.5 billion and *AGE* by thirty-seven years if the actual values exceed these thresholds. Meanwhile, the WW index is computed using the following equation:

$$\begin{aligned} \text{WW index} = & -0.091 * \text{CF} - 0.062 * \text{DIVPOS} + 0.021 * \text{TLTD} \\ & - 0.044 * \text{LNTA} + 0.102 * \text{ISG} - 0.035 * \text{SG} \end{aligned} \quad (2)$$

where *CF* is ratio of cash flow to total assets, *DIVPOS* is an indicator that takes the value of one if the firm pays cash dividends, *TLTD* is the ratio of the long-term debt to total assets, *LNTA* is the natural log of total assets, *ISG* is the firm's three-digit SIC industry sales growth, and *SG* is the firm's sales growth. A higher SA or WW index indicates a greater probability that a firm is financially constrained. We sort our sample into terciles based on the SA/WW index and assign firms in the top (bottom) tercile to the financially constrained (unconstrained) group.

3.2.2. Measures of corporate innovation

To measure corporate innovation activities, we use patents and citations instead of R&D expenditures for the following reasons. First, R&D expenditures reported in the Compustat database are unreliable because more than 50% of firms do not report R&D expenditures and missing values of R&D expenditures do not necessarily mean that a firm has no innovative activities (Chemmanur and Tian, 2012). Second, for firms that do report R&D expenditures, this variable appears to be a noisy input measure that either captures only one aspect of the observable input of innovation (Chemmanur and Tian, 2012) or includes agency-related excessive spending outside of the firm's direct expertise (Almeida et al., 2013), thus failing to accurately measure the quantity and quality of innovation output.

Our patent data are from the NBER patent citations data files created by Hall et al. (2001). This database includes all the utility patents granted between January 1963 and December 1999, and contains detailed information on assignee identifier, full assignee name, grant year, application year, technological category, number of citations received, etc. Hall et al. (2001) recommends using the application year as the relevant time placer of patents because inventors tend to apply for a patent upon the completion of the innovation while the grant year takes on average 2 years for review at the Patent Office.

The patent citations database has several weaknesses. First, patent counts suffer from truncation problem toward the end of the sample period since the average 2-year review process makes it possible that patents applied at the end of the sample period yet not granted are not included in the database. Second, patents receive citations over a long period of time, yet citations

received on patents after the sample period are not observable in this database. Third, patent and citation intensities tend to vary over time and across industries. We follow prior literature (Hall et al., 2001; Seru, 2010) to adjust for these problems. For the patent variable, we scale each patent for year t by the average number of patents of all firms in the same technological class for the same year. For the citation variable, we scale citations of a patent for year t by the average number of citations received by all patents in the same technological class for the same year. We then construct variable Adj_Patent by summing up adjusted patents applied by firm i in year t and $Adj_Citation$ by dividing the sum of adjusted patents applied by firm i in year t into the sum of adjusted citations firm i receives on all its patents in the same year.

3.2.3. Empirical model

To estimate the differential effect of antitakeover protection on corporate innovation in financially constrained and unconstrained firms, we follow the literature (Bertrand and Mullainathan, 2003; Qiu and Yu, 2009; Giroud and Mueller, 2010) to employ a standard difference-in-differences approach which has the following model specification:

$$y_{ijklt} = \alpha_i + \alpha_t + \beta_1 BC_{kt} + \beta_2 FC_{it} + \beta_3 (BC_{kt} * FC_{it}) + \theta X_{ijklt} + \delta_1 y_{jt} + \delta_2 y_{lt} + \varepsilon_{ijklt} \quad (3)$$

where i, j, k, l, t represent firm, industry, state of incorporation, state of location, and year, respectively, y_{ijklt} is the dependent variable ($\ln(1+Adj_Patent)$ or $\ln(1+Adj_Citation)$), α_i and α_t denote firm and year fixed effects, BC_{kt} is a dummy variable set to one if a firm's state of incorporation has passed a BC law by year t , FC_{it} is a dummy variable set to one if a firm is financially constrained in year t , X_{ijklt} is a vector of control variables, y_{jt} is the average $\ln(1+Adj_Patent)$ or $\ln(1+Adj_Citation)$ of all firms in industry j for year t while excluding firm i , y_{lt} is the average $\ln(1+Adj_Patent)$ or $\ln(1+Adj_Citation)$ of all firms located in state l while excluding firm i , and ε_{ijklt} is the error term assumed to be independently and identically distributed.

The variables of interest are BC_{kt} , FC_{it} , and the interaction term ($BC_{kt} * FC_{it}$). The coefficient β_1 captures the effect of antitakeover protection on corporate innovation in financially unconstrained firms ($FC_{it} = 0$), β_2 measures the stand-alone effect of financial constraints on innovation, and $(\beta_3 + \beta_1)$ measures the overall effect of antitakeover protection on corporate innovation in financially constrained firms.

In the X_{ijklt} vector, we follow Atanassov (2013) to control for firm size ($\ln(\text{Assets})$), age, industry concentration (three-digit Herfindahl-Hirschman index based on sales), profitability, tangibility, growth opportunities (market-to-book ratios), and leverage. We also include the squared size and HHI to control for potential nonlinear effects of firm size and industry concentration on corporate innovation. Data required to construct these variables come from Compustat. In addition, we use the mean value of the dependent variable in a firm's three-digit SIC industry (y_{jt}) and state of location (y_{lt}) to fully control for time-varying industry shocks and location shocks (Giroud and Mueller, 2010; Qiu and Yu, 2009). To mitigate the effect of extreme values, we winsorize all continuous variables at the top and bottom one percentage. In all of our model specifications, we control for time-invariant firm-specific characteristics through firm fixed effects and economy-wide shocks through year fixed effects.

Although we use a difference-in-differences approach to explicitly estimate the impact of financial constraints on the association between antitakeover protection and corporate innovation, yet the model specification in Eq. (3) may be subject to potential endogeneity concerns due to possible lobbying activities in the states of incorporation that result in the enactment of a BC law

(Giroud and Mueller, 2010). For robustness, we follow Atanassov (2013) to replace the BC dummy variable in Eq. (3) with four dummy variables and generate the following modified specification:

$$y_{ijklt} = \alpha_i + \alpha_t + \beta_1 Before_{kt}^{-2or-1} + \beta_2 Current_{kt}^0 + \beta_3 After_{kt}^1 + \beta_4 After_{kt}^{2+} \\ + \beta_5 FC_{it} + \beta_6 Before_{kt}^{-2or-1} * FC_{it} + \beta_7 Current_{kt}^0 * FC_{it} \\ + \beta_8 After_{kt}^1 * FC_{it} + \beta_9 After_{kt}^{2+} * FC_{it} + \theta X_{ijklt} + \delta_1 y_{jt} + \delta_2 y_{lt} + \varepsilon_{ijklt} \quad (4)$$

where $Before_{kt}^{-2or-1}$ is a dummy variable set to one if it is 1 or 2 years before a BC law is passed in the state of incorporation k in year t , $Current_{kt}^0$ is a dummy variable set to one if it is the year t when a BC law is passed in the state of incorporation k , $After_{kt}^1$ is a dummy variable set to one if it is 1 year after a BC law is passed in the state of incorporation k , and $After_{kt}^{2+}$ is a dummy variable set to one if it is 2 or more years after a BC law is passed in the state of incorporation k . A positive and significant coefficient on the combined term ($Before_{kt}^{-2or-1} * FC_{it}$ + $Before_{kt}^{-2or-1}$) would indicate that the positive effect of financial constraints on the relation between BC laws and corporate innovation already exists even before the passage of the laws.

3.3. Descriptive Statistics

Of the 11,300 firms that are included in our sample, 57.89% are incorporated in Delaware, 30.72% are incorporated in the state of location, and 11.39% are incorporated elsewhere. The statistics on the state of incorporation and the state of location are in general comparable to those reported in Giroud and Mueller (2010) and Qiu and Yu (2009). For brevity, we do not report the table that contains these statistics, but it is available upon request.

Table 1 presents the descriptive statistics for the variables used in our study. The mean (median) of BC is 0.56 (1.00), suggesting that our control and treatment samples are well balanced. The mean of Adj_Patent ($Adj_Citation$) is 0.15 (0.14), similar to those reported in Atanassov (2013). The distributions of the two measures of financial constraints, the SA index and the WW index, are comparable to those presented in previous studies (e.g., Almeida et al., 2013).

Table 1. Descriptive statistics for the main variables used

	N	Mean	S.D.	25 th	Median	75 th	Min	Max
Dependent variable								
BC	98,453	0.560	0.501	0.000	1.000	1.000	0.000	1.000
Adj_Patent	98,453	0.147	1.299	0.000	0.000	0.000	0.000	3.553
Adj_Citation	98,453	0.138	1.421	0.000	0.000	0.000	0.000	2.997
Independent variables								
Size	98,453	4.756	1.960	3.324	4.644	6.082	0.928	9.470
Size ²	98,453	26.460	19.907	11.047	21.565	36.993	0.862	89.679
Age	97,262	11.069	9.069	1.000	4.000	8.0000	17.000	37.000
HHI	98,453	0.202	0.158	0.096	0.153	0.256	0.032	1.000
HHI ²	98,453	0.066	0.122	0.009	0.024	0.065	0.001	1.000
Profitability	93,827	0.015	0.204	0.001	0.062	0.106	-1.055	0.448
Tangibility	98,255	0.323	0.276	0.130	0.255	0.440	0.008	1.981
Market-to-book	97,099	2.014	1.902	1.024	1.367	2.142	0.540	12.412
Leverage	98,139	0.246	0.212	0.061	0.215	0.373	0.000	0.935
Financial constraint measures								
SA index	97,262	-2.814	0.869	-3.417	-2.855	-2.254	-4.638	2.436
WW index	85,144	-0.204	0.113	-0.286	-0.203	-0.124	-0.566	0.178

Note: BC is a dummy variable set to one if a firm's state of incorporation has passed a BC law by year t . Adj_Patent is the sum of adjusted patents applied by firm i in year t . $Adj_Citation$ is the sum of adjusted citations firm i receives on all its patents in the year t scaled by the sum of adjusted patents applied by

firm i in the same year t . $Size$ is the natural logarithm of a firm's total assets, deflated to 2004 dollars. Age is the number of years a firm has a record in Compustat. HHI is the sum of squared market shares of all firms in an industry, where market shares are based on sales from Compustat and industry classification is based on three-digit SIC codes. $Profitability$ is operating income before depreciation minus interest (XINT), taxes (TXT) and common dividends (DVC), scaled by total assets. $Tangibility$ is net property, plant and equipment (PPENT), scaled by total assets. $Market-to-book$ is stock's closing price at the fiscal year-end (PRCC_F) multiplied by number of shares outstanding (CSHO) plus total assets minus book equity (CEQ), scaled by total assets. $Leverage$ is total debt (the sum of short-term debt (DLC) and long-term debt (DLTT)), scaled by total assets. The sample includes 98,453 firm-year observations corresponding to 11,300 unique firms from 1976 to 2000.

Table 2 presents the correlation matrix for the main variables. We note that while Adj_Patent and $Adj_Citation$ are positively associated with size, age, HHI, profitability, tangibility, and market-to-book, they are negatively correlated with the passage of BC laws, consistent with the findings in Atanassov (2013) that antitakeover legislation negatively impacts corporate innovation. We also document a negative relation between corporate innovative activities (Adj_Patent and $Adj_Citation$) and the severity of financial constraints (the SA index and the WW index), consistent with the conventional wisdom that financially unconstrained firms have the capacity to fund long-term, risky R&D investments and generate more technological innovations (Schumpeter, 1942; Cohen et al., 2013). To further investigate how the interaction between the passage of BC laws and financial constraints affect corporate innovation, we analyze our hypothesis in a multivariate framework by controlling for various firm, industry, and state variables. Main results are reported in Table 3.

Table 2. Correlation matrix for main variables used in the study

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. BC	1.000	-0.007	-0.088	0.011	-0.001	0.114	-0.107	-0.037	-0.104	0.109	-0.024	-0.062	-0.099
		0.014	<.0001	<.0001	0.831	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
2. Adj_Patent		1.000	0.892	0.205	0.249	0.157	0.032	0.104	0.231	0.047	-0.015	-0.162	-0.205
			<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
3. Adj_Citation			1.000	0.173	0.209	0.135	0.015	0.095	0.197	0.056	-0.016	-0.138	-0.169
				<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
4. Size				1.000	0.974	0.466	0.008	0.403	0.315	-0.181	0.137	-0.915	-0.938
					<.0001	<.0001	0.009	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
5. Size ²					1.000	0.467	0.015	0.340	0.356	-0.130	0.134	-0.852	-0.908
						<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
6. Age						1.000	0.051	0.228	0.183	-0.219	0.060	-0.703	-0.488
							<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
7. HHI							1.000	0.053	0.016	-0.102	0.061	-0.026	-0.042
								<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
8. Profitability								1.000	0.215	-0.277	-0.070	-0.441	-0.514
									<.0001	<.0001	<.0001	<.0001	<.0001
9. Tangibility									1.000	-0.055	0.239	-0.256	-0.304
										<.0001	<.0001	<.0001	<.0001
10. Market-to-book										1.000	-0.174	0.247	0.145
											<.0001	<.0001	<.0001
11. Leverage											1.000	-0.118	-0.011
												<.0001	0.001
12. SA index												1.000	0.887
													<.0001
13. WW index													1.0000

Note: The sample includes 98,453 firm-year observations corresponding to 11,300 unique firms from 1976 to 2000. Variables are defined in Table 1.

Table 3. Antitakeover protection and corporate innovation

	Ln(1+ Adj_Patent) (1)	Ln(1+ Adj_Citation) (2)	Ln(1+ Adj_Citation) (3)	Ln(1+ Adj_Citation) (4)
BC	-0.004*** (-2.67)		-0.004** (-2.50)	
Before ^{-2or-1}		0.001 (0.57)		0.003 (0.43)
Current ⁰		0.001 (0.27)		0.001 (0.04)
After ¹		-0.003 (-1.33)		-0.011 (-1.12)
After ²⁺		-0.008*** (-3.38)		-0.025*** (-2.60)
Size	-0.025*** (-10.62)	-0.025*** (-10.64)	-0.018*** (-6.26)	0.009 (0.83)
Size ²	0.004*** (15.30)	0.005*** (15.32)	0.003*** (8.77)	0.007*** (6.25)
Age	0.022*** (9.27)	0.022*** (9.28)	0.021*** (9.77)	0.067*** (9.80)
HHI	0.006 (0.34)	0.006 (0.35)	-0.010 (-0.53)	-0.119* (-1.93)
HHI ²	0.025 (1.28)	0.026 (1.29)	0.043** (2.07)	0.212*** (2.86)
Profitability	-0.009*** (-3.54)	-0.009*** (-3.52)	-0.015*** (-4.54)	-0.087*** (-8.91)
Tangibility	0.001 (0.91)	0.001 (0.09)	-0.007 (-0.84)	-0.028 (-1.32)
Market-to-book	-0.004*** (-7.58)	-0.004*** (-7.84)	-0.006*** (-8.33)	-0.016*** (-9.05)
Leverage	-0.022*** (-9.52)	-0.022*** (-9.47)	-0.024*** (-8.54)	-0.078*** (-8.09)
State effects	0.247*** (7.05)	0.245*** (6.97)	0.272*** (7.40)	0.302*** (10.03)
Industry effects	0.238*** (10.36)	0.234*** (10.35)	0.266*** (13.85)	0.288*** (17.52)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R²	0.852	0.852	0.774	0.775
Obs.	96,052	96,052	96,052	96,052

Table 3 replicates the estimation in Atanassov (2013) that the enactment of BC laws has a significant and negative effect on corporate innovative activities. $Before^{-2or-1}$ is a dummy variable set to one if it is 1 or 2 years before a BC law is passed in the state of incorporation k in year t . $Current^0$ is a dummy variable set to one if it is the year t when a BC law is passed in the state of incorporation k . $After^1$ is a dummy variable set to one if it is 1 year after a BC law is passed in the state of incorporation k . $After^{2+}$ is a dummy variable set to one if it is 2 or more years after a BC law is passed in the state of incorporation k . The state effects are the average $\text{Ln}(1+ \text{Adj_Patent})$ or $\text{Ln}(1+ \text{Adj_Citation})$ of all firms located in state l while excluding firm i . The industry effects are the average $\text{Ln}(1+ \text{Adj_Patent})$ or $\text{Ln}(1+ \text{Adj_Citation})$ of all firms in industry j for year t while excluding firm i . All other variables are defined in Table 1. The sample period is from 1976 to 2000. Standard errors are clustered by both firm and year. We report t -statistics in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

4. Main Empirical Results

In Table 3 above, we replicate the estimation in Atanassov (2013) using our data and we produce similar results that the enactment of antitakeover legislation has a significantly negative impact on firms' innovative activities, suggesting a dominance of the entrenchment effect on the relation between antitakeover protection and corporate innovation. Since both *Adj_Patent* and *Adj_Citation* are right-skewed, we follow Atanassov (2013) and use a natural log transformation to normalize these variables. The baseline results in columns (1) and (3) show that firms incorporated in states that adopted BC laws tend to innovate less in the post-adoption periods. In columns (2) and (4), we test for reverse causality and obtain similar results as those in Atanassov (2013) that corporate innovative activities declined significantly two years after the enactment of BC laws, inconsistent with the lobbying argument.

In Table 4, we examine the impact of financial constraints on the relation between the passage of BC laws and corporate innovation by estimating Eq. (3). Columns (1) through (2) ((3) through (4)) present results using $\ln(1 + \text{Adj_Patent})$ ($\ln(1 + \text{Adj_Citation})$) as the dependent variable. For both measures of financial constraints, the coefficient estimates of the interaction term $BC_{kt} * FC_{it}$ are significantly positive ($p < 0.01$). The coefficients of $BC_{kt} * FC_{it}$ and BC_{kt} imply that the total effect ($\beta_3 + \beta_1$) of antitakeover protection on corporate innovation is positive and statistically significant for financially constrained firms. Meanwhile, these results are also economically significant in that the number of patents (the number of citations per patent) increased by 1.4% - 1.6% (2.4% - 2.8%) in financially constrained firms following the adoption of BC laws. The coefficient estimates on BC_{kt} are negative and significant, implying that the enactment of BC laws negatively impacts innovation in financially unconstrained firms ($FC_{it} = 0$). The empirical evidence on the stand-alone effect of FC_{it} on corporate innovation suggests that financial constraints negatively affect innovation for firms incorporated in states that has not adopted BC laws ($BC_{kt} = 0$) by year t .

We proceed to analyze whether the results in Table 4 are robust to reverse causality by estimating Eq. (4). If our baseline results are outcomes of lobbying activities at the state of incorporation level, we would expect the coefficient estimates of $(\text{Before}_{kt}^{-2or-1} * FC_{it} + \text{Before}_{kt}^{-2or-1})$ to be positive and significant, indicating that the positive effect of financial constraints on corporate innovation already existed before BC laws were adopted. However, the coefficients of $(\text{Before}_{kt}^{-2or-1} * FC_{it} + \text{Before}_{kt}^{-2or-1})$ in columns (1) through (4) in Table 5 are not significant, inconsistent with the reverse causality argument. Meanwhile, the coefficients on $(\text{After}_{kt}^1 * FC_{it} + \text{After}_{kt}^1)$ and $(\text{After}_{kt}^{2+} * FC_{it} + \text{After}_{kt}^{2+})$ show that financially constrained firms began to innovate more at least one year after the passage of BC laws, evidence that supports a causal relation between antitakeover protection and corporate innovation.

For robustness, we also re-estimate Eqs. (3) and (4) by controlling for additional variables (corporate liquidity, dividend payout dummy, and sales growth rate) that may affect the relation between antitakeover protection and corporate innovation through their correlations with financial constraints. Including these variables generates very similar results, which we do not report due to space constraint but they are available upon request.

Table 4. Antitakeover protection, financial constraints, and corporate innovation

		Ln(1+ Adj_Patent)		Ln(1+ Adj_Citation)	
		SA index (1)	WW index (2)	SA index (3)	WW index (4)
BC*FC	β_3	0.028*** (10.64)	0.038*** (11.46)	0.051*** (5.43)	0.076*** (6.72)
BC	β_1	-0.014*** (-4.75)	-0.022*** (-6.63)	-0.027** (-2.55)	-0.038*** (-3.14)
FC		-0.020*** (-5.87)	0.002 (0.72)	-0.110*** (-7.17)	-0.005 (-0.34)
Size		-0.028*** (-10.01)	-0.027*** (-9.04)	-0.001 (-0.10)	0.015 (1.47)
Size ²		0.005*** (13.78)	0.006*** (14.11)	0.006*** (5.43)	0.007*** (5.47)
Age		0.024*** (8.32)	0.028*** (8.33)	0.068*** (8.41)	0.081*** (8.67)
HHI		0.034 (1.19)	0.065** (2.02)	-0.086 (-0.93)	-0.033 (-0.32)
HHI ²		0.015 (0.48)	-0.014 (-0.41)	0.212* (1.91)	0.155 (1.29)
Profitability		-0.011*** (-3.38)	-0.011** (-2.55)	-0.095*** (-8.07)	-0.096*** (6.76)
Tangibility		0.007 (0.75)	0.013 (1.27)	-0.021 (-0.82)	-0.016 (-0.58)
Market-to-book		-0.005*** (-6.95)	-0.006*** (-6.49)	-0.018*** (-8.00)	-0.023*** (-7.16)
Leverage		-0.027*** (-7.50)	-0.033*** (-7.98)	-0.091*** (-6.56)	-0.106*** (-6.88)
State effects		0.330*** (6.29)	0.346*** (5.62)	0.384*** (8.99)	0.405*** (8.35)
Industry effects		0.302*** (9.71)	0.300*** (9.31)	0.371*** (16.54)	0.355*** (15.10)
Year FE		Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes
R²		0.857	0.858	0.793	0.798
Obs.		64,035	55,294	64,035	55,294
$\beta_3 + \beta_1$		0.014***	0.016***	0.024***	0.028***
F statistics, Test $\beta_3 + \beta_1 = 0$		43.50	39.80	16.52	12.70

Table 4 reports the estimation results of the impact of financial constraints on the relation between antitakeover protection and corporate innovation. FC is a dummy variable set to one if firm i is financially constrained. The sample period is from 1976 to 2000. Standard errors are clustered by both firm and year. We report t -statistics in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

Table 5. Reverse causality

	Dep.= Ln (1+ Adj_Patent)		Dep. = Ln (1+ Adj_Citation)	
	SA index (1)	WW index (2)	SA index (3)	WW index (4)
FC	-0.022*** (-6.24)	-0.001 (-0.40)	-0.116*** (-7.36)	-0.014 (-0.83)
Before ^{-2or-1} *FC	0.005 (1.38)	0.001 (0.24)	-0.002 (0.22)	0.001 (0.09)
Current ⁰ *FC	0.004 (1.00)	0.002 (0.23)	-0.004 (-0.25)	-0.021 (-1.22)
After ¹ *FC	0.013*** (3.15)	0.019*** (3.75)	-0.027 (-1.62)	-0.023 (-1.24)
After ²⁺ *FC	0.039*** (12.03)	0.051*** (12.83)	0.088*** (7.58)	0.111*** (8.03)
Before ^{-2or-1}	0.003 (0.76)	-0.002 (-0.37)	0.014 (1.02)	0.015 (1.00)
Current ⁰	0.005 (1.00)	-0.003 (-0.49)	0.036** (2.09)	0.030 (1.63)
After ¹	-0.002 (-0.47)	-0.009 (-1.63)	0.025 (1.34)	0.027 (1.34)
After ²⁺	-0.018*** (-4.70)	-0.031*** (-6.57)	-0.045*** (-3.06)	-0.058*** (-3.48)
Size	-0.029*** (-10.37)	-0.029*** (-9.48)	-0.005 (-0.59)	0.009 (0.87)
Size ²	0.005*** (13.99)	0.006*** (14.36)	0.007*** (5.77)	0.008*** (5.90)
Age	0.025*** (8.41)	0.028*** (8.36)	0.069*** (8.53)	0.081*** (8.72)
HHI	0.038 (1.30)	0.070** (2.15)	-0.077 (-0.83)	-0.022 (-0.22)
HHI ²	0.012 (0.39)	-0.017 (-0.51)	0.204* (1.84)	0.145 (1.20)
Profitability	-0.011*** (-3.22)	-0.010** (2.38)	-0.093*** (-7.91)	-0.094*** (-6.66)
Tangibility	0.008 (0.83)	0.014 (1.42)	-0.019 (-0.71)	-0.011 (-0.40)
Market-to-book	-0.005*** (-6.83)	-0.006*** (-6.37)	-0.018*** (-7.88)	-0.023*** (-7.50)
Leverage	-0.026*** (-7.38)	-0.033*** (-7.84)	-0.089*** (-6.45)	-0.104*** (-6.75)
State effects	0.322*** (6.13)	0.335*** (5.44)	0.377*** (8.83)	0.398*** (8.20)
Industry effects	0.300*** (9.66)	0.296*** (9.22)	0.369*** (16.49)	0.353*** (15.04)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R²	0.857	0.858	0.793	0.798
Obs.	64,035	55,294	64,035	55,294

This table tests whether our results are robust to reverse causality. The sample period is from 1976 to 2000. Standard errors are clustered by both firm and year. We report *t*-statistics in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% significance levels, respectively.

5. Conclusion

In this paper, we investigate how financial constraints impact the relation between antitakeover protection and shareholder wealth by focusing on a specific channel of firm performance—corporate innovation. We develop and test two competing hypotheses. The mitigating effect hypothesis builds on the governance role played by financial constraints in mitigating managers' value-decreasing activities associated with enhanced antitakeover protection. In contrast, the exacerbating effect hypothesis argues that financially constrained firms have characteristics that are associated with severe information asymmetry problems which could potentially lead to high agency costs.

We rely on an exogenous shock in antitakeover protection created by the passage of BC laws in the mid-1980s for identification and employ a difference-in-differences estimation method. Our results are consistent with the mitigating effect hypothesis. Specifically, we show that corporate innovative activities increase significantly in the post-adoption era for financially constrained firms incorporated in states that adopted BC laws. Our results appear at least one year after the enactment of BC laws, suggesting that they are not subject to potential reverse causality bias.

Our findings complement Atanassov (2013) by documenting an important role of financial constraints in determining the relation between antitakeover protection and corporate innovation. Specifically, we show that the negative association between antitakeover protection and corporate innovation appears to occur only in financially unconstrained firms. In financially constrained firms, increased antitakeover protection actually has a positive impact on corporate innovation. These results suggest that financial constraints effectively mitigate entrenchment activities and incentivize managers to adopt a long-term orientation in investments. Our findings have important implications for future academic research. In light of the governance role played by financial constraints in mitigating managerial entrenchment effect, studies involving the entrenchment effect of antitakeover protection should account for the presence of financial constraints.

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