Received: 9 January 2020 | Revised: 19 October 2022 | Accepted: 23 October 2022

DOI: 10.1111/jbfa.12668

JBFA

ARTICLE

Does the threat of takeover affect default risk?

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[Correction added on 26 July 2023, after first online publication: An affiliation to Monash University, Malaysia has been added for Balasingham Balachandran.]

Abstract

We examine the impact of the threat of takeovers on default risk. Using a sample of 50,189 firm-year observations for US firms over the period 1990–2015, we find that the threat of takeovers has a negative relation with default risk. We use difference-in-difference analysis to address potential endogeneity concerns and propensity score matching to control for self-selection bias. The results are robust to alternative measures of default risk and exclusion of the dot com and financial crisis periods. Our results also hold after controlling for Governance Index and Entrenchment Index. We identify improvement in performance and earnings quality in response to the threat of takeovers as channels underlying our main result. The effect of the threat of takeovers on default risk is more pronounced for firms with opaque information environment and low institutional ownership. Our findings provide important insights for the market for corporate control as a disciplining mechanism in reducing default risk.

KEYWORDS

default risk, earnings quality, E-index, G-index, institutional ownership, opaque information environment, threat of takeover

JEL CLASSIFICATION

G34, G38, M41, M48

1 | INTRODUCTION

Since the recent financial crisis, there has been considerable research interest in examining the factors determining firm default risk (Bennett et al., 2015; Brogaard et al., 2017; Bruyland & De Maeseneire, 2016; Giesecke et al., 2011; Hsu et al., 2015) and estimating the cost of default (Davydenko et al., 2012; Glover, 2016). Corporate governance quality emerges as an important determinant of default risk given its importance in explaining future firm performance (see, among others, Bhagat & Bolton, 2008, 2019). While better governance based on higher board independence (Ashbaugh-Skaife et al., 2006) and larger long-term institutional ownership is associated with higher credit ratings, weaker governance based on stronger antitakeover provisions (Ashbaugh-Skaife et al., 2006; Chava et al., 2009; Klock et al., 2005) is also associated with higher credit ratings and lower cost of debt financing. These results on antitakeover provisions are puzzling since the threat of takeovers is an important external mechanism for disciplining managers (e.g., Fama & Jensen, 1983; Jensen & Ruback, 1983; Lel & Miller, 2015). We attempt to resolve this puzzle by examining the effect of the threat of takeovers on corporate default risk using the hostile takeover index developed by Cain et al. (2017).

The use of the hostile takeover index to examine the impact of the threat of takeovers on default risk offers several advantages. First, the index is constructed from the legal determinants such as changes in takeover law, along with firm-specific factors (e.g., firm age; Shumway, 2001) and general economic variables (e.g., the aggregate capital liquidity; Harford, 2005) that affect the probability of hostile takeovers but are not subject to firm choice. The use of external factors to capture the threat of takeovers overcomes potential endogeneity problems from other firm-level takeover defense measures such as the Governance Index (G-Index; Gompers et al., 2003) or Entrenchment Index (E-index; Bebchuck et al., 2009), which could be driven by managerial influence (Lel & Miller, 2015). Second, the index makes use of several changes to takeover laws or court decisions over an extended period from 1965 to 2014. This is an important extension to the existing literature, which relies on single law proxies, that are plausibly exogenous but lack power (Cain et al., 2017).

We propose two competing hypotheses regarding the effect of the threat of hostile takeovers on default risk. Established research on the market for corporate control shows that the threat of takeovers provides a governance mechanism that may act as a substitute for other external governance mechanisms (e.g., see Bebchuk et al., 2009; Bertrand & Mullainathan, 1999, 2003; Cain et al. 2017; Fama & Jensen, 1983; Gompers et al., 2003; Jensen & Ruback, 1983; Lel & Miller, 2015; Manne, 1965; Morck et al., 1989). Gompers et al. (2003) show that firms with strong shareholder rights (weak antitakeover provisions) earn higher abnormal long-run stock returns than those with strong management rights (strong antitakeover provisions). Bebchuk et al. (2009) find that increases in the E-index based on antitakeover provisions are associated with reductions in firm valuation and large negative abnormal returns. Lel and Miller (2015) find that the threat of takeovers improves managerial discipline, particularly in countries with weak investor protection. Cain et al. (2017) find that the threat of takeovers is positively related to firm value for US firms. These studies support the view that the takeover market disciplines managers' opportunistic behavior, and thus we argue that the threat of takeovers can decrease default risk.

The alternative view is that a higher threat of takeovers could increase default risk. Stein (1988) argues that the pressure from the takeover market results in managerial myopia whereby managers sacrifice long-term objectives for short-term profits. Supporting this argument, Chemmanur and Tian (2018) show that antitakeover provisions foster a key driver of firm growth—corporate innovation. Zhao and Chen (2008a) find that staggered boards are negatively associated with firm value. Zhao and Chen (2008b) show that staggered board provisions as a takeover protection mitigate managers' incentives to manage earnings opportunistically. Bhojraj et al. (2017) find that innovative firms experience increases in Tobin's Q following a change in law in Delaware that increased the effectiveness of antitakeover provisions in defending against hostile takeovers. Moreover, Klock et al. (2005) find that firms with strong (weak) antitakeover provisions are associated with lower (higher) cost of debt financing. Francis et al. (2010) find that firms incorporated in takeover-friendly states have higher cost of bonds, compared to those incorporated in takeover-restrictive states. These findings, taken together, indicate that the threat of takeovers increases default risk by exacerbating managerial myopia and increasing the cost of debt.

We test the two competing views using a sample of 50,189 firm-year observations on US firms over the period 1990–2015. Most of the studies on the takeover market focus on individual takeover laws or specific provisions therein (Cain et al., 2017). Though such research is important; it may not capture the overall impact of takeover laws as a set, to the extent that the laws interact as complements or substitutes. To address this issue, we use the takeover index (hereafter, *TIND*) developed by Cain et al. (2017) as a measure of the threat of a hostile takeover. This measure reflects 17 different takeover laws and court decisions along with a wide set of firm-specific and general economic variables that are not subject to firm choice. Cain et al. (2017) argue that the index represents a middle ground between governance proxies based on firm-level antitakeover provisions such as the G-index of Gompers et al. (2003; which are subject to endogeneity concerns) and single law proxies, such as the business combination laws (which are plausibly exogenous but lack power).

We measure default risk by the expected default frequency (*EDF*) developed by Bharath and Shumway (2008). We find that *TIND* has a significantly negative relation with *EDF*, indicating that the threat of takeovers serves as a disciplining mechanism in reducing default risk. In terms of economic significance, a one standard deviation increase in *TIND* relates to a 14.3% decrease in *EDF*.

Given that the takeover index is constructed from state-level hostile takeover laws, there may be potential endogeneity issues related to state-level omitted variables driving both takeover law and default risk. We use state fixed effects in our regression models to control for time-invariant state-specific omitted variables. We further use a difference-in-difference (DiD) analysis to examine the changes in default risk following an exogenous change in the threat of takeovers. Specifically, court rulings in Delaware in 1995 validated the use of poison pills in conjunction with a staggered board, thus effectively lowering the probability that firms incorporated in Delaware could be acquired without the cooperation of target management. We find that default risk is higher for firms incorporated in Delaware, and the difference in default risk between Delaware and non-Delaware firms became larger after the court rulings in 1995. Finally, firms with certain characteristics may self-select to incorporate in a certain state to manage hostile takeover threats. We use the propensity score matching (PSM) method to correct for self-selection bias arising from firm-related characteristics (Rosenbaum & Rubin, 1983) and find that our results continue to hold.

Our results also hold for alternative measures of default risk (Altman Z-score and bond rating as in Dyreng & Markle, 2016). Our results also hold when we exclude crisis periods where default risk could be higher due to the crisis environment. Since prior literature reveals that firm-level antitakeover governance provisions, as captured by the G- or E-index, are associated with higher credit ratings (Ashbaugh-Skaife et al., 2006) and lower debt financing (Chava et al., 2009; Klock et al., 2005), we examine whether the takeover index affects default risk after controlling for the G- and E-indexes. We find that the takeover index imparts a negative effect on default risk, indicating that the effect of *TIND* is independent of firm-level antitakeover provisions.

We examine the channels through which the threat of takeovers mitigates default risk. We argue that the takeover market provides an effective governance mechanism, leading to better firm performance and, as a result, lower default risk. To provide evidence on the performance channel, we examine the relation between the threat of hostile takeover and performance. We find that the takeover index has a positive relation with firm performance as measured by the ratio of net income to total assets. We further find that the takeover index is negatively related to the likelihood of experiencing loss (negative net income). These results support the view that the takeover market is an effective governance mechanism that leads to better performance, which, in turn, lowers default risk.

Prior studies have shown that companies with stronger governance mechanisms have higher earnings quality (Klein, 2002; Larcker et al., 2007; Yu, 2008). DeFond and Jiambalvo (1993) argue that even if the default cannot be avoided by manipulation of accounting information, managers are still likely to make income-increasing accounting choices hoping to improve their bargaining position in the event of renegotiation of covenants. DeFond and Jiambalvo (1994) show positive unexpected accruals for bankruptcy filing firms in the year prior to default. These findings indicate that earnings quality decreases the likelihood of default. We, therefore, test for earnings quality as a channel to explain the negative influence of the takeover market on default risk. We assess earnings quality by using the measures developed by Hutton et al. (2009). Our results are consistent with earnings quality as the channel for the negative influence of the takeover market on default risk.

Goyal and Wang (2013) argue that firms with favorable private information prefer short-term debt, while those with unfavorable private information prefer long-term debt. That is, short-term debt issuers will exhibit a decrease in their default risk, while long-term debt issuers will be characterized by an increase in their default risk. Liao et al. (2009) suggest that the information asymmetry between informed and uninformed traders results in deviations from a firm's correct credit risk assessment. Therefore, we next examine whether the strength of the relation between the threat of takeovers and default risk depends on the degree of information asymmetry among investors in the firm. We find that the relation between the takeover index and default risk is stronger among firms with higher information asymmetry problems, as reflected by lower analyst following, and lower stock liquidity.

We further argue that if the effect of the threat of takeovers on default risk stems from the role of hostile takeovers in disciplining managers, the effect will be stronger among firms that are subject to less monitoring from other external governance mechanisms. To test this conjecture, we focus on institutional investors as an alternative external governance mechanisms (e.g., see Chen et al., 2007; Hartzell & Starks, 2003). We find that the negative relation between the threat of takeovers and default risk is more pronounced in companies with lower institutional ownership or lower long-term institutional ownership. This result suggests that the takeover market can substitute for, at least, institutional ownership as an external governance mechanism.

Our study contributes to the prior literature in a number of ways. First, we extend the literature on the factors determining firm default risk. Prior studies show that firm characteristics such as stock liquidity (Brogaard et al., 2017; Nadarajah et al., 2021), innovation performance (Hsu et al., 2015) or incentive structure (Bennett et al., 2015) play a significant role in explaining default risk. We instead focus on the threat of takeovers, as measured by the takeover index, which by construction is largely exogenous to firm-level decisions, and we show a significant negative impact of the threat of takeovers on default risk.

Second, we contribute to the ongoing debate regarding the costs and benefits of takeover threats or antitakeover provisions (see, among others, Bertrand & Mullainathan, 1999, 2003; Cheng et al., 2005; Francis et al., 2010; Garvey & Hanka, 1999; Giroud & Mueller, 2010; Karpoff & Malatesta, 1995; Khurana & Wang, 2019 ; Lel & Miller, 2015). In particular, we extend the previous work of Cain et al. (2017) by providing further evidence that the threat of takeovers is not only related to firm value but also has a significant impact on default risk. In addition, we find that the threat of takeovers can act as an external governance mechanism to reduce corporate default risk through its effect on firms' performance and earnings quality.

Our paper is also related to the strand of literature that examines the influence of corporate governance features that protect firms from the threat of takeovers on corporate outcomes such as credit ratings or costs of debt financing. Prior studies in this line of literature show that antitakeover provisions are associated with higher credit ratings (Ashbaugh-Skaife et al., 2006) and lower cost of debt financing (Chava et al., 2009; Klock et al., 2005). These studies employ firm-level antitakeover provisions (the G-index of Gompers et al., 2003) to capture the antitakeover strength of a firm. Firm-level antitakeover provisions could be subject to endogeneity concerns because they are often established at the discretion of the firm (Comment & Schwert, 1995; Gompers et al., 2003; Lel & Miller, 2015). The mixed meanings of the G-index as indicating antitakeover strength on one hand and the weakness of shareholder rights on the other (Bradley & Chen, 2011) could also result in mixed interpretations of the findings. The takeover index, constructed from takeover laws and court decisions along with a wide set of firm-specific and general economic variables that are not subject to firm choice, addresses these limitations. Our findings, using the takeover index, show that the threat of takeovers is negatively related to default risk. We further find a low correlation between the takeover index and the G- and E-indexes and a strong influence of the takeover index on default risk even after controlling for the potential effect of the G- or E-index on default risk. Our results highlight the importance of external takeover threats in reducing default risk.

The remainder of this paper proceeds as follows: Section 2 provides a brief review of the literature on the determinants of default risk and the hypothesis development on the impact of the threat of takeovers on default risk. Section 3 describes the measures we use for the threat of takeovers and default risk, the research design, our sample and the descriptive statistics on the financial characteristics of the sample. Section 4 reports the results of the baseline regression, endogeneity tests and other robustness test results. Section 5 discusses performance and earnings quality as channels by which the takeover market affects default risk. Section 6 reports the result of the tests on the influence of the information environment on the relation between the threat of takeovers and default risk. Section 7 reports the results of the tests on the influence of institutional ownership on the relation between the threat of takeovers and default risk. Finally, Section 8 concludes the paper.

2 | BRIEF LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 | Prior literature on the determinants of default risk

Prior literature shows mixed findings on the impact of corporate governance on the cost of debt financing. Ashbaugh-Skaife et al. (2006) find that firms with higher board independence and weaker shareholder rights in terms of takeover defenses experience higher credit ratings. Klock et al. (2005) find that antitakeover governance provisions lower the cost of debt financing. Using the presence of an institutional blockholder to proxy for shareholder control and firm-level antitakeover provisions to proxy for takeover vulnerability, Cremers et al. (2007) find that stronger shareholder control is associated with higher bond yields, lower ratings and higher returns only if takeover vulnerability is high. Bradley and Chen (2011) find that firms that provide limited liability and indemnification for their directors enjoy higher credit ratings and lower yield spreads. Driss et al. (2021) examine the relation between institutional investor horizons and firm-level credit ratings using a comprehensive set of firms from 57 countries over the 2000–2016 period and find that larger long-term (short-term) institutional ownership is associated with higher (lower) credit ratings. It is puzzling to note that good governance based on higher board independence and larger long-term institutional ownership is associated with higher credit ratings, while weaker governance based on stronger antitakeover provisions is also associated with higher credit ratings.

Since the global financial crisis, much research has focused on the determinants of firm default risk (e.g., see Bennett et al., 2015; Brogaard et al., 2017; Giesecke et al., 2011; Hsu et al., 2015). Giesecke et al. (2011) find that stock market returns and stock market return volatility have significant predictive power for default rates. Hsu et al. (2015) argue that firms with extensive innovation gain more power in their market. They believe that patents may better equip firms for competition and create an entry barrier for newcomers, which has a positive impact on these firms. Indeed, they find that firms with more and higher quality patents have lower default risk. Bennett et al. (2015) show that higher holdings of inside debt relative to inside equity by Chief Executive Officers (CEOs) is associated with lower default risk during the global financial crisis. They also find that CEO inside debt can serve as an important forecast tool to predict the future default of a bank holding company. Brogaard et al. (2017) show that enhanced liquidity decreases firm default risk by improving stock price informational efficiency and facilitating corporate governance by blockholders, suggesting that corporate governance is partly responsible for reducing default risk. This sample of studies on default risk indicate that there is a wide variety of factors that have been linked to default risk.

2.2 | Brief literature review on takeover protection and the threat of takeovers

Established research on the market for corporate control shows that the threat of takeovers is an important external mechanism for disciplining managers (e.g., see Balachandran et al., 2020; Bebchuk et al., 2009; Bertrand & Mullainathan, 1999, 2003; Cain et al., 2017; Fama, 1980; Fama & Jensen, 1983; Gompers et al., 2003; Hall & Anderson, 1997; Jensen & Ruback, 1983; Lel & Miller, 2015; Manne, 1965; Morck et al., 1989; Subramaniam & Daley, 2000). Manne (1965) argues that the takeover market is likely to improve the allocation of resources through specific means such as improved efficiency in management of companies, increased mobility of capital and additional protection for non-controlling shareholders. Fama (1980) and Fama and Jensen (1983) underline that competition among external parties for control of a firm increases the effectiveness of the monitoring of management. Bertrand and Mullainathan (1999) argue that the passing of takeover laws increases the insulation of managers from market pressures and will therefore lead to increased discretionary behavior. Bertrand and Mullainathan (2003) find that protection against takeover results in lower productivity and profitability through a reduction in the destruction of old plants and the creation of new plants. Balachandran et al. (2020) find that active takeover market has a disciplining effect on managerial bad news hoarding and leads to lower future crash risk. Subramaniam and Daley (2000) find that takeover targets with golden parachutes overinvest in physical capital in the years preceding a takeover and that after the takeover the investment activity of the combined entity reverses that over-investment. Hall and Anderson (1997) find a negative market reaction to a firm's adoption of a golden parachute contract and suggest that stockholders predominantly perceive the adoption of a golden parachute to be both a preventive measure and a signal that additional antitakeover measures will follow.

Gompers et al. (2003) show that firms with strong shareholder rights (weak antitakeover provisions) earn higher abnormal long-run stock returns and higher profits, have lower capital expenditures and make fewer acquisitions relative to those with strong management rights (strong antitakeover provisions). Bebchuk et al. (2009) find that increases in the E-index based on staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes and supermajority requirements for mergers and charter amendments are associated with reductions in firm valuation and large negative abnormal returns. Cain et al. (2017) construct a firm-level index of the threat of takeovers from the impactful legal determinants in the hostile takeover model in conjunction with other plausible exogenous determinants of the threat of takeovers and find that the threat of takeovers is positively related to firm value for US firms.

Exploiting a natural experiment of staggered initiation of takeover laws across countries, Lel and Miller (2015) find that the threat of takeovers incentivizes boards to monitor management and thus improves managerial discipline, particularly in countries with weak investor protection. Further, they find that the initiation of a takeover law increases the possibility of replacing poorly performing CEOs. The results are in accord with Morck et al. (1989) who find that pressure from hostile takeover influences the replacement of poorly performing managers. The findings from these studies support the view that the threat of takeovers improves monitoring and disciplines managers' opportunistic behavior, and thus we argue that the threat of takeovers, potentially, decreases default risk.

However, there is a range of studies that support the view that the threat of takeovers has the opposite effect on default risk (Berger et al., 1997; Bhojraj et al., 2017; Cen et al., 2016; Chemmanur & Tian, 2018; Francis et al., 2010; Klock et al., 2005; Safieddine & Titman, 1999; Stein, 1988). Stein (1988) argues that the pressure from the takeover market can induce managers to focus on short-term profits while sacrificing long-term objectives. In support, Chemmanur and Tian (2018) find that antitakeover provisions increase firm value if the firm intensively innovates and engages in higher quality of innovation, whereas antitakeover provisions might be harmful if the firm is not associated with such innovation activities. In a similar vein, Bhojraj et al. (2017) find that innovative firms experienced an increase in Tobin's Q following changes in the law in Delaware that increased the effectiveness of antitakeover provisions in defending against hostile takeovers.

Takeover threat can lead to higher default risk via the effect of increasing leverage and the higher costs of servicing debt. Berger et al. (1997) and Safieddine and Titman (1999) show that target firms increase their leverage ratios following unsuccessful tender offers. Francis et al. (2010) document that firms in takeover-friendly states have significantly higher leverage than their counterparts in restrictive law states and bond issues are associated with negative average stock price reactions among firms in takeover-friendly states, while positive stock price reactions among firms in restrictive law states. Klock et al. (2005) show that firms with strong antitakeover provisions have lower cost of debt financing. Finally, since takeovers are disruptions to the customer–supplier relationship, takeover threats can impair the ability of supplier firms to commit to long-term relationships with customers, leading to reduced profitability and performance and higher default risks (Cen et al., 2016).

Given those two contrasting views regarding the effect of the pressure from the takeover market on default risk, we consider the effect of the threat of takeovers on default risk as an empirical question. We examine whether the threat of takeovers as captured by the takeover index developed by Cain et al. (2017) reduces default risk.

3 | RESEARCH DESIGN

3.1 | Measure of the threat of takeovers

In the United States, government at both the federal and state level has the authority to issue takeover laws. However, the laws issued may differ in both focus and scope. In addition to federal and state statute law, the courts have ruled on takeover-related disputes, and a number of the decisions have become common precedents. We measure the threat of takeovers by the firm-level takeover index, *TIND*, developed by Cain et al. (2017). The index reflects the effects on the probability of a hostile takeover during the period 1968 to 2014, from 17 forms of legal constraints on takeovers: one federal statute (the Williams Act 1968)[1], 13 different types of state takeover laws and three court decisions (the widely adopted Delaware cases, *Revlon*, *Unocal* and *Blasius*). A high (low) value of the index indicates the lowest (highest) level of protection against the takeover, that is, the highest (lowest) threat of takeovers. Changes in the value of the index result from changes in the legal constraints on takeovers as well as changes in capital liquidity (measured as the spread between the commercial and industrial [C&I] loan rate and the federal funds rate) and firm age in years publicly traded. The data on *TIND* is publicly available.[2] The final year of the data on *TIND* is 2014. As such, a potential limitation of using *TIND* is the lack of out-of-sample validation.[3]

We relate the threat of takeovers in year $t-1$ to default risk in year t and therefore the final year for the sample used in our study is 2015.

3.2 | Measure of default risk

We measure default risk by the expected default frequency *(EDF)* developed by Bharath and Shumway (2008) based on the functional form of the distance to default measure (DD). The DD measure is based on the view of equity as a call option on the value of the firm with a strike price equal to the face value of the debt, and thus default occurs when the value of the assets falls below the face value of the debt. The DD measure is widely used (Basel Committee on Banking Supervision, 1999; Vassalou & Xing, 2004). Though *EDF* is a simple measure, Bharath and Shumway (2008) show that it performs better than the DD measure in out-of-sample forecasts of default.

[1] The Williams Act requires the bidder of a tender offer to disclose information about their identity and background, the purpose of the acquisition, including explanation of the possibility of liquidating or changing the business of the target company after the takeover, and the source of funds for the acquisition. The Act also includes time constraints that specify the minimum time an offer may be open and the number of days for shareholders to make a decision. The Act builds on the foundation of the Securities Act of 1933 and the Securities Exchange Act of 1934. The 1933 Act deals with the new issuance of securities and specifies information disclosure for new public offerings of securities. The 1934 Act primarily requires companies to disclose information following significant events through a Securities Exchange Commission (SEC) 8k filing. While those acts are not directly related to takeover activities, they do influence takeover practices. For example, the 1933 Act affects a business takeover by requiring acquirers to disclose certain information if they issue new securities as consideration in the takeover. Similarly, the 1934 Act rules on information disclosure where takeovers involve acquisition and disposal of significant assets.

[2] We thank Stephen McKeon for making these data publicly available at http://pages.uoregon.edu/smckeon/.

[3] We thank the referee for this insight on the potential limitations of the takeover index.

We follow Brogaard et al. (2017) to calculate *EDF* as follows:

$$DD_{j,t} = \frac{Log\left(\frac{Equity_{j,t} + Debt_{j,t}}{Debt_{j,t}}\right) + \left(r_{j,t-1} - \frac{\sigma^2_{vj,t}}{2}\right) \times T_{j,t}}{\sigma_{Vj,t} \times \sqrt{T_{j,t}}}, \tag{1}$$

$$\sigma_{Vj,t} = \frac{Equity_{j,t}}{Equity_{j,t} + Debt_{j,t}} \times \sigma_{Ej,t} + \frac{Debt_{j,t}}{Equity_{j,t} + Debt_{j,t}} \times \left(0.05 + 0.25 \times \sigma_{Ej,t}\right), \tag{2}$$

$$EDF_{j,t} = N\left(-DD_{j,t}\right), \tag{3}$$

where $Equity_{j,t}$ refers to the number of shares outstanding multiplied by the stock price of firm *j* at the end of year *t*; $Debt_{j,t}$ is the sum of current liabilities and one-half of long-term debt of firm *j* at the end of year *t*; $r_{j,t\text{-}1}$ is firm *j*'s past annual return, calculated from monthly stock returns over year $t-1$; $\sigma_{Ej,t}$ refers to the stock return volatility of firm *j* during year *t*, estimated using the monthly stock return from year $t-1$ and $\sigma_{vj,t}$ is an approximation to the firm's assets volatility in year *t*; $T_{j,t}$ refers to the time frame, which is set to 1 year and *N(.)* is the cumulative standard normal distribution function.[4]

3.3 | Baseline model

We estimate the following cross-sectional model to examine the relation between the threat of takeovers and default risk:

$$EDF_{j,t} = \text{¸} + \beta_1 TIND_{j,t-1} + \beta_2 Controls_{j,t-1} + e_{j,t}, \tag{3}$$

where *EDF* is the expected default frequency in year *t*; *TIND* is the takeover index in year $t-1$,[5] and *Controls* is a vector of control variables in year $t-1$.

Following Brogaard et al. (2017), we include the following control variables: *LNEQUITY*, the natural log of the market value of equity at the end of the year as measured by the share price at the end of the year multiplied by total outstanding shares; *LNDEBT*, the natural log of the face value of debt at the end of the year as measured by the sum of debt in current liabilities and one-half of long term debt; *INVVOL*, the inverse of the annualized monthly stock return volatility; *NI/TA*, profitability as measured by the ratio of net income to total assets and *EXRET*, annual excess return as measured by the difference between company stock return and Center for Research in Security Prices (CRSP) value-weighted return. Given the finding by Brogaard et al. (2017) that liquidity is associated with default risk, we include liquidity as a control variable. We use the annual average of the daily quoted spread, *QUOTED*, as an inverse proxy for liquidity. Following Hsu et al. (2015) we include market-to-book value, *MTB*, to control for the effect of asset valuation on default risk and loss, *LOSS*, to capture the effect of default caused by loss. We expect that firms experiencing loss will have higher default risk. We also expect a positive relation between market-to-book value and default risk as a result of the impact of the overvaluation of assets. Following Ashbaugh-Skaife et al. (2006), Cremers et al. (2007) and Driss et al. (2021), we also include blockholder ownership (*BLOCK*)—the fraction of shares owned by institutional investors with an ownership stake of at least 5% in year $t-1$; institutional ownership (*INSTOWN*)—the average percentage of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year $t-1$; long-term institutional

[4] Since the takeover index data (*TIND*) is annual data, we use annual data to calculate $Debt_{j,t}$.

[5] We obtain consistent results when we use *TIND* for year *t*.

investors ownership *(LONGINV)* - fraction of shares owned by institutional investors that are long-term investors in year *t-1* in our regression analysis.

We use industry dummy variables based on the two-digit standard industrial classification (SIC) code, as well as year dummy variables, to control for the impact of industry and year effects on default risk.[6] The takeover index is constructed from state-level hostile takeover laws. As such, there are potential concerns related to state-level omitted variables that could drive both takeover law and default risk. Takeover propensity may be contaminated by other institutional, political economy and historical aspects of the background in which a law is enacted (Karpoff & Wittry, 2018). To mitigate this issue, we also use state fixed effects to control for time-invariant state-specific omitted variables.[7] We measure the dependent variable at year t and the regressor variables at year $t-1$. We winsorize all continuous variables at the 1st and 99th percentiles to account for outliers.[8] In the Appendix, we provide detailed definitions of the measures of all the variables used in the study.

3.4 | Sample

We initially identify all the listed companies for the period 1990–2015 for which data are available in the Compustat database to calculate our measure of default risk, *EDF*, with the main independent variable and control variables at time $t-1$ and the dependent variable at time t. We collect data for the other control variables from the CRSP, Compustat, Thomson Reuters and Institutional Brokers Estimate System (I/B/E/S) databases. Following Brogaard et al. (2017), we removed financial firms (those with SIC codes between 6000 and 6999), as these firms are subject to various operating and reporting regulations. Finally, we delete observations with missing values and observations for companies with less than $10 million of total assets. We also exclude observations with negative sales (Fernandes & Ferreira, 2009). Application of these classification steps resulted in a sample of 53,039 firm-year observations. Next, we removed firms with missing information on the state of incorporation and thus obtained a final sample of 50,189 firm-year observations on 6033 firms.

3.5 | Descriptive statistics

Panel A in Table 1 shows the descriptive statistics for our sample. The mean value of *EDF* is 5.8%; the mean value for *EQUITY* and *DEBT* is $2572 million and $331.7 million, respectively, while their median values are $257.6 million and $29.15 million, respectively. The mean and median values of *EXRET* are 4.3% and −5.3%, respectively; the mean and median of σ_E are 0.497 and 0.421, respectively. In general, our sample statistics are reasonably similar to Brogaard et al. (2017). For other variables, the mean value of total assets, *TA*, is $2143 million; the mean value of profitability, *NI/TA*, is −2.7%; and the mean value of cash flow, *CFLOW*, is 3.5%. We also find that the mean value of G (E) index is 9.319 (2.858).[9]

We present the Pearson correlation matrix for default risk, *TIND*, and other control variables in Panel B of Table 1. We observe a negative correlation between default risk measures and *TIND*, which provides initial support for a

[6] Cain et al. (2017) suggest that the takeover index is slow-moving, and therefore firm fixed effects wash out the variation we seek to exploit and can fail to detect a relation when one exists. Therefore, we do not use firm fixed effects in this study. Because of the lack of firm fixed effect specification, we could not fully address the potential omitted variable problem whereby firm-specific time-invariant variables could drive both default risk and the *TIND*. We use a number of control variables in the baseline regression model and state fixed effects to mitigate this issue. We thank the referee for highlighting this potential limitation of our empirical approach.

[7] Our results are robust when we use state-year joint fixed effects to control for unobserved heterogeneity across states over time.

[8] As in prior studies, we do not winsorize *EDF* as the variable is bounded on the range from 0 to 1. However, we do winsorize the DD measure as it is not similarly bounded.

[9] We use publicly available G-index data for the period 1990–2006. We utilize publicly available E-index data for the period 1990–2006, and we constructed E-index data for the period 2007–2014 by extracting it's six components from RiskMetrics (ISS).

TABLE 1 Descriptive statistics

Panel A: Descriptive statistics								
Variable	*N*	Mean	Median	STD	Min	P25	P75	Max
Main variables								
EDF_t	50,189	0.058	0.000	0.179	0.000	0.000	0.002	0.966
$TIND_{t-1}$	50,189	0.140	0.115	0.089	0.027	0.069	0.188	0.392
$DEFAULT1_t$	46,177	0.262	0.000	0.440	0.000	0.000	1.000	1.000
$DEFAULT2_t$	46,139	0.207	0.000	0.405	0.000	0.000	0.000	1.000
$BOND_t$	14,661	0.520	1.000	0.499	0.000	0.000	1.000	1.000
Main control variables								
NI/TA_{t-1}	50,189	−0.027	0.032	0.210	−1.130	−0.033	0.072	0.239
$INSTOWN_{t-1}$	50,189	0.322	0.255	0.259	0.000	0.104	0.499	0.925
$BLOCK_{t-1}$	50,189	0.157	0.125	0.138	0.000	0.055	0.237	0.596
$LONGINV_{t-1}$	50,189	0.131	0.000	0.338	0.000	0.000	0.000	1.000
$QUOTED_{t-1}$	50,189	2.536	1.391	3.264	0.019	0.273	3.416	17.60
$EQUITY_{t-1}$ (\$M)	50,189	2572	257.6	8294	4.752	59.39	1199	62,130
$DEBT_{t-1}$ (\$M)	50,189	331.7	29.15	984.5	0.000	4.834	172.9	7033
$\sigma_{E\,t-1}$	50,189	0.497	0.421	0.301	0.123	0.291	0.615	1.795
$EXRET_{t-1}$	50,189	0.043	−0.053	0.582	−0.830	−0.305	0.230	2.784
MTB_{t-1}	50,189	1.854	1.451	1.257	0.618	1.098	2.104	7.987
$LOSS_{t-1}$	50,189	0.312	0.000	0.463	0.000	0.000	1.000	1.000
$LNTA_{t-1}$	50,189	5.796	5.640	1.898	2.559	4.300	7.096	10.68
$CFLOW_{t-1}$	50,189	0.035	0.077	0.178	−0.865	0.023	0.122	0.293
$RETURNS_{t-1}$	50,189	0.159	0.053	0.667	−0.843	−0.240	0.377	3.329
$SHARE_{t-1}$	50,189	5.880	3.951	5.915	0.255	1.909	7.663	32.51

(Continues)

TABLE 1 (Continued)

Panel A: Descriptive statistics

Variable	N	Mean	Median	STD	Min	P25	P75	Max
Other variables								
TA_{t-1} ($M)	50,189	2143	281.4	6124	12.92	73.71	1207	43,453
$AMIHUD_{t-1}$	50,189	2.363	0.038	8.232	0.000	0.003	0.584	60.07
$ZERO_{t-1}$	50,189	11.07	6.746	11.23	0.000	1.594	18.58	45.67
$ANALYST_{t-1}$	50,189	3.728	1.917	4.740	0.000	0.250	5.333	21.91
$OPAQUE_{t-1}$	46,754	0.327	0.228	0.323	0.030	0.129	0.401	2.017
$G\text{-}index_{t-1}$	11,434	9.319	9.000	2.754	2.000	7.000	11.00	19.00
$E\text{-}Index_{t-1}$	14,925	2.858	3.000	1.417	0.000	2.000	4.000	6.000

Panel B: Pearson correlation matrix

	1	2	3	4	5	6	7	8	9	10
1. EDF_t	–	–	–	–	–	–	–	–	–	–
2. $TIND_{t-1}$	−0.10***	–	–	–	–	–	–	–	–	–
3. $LNEQUITY_{t-1}$	−0.27***	0.32***	–	–	–	–	–	–	–	–
4. $LNDEBT_{t-1}$	0.07***	0.34***	0.67***	–	–	–	–	–	–	–
5. $INVVOL_{t-1}$	−0.24***	0.35***	0.41***	0.32***	–	–	–	–	–	–
6. NI/TA_{t-1}	−0.23***	0.19***	0.27***	0.18***	0.31***	–	–	–	–	–
7. $EXRET_{t-1}$	−0.29***	−0.01	0.16***	−0.02***	−0.08***	0.18***	–	–	–	–
8. MTB_{t-1}	−0.16***	−0.09***	0.31***	−0.14***	−0.03***	−0.10***	0.32***	–	–	–
9. $QUOTED_{t-1}$	0.25***	−0.15***	−0.65***	−0.33***	−0.23***	−0.11***	−0.09***	−0.22***	–	–
10. $LOSS_{t-1}$	0.29***	−0.17***	−0.30***	−0.16***	−0.34***	−0.66***	−0.17***	0.01***	0.17***	–
11. $LONGINV_{t-1}$	0.01**	−0.05***	−0.23***	−0.13***	0.02***	0.02***	0.01	−0.09***	0.24***	−0.01*
12. $INSTOWN_{t-1}$	−0.12***	0.19***	0.50***	0.36***	0.19***	0.18***	0.01**	0.05***	−0.42***	−0.18***
13. $BLOCK_{t-1}$	−0.01**	0.03***	0.17***	0.15***	0.06***	0.05***	−0.01	−0.05***	−0.26***	−0.02***
14. $LNTA_{t-1}$	−0.07***	0.38***	0.89***	0.85***	0.40***	0.28***	0.02***	−0.04***	−0.54***	−0.25***

(Continues)

TABLE 1 (Continued)

Panel B: Pearson correlation matrix	1	2	3	4	5	6	7	8	9	10
15. *CFLOW* $_{t-1}$	−0.21***	0.18***	0.25***	0.18***	0.30***	0.96***	0.18***	−0.12***	−0.10***	−0.62***
16. *RETURNS* $_{t-1}$	−0.30***	−0.01	0.16***	−0.03***	−0.04***	0.19***	0.95***	0.33***	−0.07***	−0.18***
17. $\sigma_{E\ t-1}$	0.31***	−0.29***	−0.34***	−0.27***	−0.77***	−0.39***	0.17***	0.09***	0.23***	0.38***
18. *SHARE* $_{t-1}$	0.02***	−0.09***	0.30***	0.12***	−0.24***	−0.06***	0.10***	0.21***	−0.36***	0.05***
19. *EINDEX* $_{t-1}$	−0.04***	0.05***	0.08***	0.10***	0.12***	0.05***	0.01	−0.12***	−0.23***	−0.06***
20. *GINDEX* $_{t-1}$	−0.06***	0.26***	0.12***	0.19***	0.19***	0.05***	−0.01	−0.10***	−0.07***	−0.07***
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
12. *INSTOWN* $_{t-1}$	−0.12***	–	–	–	–	–	–	–	–	–
13. *BLOCK* $_{t-1}$	−0.07***	0.40***	-	–	–	–	–	–	–	–
14. *LNTA* $_{t-1}$	−0.19***	0.50***	0.22***	–	–	–	–	–	–	–
15. *CFLOW* $_{t-1}$	0.03***	0.17***	0.04***	0.27***	–	–	–	–	–	–
16. *RETURNS* $_{t-1}$	0.01***	0.03***	−0.02***	0.01	0.18***	–	–	–	–	–
17. $\sigma_{E\ t-1}$	−0.03***	−0.22***	−0.10***	−0.34***	−0.38***	0.13***	–	–	–	–
18. *SHARE* $_{t-1}$	−0.19***	0.20***	0.13***	0.23***	−0.07***	0.08***	0.27***	–	–	–
19. *EINDEX* $_{t-1}$	−0.10***	0.12***	0.16***	0.13***	0.03***	−0.01	−0.14***	0.08***	–	–
20. *GINDEX* $_{t-1}$	−0.03***	0.10***	−0.01	0.19***	0.05***	−0.01	−0.19***	−0.14***	0.73***	–

Note: Panel A reports the descriptive statistics for the sample of 50,189 firm-year observations for the period 1990–2015. Panel B shows the correlation matrix for the variables used in this study. The variables used in this table are expected default frequency (*EDF*), takeover index (*TIND*), Altman Z-score (*DEFAULT1*), modified Altman Z-score (*DEFAULT2*), S&P bond rating (*BOND*), ratio of net income to total assets (*NI/TA*), average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), fraction of shares owned by institutional investors that are long-term investors (*LONGINV*), quoted spread (*QUOTED*), face value of total equity (*EQUITY*), face value of debt (*DEBT*), annualized monthly stock return volatility (σ_E), annual excess return (*EXRET*), market-to-book ratio (*MTB*), loss dummy (*LOSS*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*) and annualized monthly trading volume divided by shares outstanding (*SHARE*), inverse of annualized stock return volatility (*INVVOL*), market-to-book ratio (*MTB*), loss dummy (*LOSS*), ratio of cash flow to total assets (*CFLOW*), total assets (*TA*), daily Amihud ratio (*AMIHUD*), percentage of zero daily returns (*ZERO*), monthly average number of analysts following over a 12-month period (*ANALYST*), moving sum of the absolute value of discretionary accruals over the 3-year period (*OPAQUE*), natural logarithm of total equity (*LNEQUITY*), natural logarithm of face value of debt (*LNDEBT*), antitakeover provisions index of Gompers et al. (2003; *G-index)* and entrenchment index (E-index) of Bebchuk et al. (2009; *E-index)*. We winsorize continuous variables at the 1% and 99% levels. The Appendix provides a detailed description of the variables. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

TABLE 2 Distribution of expected default frequency (*EDF*) by takeover index (*TIND*)

TIND group	Mean value of *EDF*
1 (highest threat of takeovers)	0.031
2	0.041
3	0.057
4	0.068
5 (lowest threat of takeovers)	0.092
Difference between the means of Groups 5 and 1	0.061***
t-statistic for the difference between the means	23.34

Note: This table shows the distribution of expected default frequency in year *t* (EDF_t) by takeover index in year *t* – 1 ($TIND_{t-1}$) during the sample period. We obtain *TIND* from Cain et al. (2017). We divide firm-year observations into five groups based on the value of *TIND*. Group 1 consists of companies with the highest values of *TIND* (companies with the lowest protection from takeover laws, i.e., the highest threat of takeover), and Group 5 consists of companies with lowest values of *TIND* (companies with the highest protection from takeover laws, i.e., the lowest threat of takeover). For each group, we calculate the mean value of *EDF*. We also provide the *t*-statistics for the difference between the mean values of *EDF* between Groups 1 and 5. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

negative relation between the threat of takeovers and default risk. We also find that the coefficient of correlation between the takeover index and the G (E) index is 0.10 (0.12). Further, we find that the correlation between *TIND* and *EDF* is –0.10, while between G (E) index and *EDF* is –0.03 (–0.10). This finding suggests that the takeover index, which is constructed from external variables that are not subject to firm choice, provides different insights on the threat of takeovers, compared to measures of the threat of takeovers constructed from firm-level antitakeover provisions.

4 | EMPIRICAL RESULTS: THE THREAT OF TAKEOVERS AND DEFAULT RISK

4.1 | Baseline results

We begin our analysis by sorting the sample based on the value of *TIND* to give a preliminary picture of the relation between the threat of takeovers and default risk. Specifically, we divide the sample into quintiles where the first group includes companies that have the highest value of *TIND* (lowest protection against takeovers) and the fifth group consists of companies with the lowest value of *TIND* (highest protection against takeover). We then calculate the mean value of *EDF* in the subsequent year for each group. The mean value of *EDF* for the first group is 3.1%, while the fifth group with the highest protection has a mean value of 9.4% for *EDF*. Table 2 presents the joint distribution of *TIND* and *EDF* and shows that the *EDF* value increases as the value of *TIND* decreases. Table 2 also shows that the difference between the mean values of *EDF* for the first and fifth groups is significant at the 1% level. These results provide a preliminary indication of a negative relation between the threat of takeovers and default risk.

We regress *EDF* on the takeover index (*TIND*) and just the control variables in Bharath and Shumway (2008) and report the results of the estimation in Column 1 of Table 3. We observe a negative and significant relation between *TIND* and *EDF*. We find similar results to those reported in Bharath and Shumway (2008) and Brogaard et al. (2017) for the control variables. Specifically, we find that *LNDEBT* is significantly and positively related to *EDF* at the 1% significance level, while *LNEQUITY*, *NI/TA*, *EXRET* and *INVVOL* are significantly and negatively related to *EDF* at the 1% level. Further, we include a liquidity measure, *QUOTED*, as an additional control variable in Column 2. The negative relation between *TIND* and *EDF* is robust after controlling for stock liquidity. Similar to Brogaard et al. (2017), we find

TABLE 3 The threat of takeover and default risk

	1	2	3
$TIND_{t-1}$	−0.063***	−0.073***	−0.093***
	(0.019)	(0.021)	(0.015)
$LNEQUITY_{t-1}$	−0.037***	−0.030***	−0.132***
	(0.004)	(0.004)	(0.010)
$LNDEBT_{t-1}$	0.034***	0.032***	0.008***
	(0.003)	(0.003)	(0.002)
$INVVOL_{t-1}$	−0.019***	−0.019***	0.012***
	(0.002)	(0.002)	(0.002)
NI/TA_{t-1}	−0.088***	−0.089***	−0.006
	(0.015)	(0.015)	(0.027)
$EXRET_{t-1}$	−0.065***	−0.066***	−0.088***
	(0.005)	(0.005)	(0.018)
MTB_{t-1}	–	–	0.062***
			(0.004)
$QUOTED_{t-1}$	–	0.006***	0.003***
		(0.001)	(0.001)
$LOSS_{t-1}$	–	–	0.017***
			(0.005)
$LONGINV_{t-1}$	–	–	−0.007**
			(0.004)
$INSTOWN_{t-1}$	–	–	0.023***
			(0.007)
$BLOCK_{t-1}$	–	–	−0.015
			(0.009)
$LNTA_{t-1}$	–	–	0.125***
			(0.009)
$CFLOW_{t-1}$	–	–	0.030
			(0.024)
$RETURNS_{t-1}$	–	–	0.011
			(0.016)
$\sigma_{E\,t-1}$	–	–	0.191***
			(0.014)
$SHARE_{t-1}$	–	–	0.001***
			(0.001)
Constant	0.156***	0.117***	−0.186***
	(0.020)	(0.021)	(0.022)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes

(Continues)

TABLE 3 (Continued)

	1	2	3
Adj *R*-square	0.3083	0.3139	0.4452
N	50,189	50,189	50,189

Note: This table shows the baseline regression results for the impact of the threat of takeovers on default risk employing the following equation:

$$EDF_{j,t} = \alpha + \beta_1 TIND_{j,t-1} + \beta_2 Controls_{j,t-1} + e_{j,t}.$$

The dependent variable is the expected default frequency (*EDF*). The main independent variable is the takeover index (*TIND*) in Columns 1–3. In Column 1, we include natural logarithm of total equity (*LNEQUITY*), natural logarithm of face value of debt (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*) and annual excess return (*EXRET*) as control variables. In Column 2, we include quoted spread (*QUOTED*) and with other control variables in Column 1. In Column 3, we include market-to-book ratio (*MTB*), loss dummy (*LOSS*), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*), annualized monthly stock return volatility (σ_E) and annualized monthly trading volume divided by shares outstanding (*SHARE*), with other control variables in Column 2. We winsorize continuous variables at the 1% and 99% levels. We present the standard errors in brackets. Standard errors are clustered at the firm and year levels. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

that *LNDEBT* and *QUOTED* are significantly and positively related to *EDF* at the 1% significance level, while *LNEQUITY*, *NI/TA*, *EXRET* and *INVVOL* are significantly and negatively related to *EDF* at the 1% level.

The "baseline results" for the estimation of equation (1) are shown in Column 3 of Table 3. We find a significantly negative relation between *TIND* and *EDF*. Specifically, we find that the estimated coefficient of *TIND* is −0.092 and significant at the 1% level. The results are not only statistically significant but also economically significant. For example, the estimated coefficient of *TIND* reported in Column 3 is −0.093. Therefore, given that the standard deviation of *TIND* is 0.089 (as reported in Table 1), a one standard deviation increase in *TIND* relates to a decrease of 0.0083 (= −0.093 × 0.089) in *EDF*. This is equivalent to a 14.3% decrease in *EDF*, evaluated at the mean value of *EDF* in the sample. Overall, the results reported in Table 3 provide the support that the threat of takeovers reduces default risk.[10]

The coefficients on the control variables show that *EDF* is higher for firms that have a higher face value of debt (*LNDEBT)*, lower liquidity (*QUOTED)*, higher market-to-book ratio (*MTB)*, lower market capitalization (*LNEQUITY)*, higher inverse of annualized stock return volatility (*INVVOL)*, lower annual excess return (*EXRET)*, higher institutional ownership (*INSTOWN*), lower long-term investor ownership *(LONGINV)*, higher stock return volatility (σ_E) and experiencing loss (*LOSS)*. Overall, these results for the control variables are similar to the results found in prior research on default risk (e.g., see Bharath & Shumway, 2008; Brogaard et al., 2017).

4.2 | Endogeneity concerns

In this section, we address potential endogeneity concerns regarding the relation between the threat of takeovers and default risk. The 1980s and 1990s witnessed the adoption of several antitakeover laws at the state level. In 1995, court rulings in Delaware validated the use of poison pills in conjunction with a staggered board, thus effectively

[10] Given that the takeover index data are available only until 2014, we construct the firm-level takeover index as the probability of hostile takeover using the coefficients from the final model in tab. 6 of Cain et al. (2017). To construct the takeover index, we need to calculate the variable *Capital Liquidity*, which is defined as the rolling four-quarter average of the spread between the rate on C&I loans minus the federal funds rate. The data for the rate on C&I loans are available only until May 2017 (the fiscal year 2016 based on the Compustat specification). Thus, we construct the firm-level takeover index for the period 2015–2017. We then rerun the baseline model for the period 1990–2017. We present the results in Table 10. We find that the results are qualitatively similar to the results reported in Table 3.

lowering the probability that firms incorporated in Delaware could be acquired without the cooperation of target management.[11] Rauh (2006), Low (2009), Yun (2009) and Bhojraj et al. (2017) have all used the changes in the Delaware legal environment as an exogenous shock to takeover threats.

We use the court rulings in Delaware in 1995 to examine how the effect of the threat of takeovers on default risk differs between firms incorporated in Delaware and other states. We perform a DiD test for the effect of the change in law in Delaware, which dramatically reduced the takeover threat on default risk. Our treatment firms are those incorporated in Delaware. Firms incorporated in other states are classified as control firms. To keep a balanced number of years for the pre- and post-event samples, we use 1990–1994 as the pre-event years and 1996–2000 as the post-event years. We exclude the event year (1995) from our analysis. We further require firms to have at least 4 or 3 firm-year observations in both the pre- and post-event periods.

The dependent variable in our DiD analysis is default risk. The variable *TREAT* is a dummy variable, which equals 1 for treatment firms and 0 for control firms. *POST* is a dummy variable for post-event years. We present the results in Table 4. Columns 1 and 2 (Columns 3 and 4) show the results when firms should have at least 4 (3) firm-year observations in both the pre- and post-event periods. In Columns 1 and 3, we find a positive and significant coefficient estimate for the interaction term *TREAT*POST*, indicating that the difference in default risk between treatment and control firms becomes larger after the law change in Delaware.

We also perform an additional test to check for the parallel trend assumption of the DiD analysis. Specifically, we create a dummy variable $BEFORE^{-2\,to\text{-}1}$, which equals 1 if the firm-year observations are from the 2-year period immediately before the event year and 0 otherwise. We include *TREAT*, *POST*, *TREAT*POST*, $BEFORE^{-2\,to\text{-}1}$, $TREAT{*}BEFORE^{-2\,to\text{-}1}$ and the control variables in our analysis. The omitted group (benchmark) group therefore comprises the observations 3, 4 or 5 years before the event (years −3, −4 and −5). Similar to the results in Columns 1 and 2, the coefficient estimates for the interaction term *TREAT*POST* in Columns 2 and 4 are positive and significant. We also observe statistically insignificant coefficient estimates for the interaction term $TREAT{*}\ BEFORE^{-2\,to\text{-}1}$, which suggests that the parallel trend assumption of the DiD approach is not violated.

Overall, our results in Table 4 show that default risk increases more for firms incorporated in Delaware, compared to other firms, following the reduction in the threat of takeovers as a result of the court rulings in Delaware in 1995.[12]

4.3 | PSM analysis

We address self-selection bias arising from firm-related characteristics that may affect our results. Specifically, firms may self-select to incorporate in a certain state to manage hostile takeover threats. We use the PSM method (Rosenbaum & Rubin, 1983) to address this potential problem. Specifically, we compare the default risk of firms with a high level of the threat of takeovers with the default risk of firms with a low level of the threat, which are otherwise comparable. For each year, we identify the state of incorporation for each firm, then calculate the industry median of the takeover index for each state as the cut-off value. We define firms facing high (low) threat of takeovers as those with the takeover index above (below) the cut-off value.[13] Firms in the above-median group are our treatment firms, while those in the below-median group are our control firms. We match treatment firms (firms with the above-median threat of takeovers) with control firms (firms with the below-median threat of takeovers) based on the firm characteristics we use as control variables in our baseline regression model. We estimate the probability of being assigned to the treatment or control group using a logit regression using all control variables and year, incorporation state and industry fixed effects as in our baseline regression.

[11] Delaware State adopted Business Combination Laws in 1988 and court rulings in 1995 arguably further entrenched firms in the state.

[12] We further examine the impact of the threat of takeover (*TIND*) on default risk for firms incorporated in Delaware and firms incorporated in other states separately for the period 1996–2015 and find that *TIND* is significantly and negatively related to default risk for both subsamples, and we do not find any significant difference in the estimated coefficient of *TIND* between these subsamples. To conserve space, we do not report these results.

[13] We also use the yearly median of the threat of takeover measure as the cut-off value and find consistent results (not reported).

TABLE 4 Difference in difference analysis

	(1)	(2)	(3)	(4)
TREAT	−0.013*	−0.018**	−0.008	−0.010
	(0.007)	(0.009)	(0.006)	(0.008)
POST	−0.015	−0.029***	−0.015	−0.028***
	(0.011)	(0.007)	(0.012)	(0.009)
TREAT POST*	0.024**	0.029**	0.021**	0.021*
	(0.010)	(0.012)	(0.009)	(0.011)
$BEFORE^{-2to\text{-}1}$	–	−0.041***	–	−0.038***
	–	(0.010)	–	(0.009)
*TREAT** $BEFORE^{-2to\text{-}1}$	–	0.014	–	0.005
	–	(0.011)	–	(0.010)
Constant and other controls	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No
State fixed effect	No	No	No	No
Industry fixed effect	Yes	Yes	Yes	Yes
Adj *R*-square	0.3558	0.3594	0.4062	0.4099
N	2135	2135	2970	2970

Note: This table shows the results for the difference-in-difference test for the effect of the change in law in Delaware in 1995, which dramatically reduced the takeover threat, on default risk. Our treatment firms are those incorporated in Delaware and firms incorporated in other states are classified as control firms. The sample period is 1990–2000, excluding the year of the law change (1995). The variable *TREAT* is a dummy variable that equals 1 for treatment firms and 0 for control firms. *POST* is a dummy variable for post-event years. $BEFORE^{-2to\text{-}1}$ is a dummy variable that equals 1 if the firm-year observations are from the 2-year period immediately before the event year and 0 otherwise. In Columns 1 and 2, we require firms to have at least 4 firm-year observations in both the pre- and post-1995 periods. In Columns 3 and 4, we require firms to have at least 3 firm-year observations in both the pre- and post-1995 periods. We include a constant and the control variables as in the baseline regression in all models. We winsorize continuous variables at the 1% and 99% levels. Standard errors (in brackets) are clustered at the firm and year levels. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Column 1 of Panel A in Table 5 shows the estimation results for the logit regression. We find that the probability of having a high level of takeover threat is negatively related to *LNEQUITY*, *NI/TA*, *MTB*, *LOSS*, *BLOCK* and *SHARE*, while it is positively related to *LNDEBT*, *INVVOL*, *EXRET*, *QUOTED*, *INSTOWN*, *LNTA* and *CFLOW*. We then use the propensity scores from this logit regression and perform the matching within caliper 0.001 without replacement. Our PSM specification yields 14,710 propensity score-matched pairs (i.e., 29,420 observations).

We perform a number of diagnostic tests to check for the quality of our matching process. In the first test, we re-estimate the logit regression used for the matching process using the matched sample. We show the results in Column 2 of Panel A in Table 5. We find that none of the matching variables is significant. This indicates that the treatment and control firms are not statistically different. In addition, the pesudo-R^2 declines from 8.43% prior to the matching to 0.14% after the matching, and a $\chi 2$ test for overall model fitness shows that we cannot reject the null hypothesis that all of the coefficient estimates on independent variables are zero.

In the second diagnostic test, we present a univariate comparison between the characteristics of our treatment and control firms. We observe in Panel B of Table 5 that the firm characteristics of the treatment and control groups are not statistically different for all control variables used in the matching process. The results of these diagnostic

TABLE 5 Propensity score matching (PSM) regression

Panel A: Pre-match propensity score regression and post-match diagnostic regression		
	TINDDUM	
	1	2
	Pre-match	Post-match
$LNEQUITY_{t\text{-}1}$	−0.082***	−0.042
	(0.023)	(0.027)
$LNDEBT_{t\text{-}1}$	0.048***	−0.001
	(0.010)	(0.012)
$INVVOL_{t\text{-}1}$	0.230***	−0.017
	(0.013)	(0.015)
$NI/TA_{t\text{-}1}$	−0.513**	−0.253
	(0.215)	(0.248)
$EXRET_{t\text{-}1}$	0.200**	−0.029
	(0.096)	(0.109)
$MTB_{t\text{-}1}$	−0.044***	0.026
	(0.015)	(0.018)
$QUOTED_{t\text{-}1}$	0.021***	−0.004
	(0.005)	(0.006)
$LOSS_{t\text{-}1}$	−0.072**	−0.006
	(0.031)	(0.035)
$LONGINV_{t\text{-}1}$	−0.023	−0.016
	(0.035)	(0.041)
$INSTOWN_{t\text{-}1}$	0.193***	0.058
	(0.067)	(0.076)
$BLOCK_{t\text{-}1}$	−0.643***	0.091
	(0.089)	(0.101)
$LNTA_{t\text{-}1}$	0.304***	0.026
	(0.027)	(0.032)
$CFLOW_{t\text{-}1}$	1.112***	0.350
	(0.219)	(0.252)
$RETURNS_{t\text{-}1}$	−0.065	0.037
	(0.086)	(0.097)
$\sigma_{E\,t\text{-}1}$	−0.020	−0.090
	(0.063)	(0.076)
$SHARE_{t\text{-}1}$	−0.035***	0.002
	(0.002)	(0.003)
Constant	−2.170	0.016
	(0.646)	(0.704)
Year fixed effect	Yes	Yes
Industry fixed effect	Yes	Yes

(Continues)

TABLE 5 (Continued)

Panel A: Pre-match propensity score regression and post-match diagnostic regression		
	TINDDUM	
	1	2
State fixed effect	Yes	Yes
p-value of $\chi2$	<0.001	1.000
Pseudo-*R*-square	0.0843	0.0014
N	43,249	29,420

Panel B: Descriptive statistics for the matched sample			
	Treatment firms	Control firms	*t*-test
Dependent variables			
EDF_t	0.053	0.063	4.83***
Control variables			
$LNEQUITY_{t-1}$	5.56	5.56	0.13
$LNDEBT_{t-1}$	3.47	3.47	0.07
$INVVOL_{t-1}$	2.60	2.61	−0.45
NI/TA_{t-1}	−0.01	−0.01	0.77
$EXRET_{t-1}$	0.04	0.04	0.62
MTB_{t-1}	1.79	1.78	0.55
$QUOTED_{t-1}$	2.54	2.58	−1.01
$LOSS_{t-1}$	0.30	0.30	−0.44
$LONGINV_{t-1}$	0.12	0.13	−0.61
$INSTOWN_{t-1}$	0.32	0.32	0.80
$BLOCK_{t-1}$	0.16	0.16	1.58
$LNTA_{t-1}$	5.72	5.71	0.25
$CFLOW_{t-1}$	0.04	0.04	1.12
$RETURNS_{t-1}$	0.16	0.16	0.70
$\sigma_{E\,t-1}$	0.49	0.49	−0.29
$SHARE_{t-1}$	5.79	5.74	0.77

Panel C: Regression analysis based on the matched sample			
	EDF_t		
	1	2	3
$TIND_{t-1}$	−0.056***	−0.060***	−0.087***
	(0.019)	(0.020)	(0.016)
$LNEQUITY_{t-1}$	−0.037***	−0.031***	−0.139***
	(0.004)	(0.004)	(0.011)
$LNDEBT_{t-1}$	0.034***	0.032***	0.006***
	(0.004)	(0.004)	(0.002)
$INVVOL_{t-1}$	−0.023***	−0.023***	0.011***
	(0.003)	(0.003)	(0.002)

(Continues)

TABLE 5 (Continued)

Panel C: Regression analysis based on the matched sample			
	EDF_t		
	1	2	3
NI/TA_{t-1}	−0.088***	−0.089***	−0.010
	(0.016)	(0.016)	(0.024)
$EXRET_{t-1}$	−0.066***	−0.067***	−0.085***
	(0.006)	(0.006)	(0.021)
MTB_{t-1}	–	–	0.068***
			(0.005)
$QUOTED_{t-1}$	–	0.005***	0.002
		(0.001)	(0.001)
$LOSS_{t-1}$	–	–	0.018***
			(0.004)
$LONGINV_{t-1}$	–	–	−0.010**
			(0.004)
$INSTOWN_{t-1}$	–	–	0.026***
			(0.007)
$BLOCK_{t-1}$	–	–	−0.015
			(0.009)
$LNTA_{t-1}$	–	–	0.132***
			(0.010)
$CFLOW_{t-1}$	–	–	0.036*
			(0.020)
$RETURNS_{t-1}$	–	–	0.010
			(0.018)
$\sigma_{E\,t-1}$	–	–	0.177***
			(0.015)
$SHARE_{t-1}$	–	–	0.001***
			(0.001)
Constant	0.195***	0.152***	−0.138***
	(0.036)	(0.036)	(0.028)
Year fixed-effect	Yes	Yes	Yes
Industry fixed-effect	Yes	Yes	Yes
State fixed-effect	Yes	Yes	Yes
Adj R-square	0.3067	0.3108	0.4392
N	29,420	29,420	29,420

Note: This table presents the results on the impact of *TIND* on default risk (*EDF*) using the PSM approach. For each year, we identify the state of incorporation for each firm, and then calculate the industry median of the takeover index for each state as the cut-off value. We define firms facing high (low) threat of takeovers as those with the takeover index above (below) the cut-off value. Firms in the above-median group are our treatment firms, while those in the below-median group are our control

(Continues)

TABLE 5 (Continued)

firms. We match treatment firms (firms with the above-median threat of takeovers) with control firms (firms with the below-median threat of takeovers) based on the firm characteristics we use as control variables in our baseline regression model. Column 1 of Panel A shows the estimation results for the logit regression in year $t-1$. Column 2 of Panel A shows the logit regression results for the post-matched sample for the year $t-1$. Panel B shows the results of the comparison of the characteristics of the treatment and control firms in year $t-1$. Panel C presents the baseline regression results for the matched sample obtained using the PSM approach. The variables used in this table are *TINDDUM*, which takes a value of 1 if the *TIND* is greater than cut-off value and 0 otherwise, expected default frequency (*EDF*), takeover index (*TIND)*, natural logarithm of total equity (*LNEQUITY*), natural logarithm of face value of debt in year (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*), annual excess return (*EXRET*), quoted spread (*QUOTED*), market-to-book ratio (*MTB*), loss dummy (*LOSS*), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*), annualized monthly stock return volatility (σ_E) and annualized monthly trading volume divided by shares outstanding (*SHARE*). We winsorize continuous variables at the 1% and 99% levels. We present the standard errors in brackets. Standard errors are clustered at the firm and year levels. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

tests suggest that the PSM process removes observable differences in the characteristics of treatment and control firms. From Panel B of Table 5, we also find that the *EDF* for firms with high threat of takeovers are significantly lower, compared to the counterpart, indicating that the negative association between the threat of takeovers and default risk does not arise from sample selection bias.

Panel C of Table 5 reports the result for estimation of equation (1) using the PSM-matched sample. Column 1 shows the results when we regress *EDF* on the *TIND* and control variables in Bharath and Shumway (2008). We find that *TIND* is negatively and significantly related to *EDF*. We include *QUOTED* as additional control variables and present the results in Column 2. The coefficient estimate for *TIND* remains negatively and significantly (at the 1% level) related to *EDF*. Column 3 shows the more comprehensive results where we include all variables as in our baseline regression. We find that the coefficient estimate of *TIND* is –0.087 and significant at the 1% level. The results presented in Panel C of Table 5 highlight that our findings are not driven by systematic differences between firms with high and low levels of the takeover index. Overall, the result after controlling for sample selection bias using the PSM method supports our baseline result that the takeover market serves as a governance mechanism to lower the probability of default.

4.4 | The impact of the threat of takeovers on alternative measures of default risk

To eliminate the possibility of measurement bias, we conduct further robustness checks by replacing *EDF* with other measures of default risk: two forms of the Altman Z-score and also bond ratings. Originally, the Altman Z-score was developed to predict company bankruptcy. Eidleman (1995) argues that the traditional Altman Z-score may underpredict certain types of bankruptcy. Altman recommends correction to that traditional form of Altman Z-score by eliminating the ratio of sales to total assets so it can better capture bankruptcy for non-manufacturing firms. Therefore, we use both the original Altman Z-score and the modified Altman Z-score excluding the sales ratio. Further, we use bond rating, as in Dyreng and Markle (2016), as an additional measure of default risk.

We create a dummy variable, *DEFAULT1*, equal to 1 if the original Altman Z-score falls in the bankruptcy level below 1.81 and 0 otherwise. Similarly, we create a dummy variable, *DEFAULT2*, equal to 1 for the modified Altman Z-score if it falls in the bankruptcy level below 1.1 and 0 otherwise. For bond rating, we create a dummy variable, *BOND*, equal to 1 if an issuer's Standard & Poor (S&P) bond rating at the end of the fiscal year is below investment grade and 0 otherwise. We classify investment grade as BBB- or higher, whereas non-investment grade is lower than BBB–. We collect the S&P domestic long-term issuer credit ratings from Compustat. In addition, given that the expected default frequency measure is highly skewed to the right, we use the logarithm of the *EDF* measure as the dependent variable. We present the results of re-estimation of equation (1) in Table 6. We still find a negative and significant relation between *TIND* and default risk for each of the alternative measures of default risk. Overall, these robustness checks thus support the primary results and therefore suggest that the negative relation between *TIND* and default risk does not result from measurement bias in *EDF*.[14]

4.5 | Robustness test

4.5.1 | Antitakeover provisions (G-index and E-index), takeover index and default risk

Utilizing the G-index of Gompers et al. (2003) based on 24 corporate governance provisions to capture the anti-takeover strength of a firm, prior literature reveals that antitakeover governance provisions are associated with higher credit ratings (Ashbaugh-Skaife et al., 2006) and lower debt financing (Chava et al., 2009; Klock et al., 2005). Bebchuk et al. (2009) investigate the relative importance of the 24 governance provisions included in the G-index and proposed an E-index based on six provisions.[15] The authors show that increases in the E-index are monotonically associated with economically significant reductions in firm valuation as measured by Tobin's Q. In this section, we investigate whether the takeover index affects default risk after controlling for the G- and E-indexes. Our findings, presented in Table 7, show that the takeover index imparts a negative effect on default risk even after controlling for the G- or E-index. This finding suggests that the effect of *TIND* is independent of firm-level antitakeover provisions captured by the G-index or the E-index.

4.5.2 | Extension of takeover index

Given that the takeover index data are available only until 2014, we construct the firm-level takeover index as the probability of hostile takeover using the coefficients from the final model in tab. 6 of Cain et al. (2017). To construct the takeover index, we need to calculate the variable *Capital Liquidity*, which is defined as the rolling four-quarter average of the spread between the rate on C&I loans minus the federal funds rate. The data for the rate on C&I loans are available only until May 2017 (the fiscal year 2016 based on the Compustat specification). Thus, we construct the firm-level takeover index for the period 2015–2017. We then re-run the baseline model for the period 1990–2017. We present the results in Table 8. We find that the results are qualitatively similar to the results reported in Table 3.

5 | WHAT DRIVES THE IMPACT OF THE THREAT OF TAKEOVERS ON DEFAULT RISK

This section explores the underlying channels by which the threat of takeovers influences default risk. Previous studies find that pressure from the takeover market is an important external governance mechanism to discipline managers (Bertrand & Mullainathan, 1999, 2003; Fama, 1980; Francis et al., 2010; Lel & Miller, 2015; Manne, 1965). Much empirical research finds that better governance is associated with higher firm performance (e.g., see L. Brown

[14] Given that our sample period includes the periods of the dot-com crisis and the global financial crisis, we also test for the possible effects of these crisis periods on the relation between *TIND* and *EDF* by re-estimating equation (1) but excluding observations from the crisis periods, 2001–2002 and 2008–2009. The results (not reported) show that the relation between *TIND* and *EDF* remains negative and significant at the 5% level, suggesting that the negative relation between *TIND* and *EDF* is not driven by phenomena specific to the two crisis periods.

[15] Four constitutional provisions that prevent a majority of shareholders from having their way: staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers and supermajority requirements for charter amendments; and two takeover readiness provisions: poison pills and golden parachutes.

TABLE 6 Alternative measures of default risk

	1	2	3	4
	DEFAULT1	*DEFAULT2*	*BOND*	*Log(EDF)*
$TIND_{t\text{-}1}$	−2.488***	−1.858***	−4.765***	−0.069***
	(0.430)	(0.505)	(0.863)	(0.012)
$LNEQUITY_{t\text{-}1}$	−1.057***	−1.009***	−2.632***	−0.097***
	(0.080)	(0.070)	(0.226)	(0.007)
$LNDEBT_{t\text{-}1}$	0.394***	0.382***	0.337***	0.007***
	(0.030)	(0.033)	(0.076)	(0.002)
$INVVOL_{t\text{-}1}$	−0.126***	−0.211***	−0.132*	0.010***
	(0.024)	(0.031)	(0.078)	(0.001)
$NI/TA_{t\text{-}1}$	−1.423***	−2.317***	−3.202*	−0.001
	(0.359)	(0.371)	(1.820)	(0.020)
$EXRET_{t\text{-}1}$	−0.417**	−0.571***	−1.275***	−0.065***
	(0.192)	(0.202)	(0.442)	(0.013)
$MTB_{t\text{-}1}$	0.180***	0.290***	0.774***	0.045***
	(0.042)	(0.039)	(0.154)	(0.003)
$QUOTED_{t\text{-}1}$	−0.017	0.001	0.003	0.002***
	(0.012)	(0.009)	(0.096)	(0.001)
$LOSS_{t\text{-}1}$	0.639***	0.896***	0.386***	0.013***
	(0.060)	(0.064)	(0.131)	(0.003)
$LONGINV_{t\text{-}1}$	−0.173**	−0.161**	−0.221	−0.005*
	(0.070)	(0.071)	(0.313)	(0.003)
$INSTOWN_{t\text{-}1}$	−0.484***	−0.719***	−0.872**	0.017***
	(0.155)	(0.153)	(0.356)	(0.005)
$BLOCK_{t\text{-}1}$	−0.302	−0.318	0.062	−0.011
	(0.213)	(0.208)	(0.498)	(0.006)
$LNTA_{t\text{-}1}$	0.709***	0.524***	0.550**	0.091***
	(0.080)	(0.073)	(0.230)	(0.006)
$CFLOW_{t\text{-}1}$	−2.226***	−1.016**	−2.979	0.020
	(0.399)	(0.417)	(1.970)	(0.017)
$RETURNS_{t\text{-}1}$	0.300*	0.357*	2.005***	0.005
	(0.176)	(0.197)	(0.393)	(0.012)
$\sigma_{E\,t\text{-}1}$	0.486***	0.508***	3.178***	0.155***
	(0.121)	(0.119)	(0.969)	(0.010)
$SHARE_{t\text{-}1}$	0.018***	0.012**	0.113***	0.001***
	(0.005)	(0.006)	(0.015)	(0.001)
Constant	−0.837	−4.152***	10.94***	−0.143***
	(1.068)	(0.827)	(1.380)	(0.016)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes

(Continues)

TABLE 6 (Continued)

	1	2	3	4
	DEFAULT1	*DEFAULT2*	*BOND*	*Log(EDF)*
State fixed effect	Yes	Yes	Yes	Yes
Adj/pseudo-*R*-square	0.3477	0.3735	0.6388	0.4687
N	46,177	46,139	14,661	50,189

Note: This table shows the baseline regression results of using alternative measures of default risk as dependent variables: Altman Z-score (*DEFAULT1)* in Column 1, modified Altman Z-score (*DEFAULT2)* in Column 2, and bond rating *(BOND)* in Column 3. We also use the natural logarithm of the expected default frequency as the dependent variable in Column 4. The main independent variable is the takeover index (*TIND).* Control variables are natural logarithm of total equity (*LNEQUITY*), natural logarithm of face value of debt (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*), annual excess return (*EXRET*), quoted spread (*QUOTED*), market to book ratio (*MTB*), loss dummy (*LOSS*), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN)*, fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*), annualized monthly stock return volatility (σ_E) and annualized monthly trading volume divided by shares outstanding (*SHARE*). Standard errors are clustered at the firm and year levels. We winsorize continuous variables at the 1% and 99% levels. We provide variable definitions in the Appendix. We present the standard errors in brackets.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

& Caylor, 2009; Core et al., 1999; Klapper & Love, 2004; Vafeas, 1999) and higher earnings quality (e.g., Klein, 2002; Larcker et al., 2007; Yu, 2008).

While the association between performance and default is reasonably clear, the relation between earnings quality and default risk is less obvious. DeFond and Jiambalvo (1993) argue that even if the default cannot be avoided by manipulation of accounting information, managers are still likely to make income-increasing accounting choices hoping to improve their bargaining position in the event of renegotiations. DeFond and Jiambalvo (1994) show that bankruptcy filing firms have positive unexpected accruals in the year prior to default. These findings indicate that earnings quality decreases the likelihood of default. In support, Rosner (2003) argues that bankrupt firms' financial statements are more likely to reflect evidence of material overstatements, presumably motivated by a desire to conceal signs of distress than those of non-bankrupt firms. Therefore, we argue that if the pressure of a takeover can discipline managers, managers' intentions to manipulate earnings will be lower, thereby increasing earnings quality.

We, therefore, argue that performance and earnings quality are potential channels through which the threat of takeovers can reduce default risk. Specifically, in Section 5.1, we present performance as a channel for the takeover market to reduce default risk and in Section 5.2, we present earnings quality as a further channel.

5.1 | Performance channel

To examine the role of performance in the relation between the threat of takeovers and default risk in this section, we first estimate the following regression equation:

$$Performance_{j,t} = \text{¸} + \beta_1 TIND_{j,t-1} + \beta_2 Controls_{j,t-1} + \tilde{e}_{j,t}, \tag{4}$$

where *Performance* is a measure of the performance of firm *j* at time *t*. We measure performance using *NI/TA* (the ratio of net income to total assets) as in Harford et al. (2018). We use the variables used by Harford et al. (2018) in the determinants of profitability as control variables in our model. They are the natural logarithm of total assets (*LNTA)*, market-to-book ratio (*MTB)*, the ratio of cash flows to total assets (*CFLOW)*, the annualized monthly stock returns

TABLE 7 Takeover index, Governance Index (G-index), E-index and default risk

	1	2
G-INDEX $_{t-1}$	−0.001	
	(0.001)	
E-INDEX $_{t-1}$		−0.001
		(0.001)
TIND $_{t-1}$	−0.043***	−0.032***
	(0.016)	(0.012)
LNEQUITY $_{t-1}$	−0.098***	−0.078***
	(0.014)	(0.009)
LNDEBT $_{t-1}$	0.002	0.001
	(0.001)	(0.001)
INVVOL $_{t-1}$	0.012***	0.011***
	(0.002)	(0.002)
NI/TA $_{t-1}$	0.010	0.045*
	(0.048)	(0.024)
EXRET $_{t-1}$	−0.078***	−0.068***
	(0.024)	(0.019)
MTB $_{t-1}$	0.049***	0.039***
	(0.005)	(0.004)
QUOTED $_{t-1}$	0.009***	0.007***
	(0.003)	(0.003)
LOSS $_{t-1}$	0.004	0.009**
	(0.005)	(0.005)
LONGINV $_{t-1}$	0.005	0.006
	(0.006)	(0.004)
INSTOWN $_{t-1}$	0.023***	0.009*
	(0.009)	(0.005)
BLOCK $_{t-1}$	−0.021**	−0.011
	(0.010)	(0.007)
LNTA $_{t-1}$	0.097***	0.076***
	(0.014)	(0.009)
CFLOW $_{t-1}$	−0.030	−0.039
	(0.036)	(0.027)
RETURNS $_{t-1}$	0.009	0.011
	(0.023)	(0.015)
$\sigma_{E\,t-1}$	0.184***	0.165***
	(0.019)	(0.023)
SHARE $_{t-1}$	0.001	0.001*
	(0.001)	(0.001)

(Continues)

TABLE 7 (Continued)

	1	2
Constant	−0.218***	−0.199***
	(0.038)	(0.032)
Year fixed effect	Yes	Yes
Industry fixed effect	Yes	Yes
State fixed effect	Yes	Yes
R-square	0.4389	0.3864
Adj *R*-square	0.4323	0.3806
N	11,434	14,925

Note: This table shows the regression results for the impact of the takeover index on default risk, controlling for G-index and E-index in Columns 1 and 2, respectively. The dependent variable is expected default frequency (*EDF*). The main independent variables are takeover index (*TIND)*, antitakeover provisions index of Gompers et al. (2003; *G-index)* and the E-index of Bebchuk et al. (2009; *E-index)*. We use the publicly available G-index for the period 1990–2006. We utilize the publicly available E-index for the period 1990–2006 and constructed E-index for the period 2007–2014 by extracting its six components from RiskMetrics (ISS). Control variables are natural logarithm of total equity (*LNEQUITY*), natural logarithm of the face value of debt (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*), annual excess return (*EXRET*), quoted spread (*QUOTED*), market to book ratio (*MTB*), loss dummy (*LOSS*), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN)*, fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*), annualized monthly stock return volatility (σ_E) and annualized monthly trading volume divided by shares outstanding (*SHARE*). Standard errors are clustered at the firm and year levels. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

(*RETURNS*), the annualized standard deviation of monthly stock returns (σ_E), the fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), the average percentage of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), the fraction of shares owned by institutional investors that are long-term investors *(LONGINV)* and the annualized monthly trading volume divided by shares outstanding (*SHARE)*.

Column 1 of Panel A in Table 9 presents the results for the impact of $TIND_{t\text{-}1}$ on performance as measured by NI/TA_t. The results show that the estimated coefficient of *TIND* is 0.076 at the 1% significance level. Overall, these findings indicate that the governance mechanism implicit in the takeover market can lead to better firm performance.

We further argue that the ability to meet financial obligations is also influenced by whether the firm experiences losses from its operations. To examine the role of *LOSS* in the relation between the threat of takeovers and default risk, we estimate the following logit regression equation:

$$LOSS_{j,t} = \alpha + \beta_1 TIND_{j,t-1} + \beta_2 Controls_{j,t-1} + \tilde{e}_{j,t}, \tag{5}$$

where, $LOSS_t$ is a dummy variable equal to 1 if net income in year *t* is less than zero and 0 otherwise. In equation (3), we use the same control variables as we used in the performance model (equation 2).

Column 2 of Panel A in Table 9 presents the results for the impact of $TIND_{t\text{-}1}$ on loss in year *t*. The estimated coefficient of $TIND_t$ is −1.297, and it is significant at the 1% significance level. In unreported results, we find that the marginal effect of *TIND* is −0.1956, which indicates that a one standard deviation increase in *TIND* will reduce the probability of

TABLE 8 Threat of takeover and default risk for the period 1990–2018

	1	2	3
$TIND_{t-1}$	–0.058***	–0.067***	–0.088***
	(0.018)	(0.020)	(0.015)
$LNEQUITY_{t-1}$	–0.037***	–0.030***	–0.131***
	(0.003)	(0.003)	(0.009)
$LNDEBT_{t-1}$	0.034***	0.032***	0.008***
	(0.003)	(0.003)	(0.002)
$INVVOL_{t-1}$	–0.018***	–0.018***	0.013***
	(0.002)	(0.002)	(0.002)
NI/TA_{t-1}	–0.087***	–0.088***	–0.011
	(0.014)	(0.014)	(0.026)
$EXRET_{t-1}$	–0.066***	–0.067***	–0.089***
	(0.005)	(0.005)	(0.018)
MTB_{t-1}	–	–	0.061***
			(0.004)
$QUOTED_{t-1}$	–	0.006***	0.003***
		(0.001)	(0.001)
$LOSS_{t-1}$	–	–	0.015***
			(0.005)
$LONGINV_{t-1}$	–	–	–0.007**
			(0.003)
$INSTOWN_{t-1}$	–	–	0.022***
			(0.007)
$BLOCK_{t-1}$	–	–	–0.017**
			(0.008)
$LNTA_{t-1}$	–	–	0.124***
			(0.009)
$CFLOW_{t-1}$	–	–	0.031
			(0.022)
$RETURNS_{t-1}$	–	–	0.011
			(0.016)
$\sigma_{E\,t-1}$	–	–	0.193***
			(0.013)
$SHARE_{t-1}$	–	–	0.001***
			(0.001)
Constant	0.152***	0.114***	–0.188***
	(0.019)	(0.020)	(0.022)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes

(Continues)

TABLE 8 (Continued)

	1	2	3
R-square	0.3102	0.3154	0.4469
Adj *R*-square	0.3083	0.3135	0.4452
N	53,622	53,622	53,622

Note: This table shows the regression results for the impact of threat of takeover on default risk. Column 1 shows the result for the model reported in Column 1 of Table 4 of Brogaard et al. (2017, p.492). Column 2 presents the result when we include liquidity measure (*QUOTED*) as well as variables in Column 1. Column 3 shows the result when all control variables are included in the estimation. We utilize the *TIND* measure available in http://pages.uoregon.edu/smckeon/ for the period 1989–2014 and construct the firm-level takeover index as the probability of hostile takeover using the coefficients from the final model in tab. 6 of Cain et al. (2017) for the period 2015–2017. The dependent variable is expected default frequency (*EDF*). The main independent variable is takeover index (*TIND*) in Columns 1–3. In Column 1, we include natural logarithm of total equity (*LNEQUITY*), natural logarithm of face value of debt (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*) and annual excess return (*EXRET*) as control variables. In Column 2, we include quoted spread (*QUOTED*) and with other control variables in Column 1. In Column 3, we include market-to-book ratio (*MTB*), loss dummy (*LOSS*), fraction of shares owned by institutional investors that are long-term investors (*LONGINV*), average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets (*CFLOW*), annualized monthly stock returns (*RETURNS*), annualized monthly stock return volatility (σ_E) and annualized monthly trading volume divided by shares outstanding (*SHARE*), with other control variables in Column 2. We winsorize continuous variables at the 1% and 99% levels. We present the standard errors in brackets. Standard errors are clustered at the firm and year levels. We provide variable definitions in the Appendix.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

experiencing loss by 19.56%.[16] These findings indicate that if the threat of takeovers leads to better performance, it is likely that the threat of takeovers will also lead to a lower chance of loss.

To confirm the performance channel, we investigate the impact of predicted *NI/TA* and predicted *LOSS* obtained in equations (2) and (3), respectively, on default risk. We present the results in Panel B of Table 9. We find that the predicted *NI/TA* is significantly and negatively related to *EDF*, while the predicted *LOSS* is significantly and positively related to *EDF*. Overall, the findings in this section lend support to the governance mechanism implicit in the takeover market reducing default risk by increasing firm performance.

5.2 | Earnings quality channel

Prior studies find that firms with stronger governance mechanisms have higher earnings quality (e.g., see Klein, 2002; Larcker et al., 2007; Yu, 2008). Motivated by this finding, we explore the ability of earnings quality as a channel for the takeover market to reduce default risk. We test this conjecture by estimating the following equation:

$$EARNQ_{j,t} = \text{¸} + \beta_1 TIND_{j,t-1} + \beta_2 Controls_{j,t-1} + \tilde{e}_{j,t}. \quad (6)$$

We measure earnings quality (*EARNQ*) using the degree of financial statement opacity (*OPAQUE*) as in Hutton et al. (2009). We use all the control variables we used in the performance model in equation (2) in our earnings quality model. Higher values of *OPAQUE* indicate lower earnings quality. The results of the estimation of equation (4) are reported in Column 3 of Panel A of Table 9. It shows that $TIND_{t\text{-}1}$ is negatively related to *OPAQUE* and is significant at the 1% level.

[16] Marginal effects relate to the slope of the probability curve and are based on a one standard deviation change in a given explanatory variable holding all other explanatory variables at their sample means.

TABLE 9 Channels

Panel A: The impact of takeover index on performance			
	NI/TA	*LOSS*	*OPAQUE*
	1	2	3
$TIND_{t-1}$	0.077***	−1.297***	−0.125***
	(0.016)	(0.226)	(0.046)
MTB_{t-1}	0.001	−0.112***	0.020***
	(0.002)	(0.028)	(0.003)
$LNTA_{t-1}$	0.006***	−0.142***	−0.024***
	(0.001)	(0.026)	(0.003)
$CFLOW_{t-1}$	0.614***	-6.756***	−0.231***
	(0.024)	(0.499)	(0.043)
$LONGINV_{t-1}$	0.004*	−0.045	−0.030***
	(0.002)	(0.057)	(0.006)
$INSTOWN_{t-1}$	0.030***	−0.681***	−0.082***
	(0.009)	(0.143)	(0.016)
$BLOCK_{t-1}$	0.011	0.726***	−0.106***
	(0.009)	(0.147)	(0.022)
$RETURNS_{t-1}$	0.028***	−0.458***	−0.016***
	(0.004)	(0.055)	(0.003)
$\sigma_{E\,t-1}$	−0.077***	1.346***	0.131***
	(0.010)	(0.093)	(0.013)
$SHARE_{t-1}$	−0.002***	0.025***	0.004***
	(0.001)	(0.005)	(0.001)
Constant	−0.043***	−1.017***	0.401***
	(0.016)	(0.358)	(0.093)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes
R-square/pseudo-*R*-square	0.4406	0.2654	0.2173
Adj. *R*-square	0.4390	N/A	0.2149
N	50,189	50,178	46,754

Panel B: The impact of predicted performance on default risk			
	Performance		Opaque
	1	2	3
Predicted NI/TA_t	−1.203***	–	–
	(0.203)		
Predicted $LOSS_t$	–	0.072***	–
		(0.012)	
Predicted $OPAQUE_t$	–	–	0.671***
			(0.119)

(Continues)

TABLE 9 (Continued)

Panel B: The impact of predicted performance on default risk			
	Performance		Opaque
	1	2	3
LNEQUITY $_{t-1}$	−0.132***	−0.134***	−0.131***
	(0.010)	(0.010)	(0.010)
LNDEBT $_{t-1}$	0.008***	0.008***	0.007***
	(0.002)	(0.002)	(0.002)
INVVOL $_{t-1}$	0.012***	0.012***	0.013***
	(0.002)	(0.002)	(0.002)
NI/TA $_{t-1}$	–	−0.034	−0.008
		(0.024)	(0.026)
EXRET $_{t-1}$	−0.088***	−0.089***	−0.087***
	(0.018)	(0.018)	(0.018)
MTB $_{t-1}$	0.063***	0.071***	0.048***
	(0.004)	(0.005)	(0.004)
QUOTED $_{t-1}$	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)
LOSS $_{t-1}$	0.017***	–	0.016***
	(0.004)		(0.005)
LONGINV $_{t-1}$	−0.002	−0.004	0.014***
	(0.004)	(0.004)	(0.005)
INSTOWN $_{t-1}$	0.060***	0.072***	0.081***
	(0.010)	(0.011)	(0.012)
BLOCK $_{t-1}$	−0.001	−0.066***	0.055***
	(0.009)	(0.012)	(0.015)
LNTA $_{t-1}$	0.132***	0.137***	0.140***
	(0.010)	(0.010)	(0.011)
CFLOW $_{t-1}$	0.763***	0.524***	0.184***
	(0.126)	(0.077)	(0.030)
RETURNS $_{t-1}$	0.044***	0.044***	0.022
	(0.015)	(0.015)	(0.015)
$\sigma_{E\,t-1}$	0.098***	0.096***	0.104***
	(0.021)	(0.020)	(0.021)
SHARE $_{t-1}$	−0.001***	−0.001**	−0.002***
	(0.001)	(0.001)	(0.001)
Constant	−0.238***	−0.110***	−0.447***
	(0.024)	(0.025)	(0.053)
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes

(Continues)

TABLE 9 (Continued)

Panel B: The impact of predicted performance on default risk	Performance		Opaque
	1	2	3
R-square	0.4469	0.4455	0.4468
Adj. *R*-square	0.4452	0.4439	0.4449
N	50,189	50,178	46,754

Note: Panel A of this table shows the impact of the threat of takeovers on performance and earnings quality. We use two measures of performance, ratio of net income to total assets in year *t* (NI/TA_t) and a dummy for loss in year *t* ($LOSS_t$). We measure earnings quality (*EARNQ)* as the moving sum of the absolute value of discretionary accruals over the 3-year period in year *t* ($OPAQUE_t$). The results of the estimation of the regression model for *NI/TA* are shown in Column 1 of Panel A. The results for the estimation of the logit regression model for *LOSS* are shown in Column 2 of Panel A. The results for the estimation of the regression model for *OPAQUE* are shown in Column 3 of Panel A. Panel B presents the impact of predicted performance and predicted earnings quality, obtained from Panel A, on default risk. The dependent variables used in this table are NI/TA_t, $LOSS_t$ and $OPAQUE_t$ in Panel A, and EDF_t in Panel B. Main independent variables are takeover index (*TIND*) in Panel A and *Predicted* NI/TA_t, *Predicted* $LOSS_t$ and *Predicted* $OPAQUE_t$ in Panel B. Other control variables used in this table are market-to-book ratio (*MTB*), natural logarithm of total assets (*LNTA*), ratio of cash flow to total assets ($CFLOW_{t-1}$), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, average of the percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors with an ownership stake of at least 5% (*BLOCK*), annualized monthly stock returns ($RETURNS_{t-1}$), annualized monthly stock return volatility (σ_E), annualized monthly trading volume divided by shares outstanding (*SHARE*), natural logarithm of total equity I (*LNEQUITY*), natural logarithm of the face value of debt (*LNDEBT*), inverse of annualized stock return volatility (*INVVOL*), ratio of net income to total assets (*NI/TA*), annual excess return (*EXRET*), quoted spread (*QUOTED*) and loss dummy (*LOSS*). We provide variable definitions in the Appendix. We winsorize continuous variables at the 1% and 99% levels. We cluster standard errors at firm and year levels. We present the standard errors in brackets.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

This result provides supporting evidence that the governance mechanism implicit in the takeover market can increase earnings quality through the reduction of earnings management.

To confirm the earnings quality channel, we investigate the impact of predicted *OPAQUE* obtained in equation (4) on *EDF*. We report the results in Column 3 of Panel B of Table 9. The results show that *EDF* increases when earnings quality declines as measured by predicted *OPAQUE*. Overall, the findings in this section lend support to the governance mechanism implicit in the takeover market reducing default risk by increasing companies' earnings quality.

6 | INFORMATION ENVIRONMENT, TAKEOVER INDEX AND DEFAULT RISK

Goyal and Wang (2013) argue that a borrower's choice of debt maturity depends on the private information available regarding default probabilities and show that borrowers with favorable information prefer short-term debt, while those with unfavorable information prefer long-term debt. Liao et al. (2009) suggest that the information asymmetry between informed and uninformed traders results in deviations from a firm's correct credit risk assessment. Further, Brogaard et al. (2017) find that stocks with the largest improvement in information efficiency experience the greatest reduction in default risk. Drawing on the above studies, we therefore argue that the impact of the threat of takeovers on default risk will be more pronounced for firms with a poor information environment. In this section, we examine whether the relation between the threat of takeovers and default risk varies among firms with high versus low information environments.

Previous studies find that analyst coverage is related to the degree of information asymmetry (e.g., see Chang et al., 2006; Frankel & Li, 2004; Roulstone, 2003). Roulstone (2003) finds that analyst coverage induces higher public information availability, thereby reducing information asymmetry and increasing market liquidity. Further, Subrahmanyam and Titman (2001) show that higher liquidity increases informational price efficiency by triggering the entry of informed traders. We consider analyst coverage and the degree of stock liquidity in investigating the effect of information environment on the relation between *TIND* and *EDF*.

6.1 | Analyst coverage

Similar to previous studies (S. Brown & Hillegeist, 2007; Kim et al., 2016), we measure the information environment using the number of analysts following the stock (*ANALYSTS)*. We compute the analyst coverage measure using data from the I/B/E/S database. We measure analyst following (*ANALYSTS)* as the average number of analysts following over a 12-month period for a particular firm. We predict that the negative relation between *TIND* and *EDF* is stronger for firms belonging to the lower analyst coverage, compared to those belonging to the higher analyst coverage.

To test this conjecture, we create dummy variables based on the degree of information asymmetry measures. In each year, we divide firms into those having a stronger information environment and those having a weaker information environment. In the case of analysts following, we create two dummy variables *HANALYSTS* and *LANALYSTS*. *HANALYSTS* is equal to one for those firms having more analysts following than the median analysts following for each year of our sample and zero otherwise. *LANALYSTS* is equal to one for those firms having a lower than or equal to yearly median analysts following. We then perform our baseline regression model for the two subsamples of firms with high (*HANALYSTS*) versus low (*LANALYSTS*) analyst coverage.

We present the results in Columns 1 and 2 of Table 10. We find that *TIND* is negatively related to default risk for both subsamples of firms with high and low analyst coverage. The coefficient estimate for the low analyst coverage sample (*LANALYSTS*) is −0.112, while that for the high analyst coverage sample (*HANALYSTS*) is −0.057, and the difference between these coefficients is statistically significant. These results support our argument that the negative relation between *TIND* and *EDF* is stronger for firms belonging to the lower information environment (lower analyst coverage) group, compared to those that belong to the higher information environment (higher analyst coverage) group.

6.2 | Liquidity

As previous studies find that liquidity is associated with the information environment (e.g., see Attig et al., 2006; Welker, 1995), we also use a liquidity measure to capture the quality of the information environment. We use three alternative measures for liquidity: (i) the Amihud illiquidity measure, *AMIHUD* (Amihud, 2002), (ii) the quoted spread, *QUOTED* and (iii) the percentage of zero daily returns, *ZERO* (Lesmond et al., 1999). We compute the liquidity measures using data from the CRSP database. We predict that the negative relation between *TIND* and *EDF* is stronger for firms with lower liquidity (higher *AMIHUD*, *QUOTED* and *ZERO*) as compared to firms with higher liquidity (lower *AMIHUD*, *QUOTED* and *ZERO*).

As before, we sort all firms in our sample into two groups based on the median value of the liquidity measures for each year. Specifically, for each of the liquidity measures that we used, we classify our sample as having low liquidity if *AMIHUD*, *QUOTED* and *ZERO* are higher than the median value of the particular liquidity measures for each year of our sample. We label these groups as *HAMIHUD*, *HQUOTED* and *HZERO*, respectively. While those having scores lower than or equal to the yearly median value of the respective liquidity measures are labeled as *LAMIHUD*, *LQUOTED* and *LZERO*. We then perform our baseline regression analysis separately for the high versus low liquidity groups.

We present the results for the liquidity measures of the information environment in Columns 3–8 of Table 10. We find that the estimated coefficient of *TIND* is negative and significant in both high and low liquidity groups for all measures of liquidity. More importantly, the magnitude of the estimated coefficient of *TIND* is more negative among firms

TABLE 10 The threat of takeovers and default risk: Information asymmetry

	ANALYST		QUOTED		AMIHUD		Zero	
	HANALYST	LANALYST	HQUOTED	LQUOTED	HAMIHUD	LAMIHUD	HZERO	LZERO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TIND $_{t-1}$	−0.057***	−0.112***	−0.125***	−0.049***	−0.112***	−0.056***	−0.115***	−0.065***
	(0.014)	(0.021)	(0.022)	(0.011)	(0.021)	(0.015)	(0.020)	(0.015)
Constant	−0.169***	−0.161***	−0.132***	−0.108***	−0.132***	−0.131***	−0.148***	−0.128***
	(0.037)	(0.027)	(0.030)	(0.019)	(0.037)	(0.019)	(0.029)	(0.024)
Diff in coefficient of TIND	0.055		−0.076		−0.056		−0.050	
Chi-square test	9.67***		13.54***		7.72***		5.38**	
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-square	0.4222	0.4590	0.4873	0.3248	0.4803	0.3598	0.4843	0.3646
N	24,794	25,395	25,087	25,102	25,087	25,102	24,220	25,969

Note: This table reports the results on how the relation between the threat of takeovers and default risk varies between high and low information asymmetry environments. We use the following information asymmetry measures: *ANALYST, QUOTED, AMIHUD* and *ZERO*. For each fiscal year in the sample period, we sort firms into two groups based on the median value of each of the information asymmetry measures. Due to the availability of data, our sample size varies across different measures. In addition, to control variables used from the baseline model in Table 4, we use the following variables: takeover index (*TIND*); monthly average number of analysts following over a 12-month period (*ANALYST*); daily Amihud ratio (*AMIHUD*); quoted spread (*QUOTED*); percentage of zero daily returns (*ZERO*); dummy variable *HANALYST*, which takes a value of 1 if *ANALYST* is greater than its median value in $t-1$ and 0 otherwise; dummy variable *LANALYST*, which takes a value of 1 if *ANALYSTS* is equal to or less than its median value in year $t-1$ and 0 otherwise; dummy variable *LQUOTED*, which takes a value of 1 if QUOTED is equal to or less than its median value in year $t-1$ and 0 otherwise; dummy variable *HQUOTED*, which takes a value of 1 if *QUOTED* is greater than its median value in $t-1$ and 0 otherwise; dummy variable *HAMIHUD*, which takes a value of 1 if *AMIHUD* is greater than its median value in $t-1$ and 0 otherwise; dummy variable *LAMIHUD*, which takes a value of 1 if *AMIHUD* is equal to or less than its median value in year $t-1$ and 0 otherwise; dummy variable *HZERO*, which takes a value of 1 if *ZERO* is greater than its median value in $t-1$ and 0 otherwise and dummy variable *LZERO*, which takes a value of 1 if *ZERO* is equal to or less than its median value in year $t-1$ and 0 otherwise. We provide variable definitions in the Appendix. We winsorize continuous variables at the 1% and 99% levels. We cluster the standard error at firm and year levels. We present the standard errors in brackets.
*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

with low liquidity (i.e., the *HAMIHUD*, *HQUOTED* and *HZERO* groups) than among firms with high liquidity. The difference in the coefficient estimates for *TIND* in the high versus low liquidity groups are also statistically significant. Overall, the results show that the negative relation between *TIND* and *EDF* is stronger for firms that are characterized as having less information availability, irrespective of how the information environment is measured. Overall, the findings indicate that a firm's information environment plays a significant role in determining the relation between the threat of takeovers and default risk.

7 | INSTITUTIONAL OWNERSHIP, TAKEOVER INDEX AND DEFAULT RISK

Brogaard et al. (2017) argue that good corporate governance induces managers to invest in value-enhancing activities and mitigates the opportunistic behavior of managers, thereby it may lead to a lower probability of default. Prior research finds that the pressure of takeover provides a governance mechanism that may act as a substitute for other external governance mechanisms. (Bertrand & Mullainathan, 1999, 2003; Francis et al., 2010; Lel & Miller, 2015; Morck et al., 1989). Hence, if the effect of the takeover index on default risk stems from the role of hostile takeovers in disciplining managers, the effect will be stronger among those firms that are subject to less monitoring from other external governance mechanisms. To test this conjecture, we examine the impact of the takeover market on default risk for different subsamples of firms based on the degree of institutional ownership. We focus on institutional investors given their important role as external monitors of firms (Hartzell & Starks, 2003).

We use two measures of institutional ownership that are well established in the governance literature: institutional ownership, *INSTOWN* (Hartzell & Starks, 2003) and the fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*. We use data from the Thomson Reuters Institutional Holdings (13F) database to calculate these measures.

We divide our sample into those having a higher institutional ownership in year $t-1$ above the yearly median value of the measure used (*HINSTOWN*) and those having a lower institutional ownership in year $t-1$ below or the same as the yearly median value of the measure used (*LINSTOWN*). A similar high/low ownership classification is used for *LONGINV*. We then perform our baseline regression model on the subsamples of firms with high versus low institutional ownership or high versus low long-term institutional investor ownership. We predict that the negative effect of the threat of takeovers on default risk will be stronger for firms with lower institutional ownership (long-term institutional investor ownership), compared to the higher institutional ownership (long-term institutional investor ownership) group. We present the results in Table 11.

We find that *TIND* reduces default risk for firms with lower institutional ownership or lower long-term institutional investor ownership. *TIND* also exerts a negative effect on default risk for firms with higher institutional ownership, but its impact on firms with higher long-term institutional investor ownership is not significant. The magnitude of the estimated coefficients of *TIND* is more negative for firms with lower institutional ownership (long-term institutional investor ownership), compared to the higher institutional ownership (long-term institutional investor ownership) group. The differences in the coefficient estimates between these groups are also statistically significant. Overall, the findings in Table 11 indicate that the negative relation between *TIND* and *EDF* is stronger for firms with lower levels of institutional holdings. This result indicates that the governance mechanism reflected within the takeover market is more pronounced among firms that are subject to lower monitoring by institutional investors.

8 | CONCLUSION

We examine the impact of the threat of takeovers on default risk for US firms over the period 1994–2015. Our results indicate that there is a negative relation between the threat of takeovers and default risk. Our results hold after we address potential endogeneity concerns using changes in the law in Delaware as an exogenous shock to takeover threats and self-selection bias utilizing the PSM approach. Our results are robust to alternative measures of default risk and exclude crisis periods. We also find that the takeover index imparts a negative effect on default risk, even after controlling for the G- or E-index, indicating that the effect of *TIND* is independent of firm-level antitakeover provisions captured by the G- or the E-index. We also examine the underlying channels through which the threat of takeovers affects default risk. Our results indicate that firms with a higher threat of takeovers have better performance, a lower likelihood of experiencing loss and higher earnings quality, which, in turn, mitigate default risk.

Further, we test the impact of the quality of the information environment on the relation between the threat of takeovers and default risk and find that the relation is stronger for firms with an opaque information environment. We also test for the impact of institutional ownership as an external governance mechanism on the relation between the threat of takeovers and default risk and find that the effect of the takeover market on default risk is greater for firms with low institutional ownership.

Our study contributes to the understanding of the impact of takeover threats on default risk. Existing studies based on the firm-level antitakeover provisions show that higher level of antitakeover provisions or lower level of takeover

TABLE 11 The threat of takeovers index and default risk: Institutional ownership

	INSTOWN		LONGINV	
	HINSTOWN	LINSTOWN	HLONGINV	LLONGINV
TIND $_{t-1}$	−0.057***	−0.120***	−0.007	−0.103***
	(0.016)	(0.021)	(0.025)	(0.016)
Constant	−0.208***	−0.158***	−0.203***	−0.197***
	(0.027)	(0.032)	(0.053)	(0.023)
Difference in coefficient of TIND	0.063		0.096	
Chi-square test	8.48***	9.80***		
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
State fixed effect	Yes	Yes	Yes	Yes
R-square	0.4192	0.4619	0.4851	0.4460
Adj. R-square	0.4158	0.4587	0.4739	0.4441
N	25,087	25,102	6589	43,600

Note: This table reports the results on how the relation between the threat of takeovers and default risk varies between high and low institutional ownership measures. We use two measures of institutional ownership: *INSTOWN* and *LONGINV*. For each fiscal year in the sample period, we sort firms into two groups based on the median value of each of the institutional ownership measures. We exclude *INSTOWN* and *LONGINV* from the list of control variables in this table. In addition to control variables used from the baseline model, we use the following variables: takeover index (*TIND*), average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year (*INSTOWN*), fraction of shares owned by institutional investors that are long-term investors *(LONGINV)*, dummy variable *HINSTOWN*, which takes a value of 1 if *INSTOWN* is greater than its median value in $t-1$ and 0 otherwise and dummy variable *LINSTOWN*, which takes a value of 1 if *INSTOWN* is equal to or less than its median value in year $t-1$ and 0 otherwise. We provide variable definitions in the Appendix. We winsorize continuous variables at the 1% and 99% levels. We cluster the standard error at firms and years level. We present the standard errors in brackets.

*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

threats are associated with lower default risk as indicated by higher credit ratings (Ashbaugh-Skaife et al., 2006) and lower debt financing (Chava et al., 2009; Klock et al., 2005). These findings support the view that the pressure from the takeover market could result in managers sacrificing long-term objectives for short-term profits (Stein, 1988). However, using the hostile takeover index, we show that higher levels of takeover threats result in lower levels of default risk. Our results hold controlling for G- and E-indexes. The construction of the takeover index from external takeover laws and court decisions helps circumvent endogeneity-related issues stemming from the endogenous nature of firm-level antitakeover provisions. Overall, our study highlights the beneficial role of the discipline exerted on management by the takeover market in reducing firm default risk.

ACKNOWLEDGMENTS

We thank the anonymous referee, the editor Ronan Powell, Robert Faff, Sagarika Mishra and Michael Theobald and participants at the 10th Financial Markets and Corporate Governance Conference for their valuable comments. All errors are our own.

Open access publishing facilitated by La Trobe University, as part of the Wiley - La Trobe University agreement via the Council of Australian University Librarians.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the sources identified in the paper.

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How to cite this article: Balachandran, B., Duong, H. N., van Zijl, T., & Zudana, A. E. (2023). Does the threat of takeover affect default risk? *Journal of Business Finance & Accounting*, *50*, 1572–1611.
https://doi.org/10.1111/jbfa.12668

APPENDIX

VARIABLE DEFINITIONS

Variable name	Definition
Key dependent variable	
EDF $_t$	Expected default frequency (Bharath & Shumway, 2008) in year *t*. We use equation (3) to calculate this measure
Key independent variable	
TIND $_{t-1}$	Takeover index in year t – 1. We use the takeover index measure developed by Cain et al. (2017) and obtain this from http://pages.uoregon.edu/smckeon
Other variables	
$\sigma_{E\,t-1}$	Annualized monthly stock return volatility in year *t* – 1
AMIHUD $_{t-1}$	The daily Amihud ratio is defined as the average of the ratio of the daily absolute return to the (dollar) trading volume on that day multiplied by 106. The annual Amihud ratio is the average of the daily Amihud ratio
ANALYST $_{t-1}$	The monthly average number of analysts following over a 12-month period in year *t* – 1
BLOCK $_{t-1}$	Fraction of shares owned by institutional investors with an ownership stake of at least 5% in year *t* – 1
BOND $_t$	Dummy variable coded 1 for firms' S&P bond rating at the end of period t is below the investment grade and 0 otherwise
CFLOW $_{t-1}$	(Income before extraordinary items + depreciation and amortization)/total assets as in Harford et al. (2018) year *t* – 1
DEBT $_{t-1}$	Face value of debt, computed as the sum of debt in current liabilities and one-half of long-term debt year *t* – 1
DEFAULT1 $_t$	Dummy variable, which takes a value of 1 if the original Altman Z-score falls in the bankruptcy level below 1.81 and 0 otherwise
DEFAULT2 $_t$	Dummy variable, which takes a value of 1 if the modified Altman Z-score falls in the bankruptcy level below 1.1 and 0 otherwise
EQUITY $_{t-1}$	Number of shares outstanding x shares price in the end of year *t* – 1
EXRET $_{t-1}$	Annual excess return, calculated as the difference between company stock return and market return in the same period, in year *t* – 1
HAMIHUD	Dummy variable takes a value of 1 if AMIHUD is greater than its median value in *t* – 1 and 0 otherwise
HANALYST	Dummy variable takes a value of 1 if ANALYST is greater than its median value in *t* – 1 and 0 otherwise
HINSTOWN	Dummy variable takes a value of 1 if INSTOWN is greater than its median value in *t* – 1 and 0 otherwise
HQUOTED	Dummy variable takes a value of 1 if QUOTED is greater than its median value in *t* – 1 and 0 otherwise
HZERO	Dummy variable takes a value of 1 if ZERO is greater than its median value in *t* – 1 and 0 otherwise

(Continues)

Variable name	Definition
$INSTOWN_{t-1}$	The average of percentages of shares outstanding held by institutional investors over the four quarters of the firm's fiscal year in year $t-1$
$INVVOL_{t-1}$	Inverse of annualized stock return volatility in year $t-1$
LAMIHUD	Dummy variable takes a value of 1 if *AMIHUD* is equal to or less than its median value in year $t-1$ and 0 otherwise
LANALYST	Dummy variable takes a value of 1 if *ANALYSTS* is equal to or less than its median value in year $t-1$ and 0 otherwise
LINSTOWN	Dummy variable takes a value of 1 if *INSTOWN* is equal to or less than its median value in year $t-1$ and 0 otherwise
$LNDEBT_{t-1}$	Natural logarithm of face value of debt in year $t-1$
$LNEQUITY_{t-1}$	Natural logarithm of total equity in year $t-1$
$LNTA_{t-1}$	Natural logarithm of total assets in year $t-1$
$LONGINV_{t-1}$	Fraction of shares owned by institutional investors that are long-term investors in year $t-1$
$LOSS_{t-1}$	Dummy variable equal to 1 if net income in year $t-1$ is less than zero and 0 otherwise
LQUOTED	Dummy variable takes a value of 1 if *QUOTED* is equal to or less than its median value in year $t-1$ and 0 otherwise
LZERO	Dummy variable takes a value of 1 if *ZERO* is equal to or less than its median value in year $t-1$ and 0 otherwise
MTB_{t-1}	[(Total assets − book value of common equity) + market value of common equity]/total assets in year $t-1$
NI/TA_{t-1}	Ratio of net income to total assets in year $t-1$as in Harford et al. (2018)
$OPAQUE_{t}$	The moving sum of the absolute value of discretionary accruals over the 3-year period, where discretionary accruals are calculated based on the modified Jones model in Dechow et al. (1995). We follow Hutton et al. (2009) to calculate this measure
POST	Dummy variable takes a value of 1 for observations after 1995 and 0 otherwise
$QUOTED_{t-1}$	Quoted spread in year $t-1$, defined as the average of the daily quoted spread. The quoted spread for each day is computed as (Ask − Bid)/M, where Ask and Bid are the closing best offer and bid prices, respectively, and M is the quote midpoint, computed as (Ask + Bid)/2. Multiply by 100
$RETURNS_{t-1}$	Annualized monthly stock returns in year $t-1$
$SHARE_{t-1}$	Annualized monthly trading volume divided by shares outstanding in year $t-1$
TA_{t-1}	Total assets in million in year $t-1$
TREAT	Dummy variable takes a value of 1 if the firm reincorporated in Delaware and 0 otherwise
$ZERO_{t-1}$	The percentage of zero daily returns (Lesmond et al., 1999) in year $t-1$. Multiply by 100