

Firm Risk Exposure Concentration and Debt Structure Choice

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Abstract

Firms with more risk shifting problems due to the high-risk exposure concentration are likely to include more short-term debt in their capital structures and less covenants in their outstanding bonds. Using a firm's risk exposure concentration derived from the written text in 10-K filings, we find this effect is more pronounced among companies with strong managerial incentive alignment with shareholders. The findings suggest maintaining future investment flexibility is important for firms with high-risk exposure concentration, even at the expense of a higher liquidity risk associated with the use of short-term debt.

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1 Introduction

When a firm decides to issue debt to fund its operational and investment needs, among the key elements accompanying this choice are covenants and the maturity of the new security. Both alternatives help reduce agency costs of debt arising from the underinvestment problem (see Billett et al., 2007; Jensen and Meckling, 1976; Myers, 1977). However, the mechanism to which they minimize these conflicts is different. Short-term debt permits a more frequent adjustment to the cost of debt, and thus, strict monitoring by creditors but at the cost of a higher liquidity risk for the firm (Diamond, 1991). Restrictive covenants on the other hand grant control rights to lenders following covenant violations but at the cost of restricting future financing and investment decisions (Chava and Roberts, 2008; Nini et al., 2009; Press and Beneish, 1993; Smith and Warner, 1979). While both alternatives mitigate the underinvestment problem, the net benefit for these alternatives are likely to be different in reducing asset substitution issues, another major contractual problem of debt.

Companies that have their operations, investments, and future earnings exposed to a narrow set of risk factors, i.e., concentrated risk exposure, are likely to suffer from higher asset substitution costs relative to firms with a more diverse risk exposure. In this paper, we examine whether a firm's risk exposure concentration leads to more short-term debt in its capital structure as oppose to covenants, since future investment flexibility is more important for such firms. Further, we examine whether asset substitution problems can affect new bond-offering yields.

Unlike previous studies that rely on business segment reporting, which may not be an accurate estimate of diversification¹, we use the concentration of risk exposure topics declared in a firm's 10-K filings. More specifically, the U.S. Securities and Exchange Commission (SEC) requires all

¹In many cases firm segments can share the same underlying risk exposures and/or customer base. Thus, using reported business segments as the base of diversification may inflate the firm's true level of diversification.

public firms to disclose any relevant risks affecting their future earnings. Thus, inspired by the work of Davis et al., 2021, we first construct firm-level estimates of risk exposures² derived from the written text under "Item 1" to measure a firm's diversification level through its risk exposure concentration (REC hereafter). Consistent with our hypothesis, we find firms' degree of REC is an important determinant of short-term debt. REC increases the fraction of short-term debt by roughly 8%, while the covenant index increases by 15%. However, when managerial incentives are well aligned with shareholders, short-term debt is preferred over covenants, and the effect is more pronounced. A one unit increase in the REC leads to 28% increase in the fraction of short-term debt and -26% in the covenant index. These results are consistent while using alternative measures of short-term debt or managerial incentive alignment. Further, the results are robust after including industry, time, and firm fixed effects. We also control for the effect of each risk factor on the debt structure choice, and our findings remain consistent.

The results overall demonstrate that similar to previous studies, short-term debt and covenants are used to mitigate agency costs of debt. However, when agency costs of debt arises from asset substitutions, short-term debt seems to be the preferred option by shareholders. This preference, especially among firms with high managerial alignment with shareholders, indicates that costs of investment restrictions are higher relative to repayment risks of short-term debt³ for firms with high REC levels. Our paper is also related to Chen et al., 2021. They find firms with high systematic risk exposure prefer longer-term debt if external financing costs are high, and the opposite is true for firms with low external financing costs. In their model, firm's maturity structure choice reflect tradeoffs of liquidity discounts (With the use of long-term debt), repayment risks of short-term debt, and the benefit of short-term debt as a commitment device for timely leverage adjustments. We add to these consideration the costs of risk shifting, which can impact a firm's

²There are 44 risk factors. The type, and term dictionaries, of these factors are presented in greater detail in section 3.1.

³Also referred as Refinancing Risk of short-term debt; see Diamond, 1991; Harford et al., 2014.

debt maturity choice.

The remainder of this article is organized as follows. Section 2 develops our hypotheses, while section 3 describes the data collection process and measures of firm-level risk exposures. Section 4 examines the effect of REC on debt structure choices. Section 5 examines the effect of managerial ownership on the relation between REC and debt structure choice, section 6 performs additional robustness checks, and section 7 concludes.

2 Hypothesis Development

There are mixed evidence on whether diversified firms are efficient relative to stand alone firms. Some evidence show associated costs with diversification, such as valuation discounts and inefficient allocation of capital among divisions (e.g., see Berger and Ofek, 1995; Lamont, 1997; Rajan et al., 2000; Servaes, 1996). Other studies on the other hand suggest certain benefits to diversification; for example increased productivity and the presence of specific assets (Khanna and Palepu, 2000; Wernerfelt and Montgomery, 1988). Our analysis sits on the intersection of diversification and the agency costs of debt.

Traditional theories on agency costs of debt, such as Jensen and Meckling, 1976 and Myers, 1977, demonstrate how short-term debt can be a valuable tool in mitigating these problems. Our examination focuses on one particular agency issue; the *risk-shifting* (or asset-substitution) problem. We argue that firms high in REC are likely to have stronger risk-shifting agency issues compared to firms low in REC for two main reasons. First, firms high in their REC are expected to specialize in a narrow field of business, and their knowledge of future available investment projects

are likely within the boundaries of this narrow field. Thus, if asset substitution occurs, the consequences are dire (in the eyes of lenders) because any future riskier investment managers may pursue will possibly have a high positive correlation with the firm's existing assets. Second, companies that choose to have a concentrated risk are plausibly firms that also have a high tolerance for risk, and thus, the incentive for asset substitution is likely to be high.

Smith and Warner, 1979 theorize that covenants restricting certain firm activities in new debt issues can aid in reducing shareholder-debtholder conflicts, and maximize shareholder value. Billett et al., 2007 empirically tests whether covenants are used by firms with high growth opportunities. Such firms are likely to have strong shareholder-debtholder conflicts stemming from the debt-overhang problem. They find covenants tend to increase for firms with high growth options, and short-term debt and covenants act as substitutes in reducing agency costs of debt overhang. However, restrictive covenants may not be as valuable as short-term debt in reducing risk shifting costs of high REC firms. Such firms are likely to preserve future investment flexibility given the narrow set of future investments they can pursue⁴. Additionally, the mere existence of covenants in the firm's outstanding debt pose the threat for the transfer of control rights to creditors, which may not be an optimal choice for lenders. First, firms with high REC would require a decision maker who has deep and specific knowledge in the investment opportunities available within the scope of projects available for the firm. Lenders are likely to have general knowledge as appose to specific knowledge in assessing risks. As such, if control rights are transferred to creditors, they are likely to make sub-optimal investment choices for stand alone firms (i.e., high REC firms), and as a result, both shareholders and debtholders would benefit if the firm is actually run by existing managers. For example, Chava and Roberts, 2008 provide evidence of investment distortions following covenant violations due to the transfer of control rights. Leland, 1994 shows that covenants can mitigate the risk shifting incentives borne by shareholders. However, his anal-

⁴As Smith and Warner, 1979 points out. Due to the cash flow identity, covenants restricting dividends and financing policy will also restrict investment policy.

ysis demonstrate that in some anomaly states, unprotected debt can benefit both shareholders and stockholders, because in those circumstances both stakeholders prefer to increase firm risk. Finally, bankruptcy costs are likely high for firms with concentrated risk exposure. The assets they hold are presumably specialized assets that have high liquidation costs or require special knowledge and skill to manage, and it is in the interest of shareholders and debtholders to keep the firm as an ongoing concern. Thus we state the following hypotheses:

Hypothesis 1 : Firms with high risk exposure concentration are likely to mitigate their risk shifting agency costs through short-term debt.

Hypothesis 2 : Firms with high risk exposure concentration are likely to mitigate their risk shifting agency costs through more covenant restrictions.

Most of the theories discussing agency costs of debt assume managerial incentives are aligned with shareholders (Leland, 1994; Myers, 1977; Smith and Warner, 1979). When incentives are aligned, managers are likely to choose the value maximizing option to reduce risk shifting problems. Thus, we state the following:

Hypothesis 3 : When managerial incentives are well aligned with shareholders, firms with high risk exposure concentration are likely to mitigate their risk shifting agency costs through short-term debt as appose to covenant restrictions.

3 Data

Our sample comes from several sources. Firm-level risk exposures are obtained from the written text in 10-K filings, executive ownership comes from ExecuComp, public debt information is from Mergent FISD, and other firm characteristics is obtained from Compustat. Section 3.1 describes

our methodology of measuring risk exposure concentration, while section 3.2 describes the rest of the variables used in this research.

3.1 Risk Exposure Concentration

To measure a firm's concentration in risk exposures, one needs to define the set of risk factors as well as the level of exposure to each of those factors. We develop our REC measure from the information discussed under (Item 1) in firms' 10-K filings. Item 1 in the annual 10-K filing typically includes three sections; Business Description, Risk Factors, and Unresolved Staff Comments. Although corporations are required by the Securities and Exchange Commission to disclose all risk factors that are relevant to their future earnings under item 1.A, our manual screening of 10-K filings suggests that many companies discuss their operational and/or non-operational risks under the business section as well. Thus, our initial step is extracting all the readable text under (Item 1) from 10-K filings between calendar years 2006 and 2018⁵. We then process the text through an algorithm to insure the extracted raw terms are following the standard procedure in the text-analysis literature; i.e., the text is cleaned from abbreviations, headings, plurals, stop words, and numbers, leaving only relevant lower-cased terms (Baker et al., 2016; Davis et al., 2021; Loughran and McDonald, 2011, 2014).

However, the information captured from the filings is qualitative in nature. As such, the process of determining the number of risk categories (*factors, or topics*) and quantifying a firm's exposure to each one is a crucial step for our analysis. A common practice used in the literature is the dictionary approach (Baker et al., 2016; Loughran and McDonald, 2011; Tetlock, 2007), where a predetermined set of terms are grouped to define a dictionary category. Firm-level exposure to

⁵The data for the complete raw text of all EDGAR filings are made available by Bill McDonald at the University of Notre Dame - [The Software Repository for Accounting and Finance](#), we thank him and the University of Notre Dame for their contribution to the academic community.

each category is then estimated by some proxy, e.g., counting the number of sentences containing any term in the dictionary set (Davis et al., 2021), or the ratio of terms belonging to the dictionary set to the total number of terms in the document (Loughran and McDonald, 2011). However, dictionary methods rely heavily on expert-curated terms, which in some cases can be subjective and limited. Further, such an approach may not guarantee a set of *distinct* topics or categories. A newer approach to quantify information from content is Supervised Machine Learning (ML), where an algorithm identifies and groups text terms sharing similar topics. This methodology requires the examination of all the terms appearing in the text corpus. The set of terms can be large, depending on the number of distinct categories or topics set a priori. Davis et al., 2021 apply a hybrid approach by first using (ML) to identify the most important and distinctive seed terms in explaining firm-level abnormal returns during COVID-19 pandemic, then systematically expanding each dictionary set with terms from the corpus based on similarity in both content and effect on abnormal daily returns. The categories produced by the authors contain a finite set of terms for a finite set of categories that are sufficient to distinguish firms' varying response to economic crisis.

Our paper uses the 44 risk categories constructed by Davis et al., 2021⁶. Factors include Commercial Property, Display Technology, Traditional Retail, E-commerce, and Franchising. All 44 risk factors, and their terms, are obtained from the authors' article and re-listed in the appendix A.1.

To estimate firm i 's exposure to risk factor j , we use the following approach:

$$re_{i,j} = \frac{\sum_{y=1}^{Y_j} term_{y,j}}{\sum_{j=1}^{J=44} \sum_{y=1}^{Y_j} term_{y,j}} \quad (1)$$

Equation 1 estimates firm i 's risk exposure to factor j as the total number of terms (y) extracted from Item 1 that belongs to risk factor j , divided by the total number of terms captured for all

⁶The authors construct 45 categories. However, following their approach, we drop the manufacturing category due to its high correlation with the other categories, leaving 44 in total. The Python code for measuring the risk exposures, and the risk exposure measures are available by the authors upon request.

the 44 risk factors. Alternatively, $R.E_{i,j}$ can be measured as the total number of terms for factor j over the *total* number of terms in item 1, or using sentences as appose to terms. However, the approach in equation 1 insures the proxy is not influenced by either the size or the readability of the document itself (Loughran and McDonald, 2014). Firm-level risk exposures are then merged with firm fundamentals from Compustat using (CIK) keys. Table 1 presents the summary statistics for each risk topic. Note that some of the categories have means that tend to deflate their true economic importance, such as Investment Funds, Banking, and Deposits. Such factors are probably not representing the true population mean for all firms in the economy due to excluding regulated industries from our sample⁷.

Our primary proxy for the firm's REC is the Herfindahl–Hirschman index from the 44 risk exposures. Specifically:

$$REC_{i,t} = \sum_{j=1}^{J=44} re_1^2 + re_2^2 + \dots + re_{44}^2 \quad (2)$$

Where firm i 's risk exposure concentration at time t is the aggregated exposure levels squared. A high REC level indicates a strong concentration of risk exposure, while low levels of REC demonstrate a more diverse risk exposure affecting the firm's future earnings. Albeit its simplicity, our measure does not account for the varying effect of each risk factor composing the REC measure, and assumes homogeneity across the 44 factors. We address this issue in the robustness section of our paper. Figure 1 plots the time trend for the cross sectional average of REC. Note that concentration levels tend to have a downward trend after the 2007-2008 financial crisis then increases slightly years thereafter. One explanation for the downward trend could be due to the waive of mergers and acquisitions that occur post the financial crisis period. Such M&A activities could potentially diversify a firm's risk concentration, especially if the firms involved operate in different industries or business segments.

⁷Firms operating in the financial and utilities sectors are dropped from our sample. Such firms are likely to have significant constraints on their capital and debt structure choices.

3.2 Firm Financial Data

The rest of the variables are obtained from Compustat, ExecuComp, and Mergent FISD. Firm characteristics come from Compustat. Specifically, we follow the literature in measuring short-term debt as the fraction of debt that matures in three years or less ($dd1 + dd2 + dd3 / dlc + dltd$). Alternatively, we use the fraction of debt maturing in 5 years or less ($dd1 + dd2 + dd3 + dd4 + dd5 / dlc + dltd$). We construct other essential variables that have been documented to effect debt maturity choices, such as the natural log of size and size squared after adjusting for inflation; $\ln(\text{Total Assets})$, $\ln(\text{Total Assets})^2$, Book Leverage ($dlc + dltd / at$), Market-to-Book ($csho * prcc_f + dlc + dltd + pstkl - txdlc / at$), Profitability ($oibdp / at$), and Cash (che/at) (Barclay and Smith, 1995; Billett et al., 2007; Datta et al., 2005; Johnson, 2003).

Managerial-Shareholder agency issues are proxied by insider ownership. We obtain data from Execucomp on CEO and total executive share ownership in the firm. Share ownership is measured as the total number of shares including restricted stock ($shown_tot + stock_unvest_num$) divided by the total number of shares outstanding. We create two indicators *High CEO Ownership* and *High Exec. Ownership*, both take the value of 1 if the ownership level is in the top quartile of the industry distribution (Fama-French 49 industry classification), and zero otherwise. Finally, we supplement the data with public debt information from FISD. Specifically, we measure the firm's covenant index at a given year following the approach of Billett et al., 2007, and obtain data on new bond issues. Further, we gather information on new public debt issues that have the following characteristics: denominated in US dollars, offering amount of at least \$10 million, fixed semi-annual coupon, not asset-backed, not putable, no sinking fund, not a Yankee bond, not a unit offering, and not convertible. For the purposes of our study, we construct three variables for the new bond issues; $\ln(1 + \text{Offering Yield})$, $\ln(\text{Offering Amount "inflation adjusted"})$, $\ln(\text{Years to Maturity})$. We merge the FISD sample with Compustat following the methodology presented by Brown and Powers, 2020⁸. Finally, we drop firm-years operating in regulated industries or

⁸Specifically, we use the historic CUSIP to create a matching index between FISD and Compustat. Issuers in FISD have a unique permanent identifier (Issuer_Id). Because an (Issuer_Id) can use multiple "Issuer Cusip" identifiers for

reporting unrealistic information, such as a fraction of short-term debt outside the interval $(0, 1]$. All variables are winsorized at the 1st and 99th percentile to reduce the effect of outliers on our empirical tests.

The final sample includes around 31 thousand firm-year observations for 5,890 firms from 2006 - 2018. Table 2 reports the descriptive statistics for the final sample.

4 Risk Exposure Concentration and Debt Structure

We begin our analysis by examining firm debt maturity choice. We then investigate whether debt covenants may serve as an alternative mechanism in mitigating the risk-shifting problem. Finally, we examine the price of new bond issues.

Barnea et al., 1980 argue that the value of short-term debt, compared to long-term debt, is less sensitive to changes in asset volatility, and therefore, short-term debt can be used to mitigate agency costs of debt when the costs of risk-shifting are high. We test this prediction by estimating the following regression:

$$\text{Fraction of S.T. Debt}_{itj} = \beta_0 + \beta_1 \text{REC}_{t-1} + \delta' X_{t-1} + \lambda_t + \gamma_j + \varepsilon_i \quad (3)$$

where REC is firm i 's risk exposure concentration at time $t - 1$, δ' is a vector of control variables used in the literature (Barclay and Smith, 1995; Harford et al., 2014; Johnson, 2003), λ is a fiscal year fixed effect, and γ is an industry fixed effect using the Fama-French 49 industry classification.

Table 3 reports the regression results. The coefficient on the REC variable is positive and statisti-

new notes, any new bond issued is matched with a corresponding firm in Compustat if either its issuer cusip number or any sibling issuer cusips belonging to the same permanent identifier issuer_id finds a match during the calendar year.

cally significant across all different regression specifications. According to column 3, a one unit increase in the firm's risk exposure concentration is related to an average of 8% increase in the firm's fraction of short-term debt, after controlling for year, industry, and other debt maturity determinants. Table 4 reports the regression estimation of equation 3 when using the standard deviation of the risk exposures as an alternative proxy to REC. The coefficient remains positive and mostly significance across the different models. These results are inline with our hypothesis; firms with concentrated risk exposure tend to choose shorter-term debt to mitigate agency costs stemming from the potential risk shifting behavior by shareholders.

Smith and Warner, 1979 show debt covenants can aid in reducing shareholder-debtholder conflicts, including the issue of asset substitution. Billett et al., 2007 examine whether covenants are used by firms with high growth opportunities. Such firms are likely to have strong shareholder-debtholder conflicts stemming from the debt-overhang problem. They find covenants tend to increase for firms with high growth options, and short-term debt and covenants act as substitutes in reducing agency costs of debt overhang. Therefore, we examine whether covenants tend to incense for firms with high risk-shifting problems, another major component of debt related agency issues. Table 5 reports the the estimation results of equation 3 while using the covenant index as the dependent variable. The covenant index we use follow the methodology of Billett et al., 2007. Specifically, an issuer's covenant index during the period is calculated by counting the occurrences of 15 covenant categories in the firm's outstanding public bonds during the calendar year, then dividing the sum by 15. The results reported in table 5 suggest a positive association between REC and the covenant index, but the statistical significance only occurs when other firm characteristics are introduced in the regression model. Note that the sample size for our covenant analysis is relatively smaller due to the loss of data after the merging Compustat with FISD.

Our last examination is the offering price of new bond issues. Franco et al., 2016 finds firm

diversification leads to lower bond-offering yields, and such a relation is more pronounced among firms with high quality business segment disclosure due to the better assessment of risk by bond investors. However, measuring diversification via the number and quality of business segments is likely influenced by the firm's endogenous choice to report such information. For example the choice might be effected by whether the proprietary costs are high if the information is relevant to a firm's competitors (Bens et al., 2011; Berger and Hann, 2007; Nagarajan and Sridhar, 1996). Olibe et al., 2019 finds the cost of debt to be lower for geographically diversified firms. By measuring diversification through the firm's risk exposure discussion in 10-K filings, which are mandated by the SEC and managers are legally liable for any misinformation, we are able to verify and complement previous studies on the effect of diversification on the cost of debt. Thus, we estimate the following model:

$$\text{Ln}(1+\text{Offering Yield})_{itj} = \beta_0 + \beta_1 \text{REC}_{t-1} + \delta' X_{t-1} + \lambda' Y_t + \lambda_t + \gamma_j + \varepsilon_i \quad (4)$$

X is a vector of firm characteristics at time $t - 1$ while Y_t is a vector of issue characteristics, including $\text{Ln}(\text{Amount})$, Covenant Index of the new issue, and the natural log of years to maturity; $\text{Ln}(\text{Maturity})$. We also control for year and industry fixed effects; λ and γ_j , respectively.

Table 6 reports the estimation results for equation 4. Using both proxies of risk exposure concentration, the primary measure (REC) and the standard deviation of risk exposure, creditors seem to demand a higher price from issuers who tend to have high risk exposure concentration. These findings shed some light on some of the consequences of the higher agency costs in firms with high risk exposure concentration due to the asset substitution problem.

5 The Managerial Ownership Channel

In this section, we focus our analysis on debt maturity choices and covenants for firms that are considered to have severe risk shifting problems. When manager-shareholder interests are more aligned and the firm has a high risk exposure concentration, our hypothesis predict a stronger preference for short-term debt over covenants, since managers will have the right incentives to minimize debt-agency costs of risk shifting while maximizing shareholder value. We measure the degree of manager-shareholder incentive alignment by managerial equity ownership in the firm. Self-interested managers that have low or no equity ownership are likely to make sub-optimal choices. That is, they are likely to choose covenants, or other alternatives, over short-term debt since the latter alleviates the self-interested manager from the pressure arising due to frequent monitoring by creditors. Thus, we estimate the following model:

$$\begin{aligned} \text{Frac. ST Debt / Covenant}_{itj} = & \beta_0 + \beta_1 \text{REC}_{t-1} + \beta_2 \text{Ownership}_{t-1} \\ & + \beta_3 \text{REC}_{t-1} \times \text{Ownership}_{t-1} + \delta' X_{t-1} \\ & + \lambda_t + \gamma_j + \varepsilon_i \end{aligned} \quad (5)$$

The coefficient of interest in equation 5 is β_3 , which estimates the effect of high substitution problems arising from the REC for firms with strong manager-shareholder alignment. The Ownership variable in the estimation model is an indicator taking the value of unity if the firm's CEO (Total executive) ownership is in the top quartile of its industry, and zero otherwise. Industry classifications follow the Fama-French 49 method, and the rest of the variables follow the definitions in equation 3.

Table 7 reports the regression estimates. Consistent with our prediction of a higher risk shifting agency problem for firms with concentrated risk exposures, the coefficient on the interaction term is positive and statistically significant in columns 1-4. Note that the effect is even stronger when

total executives at the firm are well aligned with shareholders (columns 2 and 4). In economic terms, a one unit increase in our measure of REC for firms with high executive share ownership is associated with an average of 28% increase in the firm’s fraction of debt maturing in 3 years or less. Moreover, the effect of REC on debt maturity choice is mainly driven by managerial ownership. That is, firms that have a strong risk exposure concentration but tend to have self-interested managers are likely to choose sub-optimal alternatives in controlling the asset substitution issue; e.g., foregoing future financial flexibility by accepting stricter covenants as observed in columns 5 and 6⁹. Further, consistent with our hypothesis, the interaction terms in columns 5 and 6 are negative, albeit the statistical significance is weak. We address this issue in the next section. Note that according to our estimates, managerial ownership in itself does not increase the firm’s fraction of short-term debt as reported by Datta et al., 2005. Rather, if the incentive alignment between managers and shareholders can lead the firm to easily increase its risk, firms then prefer shorter debt maturity to reduce the higher debt-agency costs¹⁰.

6 Additional Robustness Tests

6.1 Adjusting for Risk-Factor Composition

In our earlier analysis, risk categories are assumed to have a homogeneous effect on the firm’s choice of debt maturity or covenant intensity. For example, a firm that has 100% exposure to E-commerce and another with 100% exposure to Travel will both have a strong risk exposure concentration (REC = 1). However, both firms’ choices of debt maturity or covenant intensity is likely influenced by the *type* of risk exposure as well. Moreover, a firm’s choice of risk exposures

⁹However, the coefficient estimate of REC in columns 5 and 6 is not statistically significant in table 7. Section 6 presents an alternative specification and shows the coefficient is indeed statistically positive.

¹⁰In our analysis, the shareholder-debtholder conflict we examine is the risk-shifting problem. However, there are other potential agency costs of debt, for example the underinvestment problem. The interaction of managerial ownership and debt overhang is examined in greater detail by Datta et al., 2005.

is likely correlated with unobservable characteristics, such as management quality. In this section, we attempt to address these issues to confirm our findings.

In order to account for the effect of firm's composition of risk exposures on debt structure choices, we estimate the beta for each risk category on debt maturity (covenants). Specifically, we run 44 individual regressions and obtain the estimated beta coefficients. We then examine whether the unexplained portion of the observed debt maturity (covenant intensity) is explained by the firm's risk exposure concentration while including firm fixed effects. In formal terms, we first estimate the following equation:

$$\text{Frac. ST Debt / Covenant Index}_{it} = \beta_0 + \beta_{1,y} \text{re}_{t-1,y} + \varepsilon_i \quad \text{for } y \in [1, \dots, 44] \quad (6)$$

Where $\beta_{1,y}$ is the estimated coefficient for each risk factor y . Then we measure the unexplained portion of debt maturity (Covenant Index) by measuring the weighted average of the predicted dependent variable¹¹:

$$\text{Unex. ST Debt (Cov.)}_{i,t} = \text{ST Debt (Cov.)}_{i,t} - \sum_{y=1}^{Y=44} \text{ST Debt } \widehat{(\text{Cov.})}_{i,y,t} \times \text{re}_{i,y,t-1} \quad (7)$$

from 6 and 7, we estimate the following equation to determine whether a firm's risk exposure concentration affects the fraction of short-term debt (Covenant Index):

$$\begin{aligned} \text{Unex. ST Debt (Cov.)}_{i,t,j} = & \alpha_i + \beta_1 \text{REC}_{t-1} + \beta_2 \text{Ownership}_{t-1} \\ & + \beta_3 \text{REC}_{t-1} \times \text{Ownership}_{t-1} + \delta' X_{t-1} \\ & + \lambda_t + \gamma_j + \varepsilon_{i,t,j} \end{aligned} \quad (8)$$

Where α_i is a firm fixed effect, X_{t-1} is a vector of controls, λ_t is a fiscal year fixed effect, and γ_j

¹¹We use the weighted average in order to give more weight to the estimated coefficients that the firm has more exposure to, and less weight to coefficients that seem unimportant to the firm's risk composition. Note that by construction, firm-level risk exposures sum up to 1, i.e., $\sum_{y=1}^{Y=44} \text{re}_y = 1$ for each firm at time t .

is an industry fixed effect. The coefficient on the interaction term β_3 estimates the effect of the *change* in a firm's risk exposure concentration, for firms with high managerial ownership, on the fraction of short-term debt (Covenant Index).

Table 8 reports the estimates for equation 8. In all alternative proxies for either short-term debt (except column 1) or the degree of management alignment with shareholders, the interaction term is positive and statistically significant. Further, columns 7 and 8 show the interaction term for the covenant index choice is negative and statistically significant, while the coefficient on REC is positive and significant. That is, firms with strong risk exposure concentration but have self-serving managers are more likely to have stronger covenants. The results here confirm our earlier findings. Short-term debt mitigates debt-agency problems arising from asset substitution, and it is preferred over covenants for firms with high manager-shareholder incentive alignment.

7 Concluding Remarks

Traditional theories on agency costs, such as Jensen and Meckling, 1976 and Myers, 1977, show how the use of short-term debt can mitigate contractual problems arising from debt financing. This paper examines firms' choices of short-term debt and covenants, which is argued to be substitutes in reducing shareholder-debtholder conflicts. However, we focus on a particular debt agency issue; the risk-shifting (or asset-substitution) problem. Using a firm's risk exposure concentration derived from the written text in 10-K filings, we find firms who are likely to have severe risk shifting problems due to high risk exposure concentration are likely to have more short-term debt in their capital structure, and less covenants intensity in their outstanding bonds. This effect is more pronounced for firms with managers that have stronger alignment with shareholders. Further, issuing costs of public debt tend to increase with the firm's risk exposure concentration.

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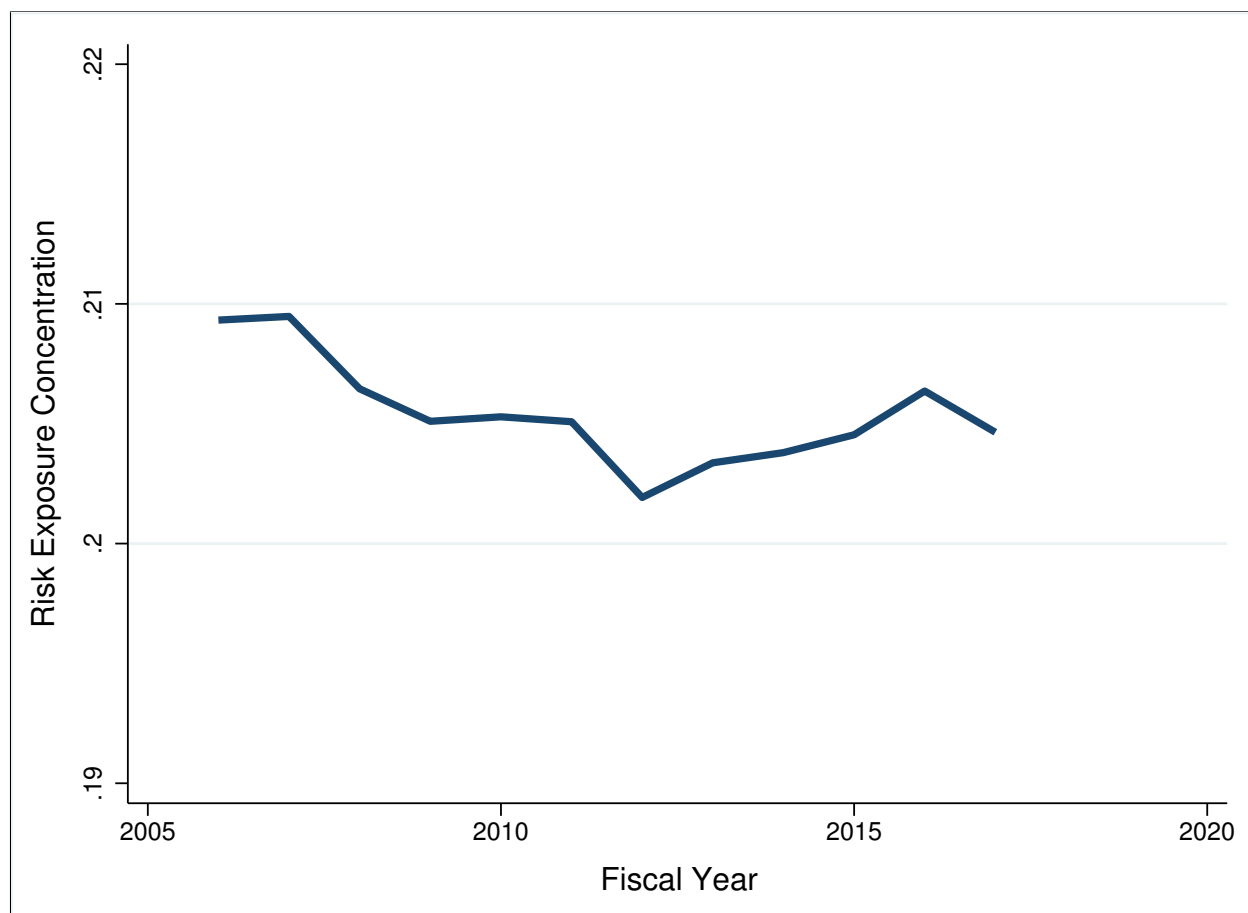


Figure 1: Average REC Across Time

This figure plots the time trend for the average risk exposure concentration for all unregulated publicly traded firms between 2006 and 2018. Firms' risk exposure concentration is measured as the Herfindahl index of the firm's exposure to the 44 risk categories. Measures of risk exposure are obtained from the readable text under Item 1 in company 10-K filings, and the categories follow the work of Davis et al., 2021; see section 3.1 for further details on measuring exposure levels and appendix A.1 on the 44 categories. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample.

Tables and Figures

Table 1: Summary Statistics for Firm-level Risk Exposures

| Firm-level Risk Exposures | SD | Mean | Min | Median | Max | N | Firm-level Risk Exposures | SD | Mean | Min | Median | Max | N |
|---------------------------|-------|-------|-------|--------|--------|--------|----------------------------|--------|--------|-------|--------|---------|--------|
| Advertising | 3.10% | 1.10% | 0.00% | 0.20% | 48.10% | 23,672 | Traditional Media | 4.70% | 1.70% | 0.00% | 0.40% | 50.80% | 23,672 |
| Alternative Energy | 4.00% | 0.80% | 0.00% | 0.00% | 77.20% | 23,672 | Energy Infrastructure | 6.30% | 1.90% | 0.00% | 0.10% | 59.90% | 23,672 |
| Card Payments | 3.70% | 1.10% | 0.00% | 0.00% | 72.50% | 23,672 | Oil and Gas | 12.00% | 4.40% | 0.00% | 0.00% | 89.50% | 23,672 |
| Clearing Houses | 0.30% | 0.10% | 0.00% | 0.00% | 8.30% | 23,672 | Drug Trials | 16.40% | 8.10% | 0.00% | 1.60% | 86.00% | 23,672 |
| Commercial Property | 5.10% | 4.00% | 0.00% | 2.70% | 80.00% | 23,672 | E-Commerce | 3.80% | 3.20% | 0.00% | 1.80% | 60.00% | 23,672 |
| Display Technology | 4.20% | 1.80% | 0.00% | 0.40% | 56.00% | 23,672 | Electronics | 7.50% | 5.30% | 0.00% | 1.90% | 62.80% | 23,672 |
| Financial Management | 1.40% | 0.90% | 0.00% | 0.50% | 37.00% | 23,672 | Food Related Products | 6.30% | 2.60% | 0.00% | 0.60% | 66.90% | 23,672 |
| Foreign Exchange | 0.30% | 0.10% | 0.00% | 0.00% | 5.10% | 23,672 | Foreign Countries | 9.50% | 9.80% | 0.00% | 7.20% | 71.40% | 23,672 |
| Franchising | 3.60% | 0.60% | 0.00% | 0.00% | 81.50% | 23,672 | Health Insurance | 11.50% | 5.10% | 0.00% | 0.40% | 86.40% | 23,672 |
| Gambling | 4.40% | 0.50% | 0.00% | 0.00% | 78.70% | 23,672 | Investment Funds | 0.50% | 0.10% | 0.00% | 0.00% | 13.20% | 23,672 |
| Gold or Silver | 2.00% | 0.30% | 0.00% | 0.00% | 60.20% | 23,672 | Metal Products | 7.50% | 3.40% | 0.00% | 0.50% | 81.60% | 23,672 |
| Healthcare Providers | 2.40% | 0.50% | 0.00% | 0.00% | 56.50% | 23,672 | Power Generation | 6.10% | 1.90% | 0.00% | 0.10% | 85.90% | 23,672 |
| Insurance | 1.50% | 1.20% | 0.00% | 0.80% | 41.90% | 23,672 | Metals and Minerals | 1.60% | 0.50% | 0.00% | 0.00% | 37.20% | 23,672 |
| Mortgages | 4.20% | 1.30% | 0.00% | 0.40% | 73.30% | 23,672 | Semiconductors | 3.20% | 1.00% | 0.00% | 0.00% | 49.40% | 23,672 |
| REITs | 3.70% | 1.20% | 0.00% | 0.40% | 76.20% | 23,672 | Video Games | 3.10% | 0.90% | 0.00% | 0.00% | 61.50% | 23,672 |
| Residential Construction | 2.30% | 0.40% | 0.00% | 0.00% | 39.00% | 23,672 | Web Services | 4.80% | 2.90% | 0.00% | 0.90% | 57.10% | 23,672 |
| Restaurants | 5.40% | 0.70% | 0.00% | 0.00% | 69.90% | 23,672 | Banking | 4.30% | 1.50% | 0.00% | 0.50% | 65.10% | 23,672 |
| Traditional Retail | 7.60% | 3.90% | 0.00% | 0.60% | 59.70% | 23,672 | Deposits | 0.30% | 0.00% | 0.00% | 0.00% | 16.50% | 23,672 |
| Workforce | 0.20% | 0.00% | 0.00% | 0.00% | 10.00% | 23,672 | Shipping Containers | 3.80% | 1.00% | 0.00% | 0.00% | 60.70% | 23,672 |
| Airlines or Aircraft | 5.30% | 0.90% | 0.00% | 0.00% | 77.30% | 23,672 | Transportation | 5.40% | 2.00% | 0.00% | 0.50% | 67.60% | 23,672 |
| Travel | 2.60% | 0.80% | 0.00% | 0.00% | 59.60% | 23,672 | Software Services | 10.70% | 12.70% | 0.00% | 9.50% | 100.00% | 23,672 |
| Communications | 5.30% | 1.60% | 0.00% | 0.20% | 65.80% | 23,672 | Software-Hardware Products | 6.90% | 6.10% | 0.00% | 3.80% | 58.60% | 23,672 |

This table reports the summary statistics for the sample used to measure firms' risk exposure concentration (REC). Measures of risk exposure are obtained from the readable text under Item 1 in company 10-K filings for years 2006-2018, and the categories of risk follow the work of Davis et al., 2021; see section 3.1 and appendix A.1 for further details. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample.

Table 2: Descriptive Statistics

| | SD | Mean | Min | Median | Max | N |
|------------------------------|-------|-------|-------|--------|--------|--------|
| EDGAR: | | | | | | |
| REC | 0.10 | 0.21 | 0.08 | 0.17 | 0.54 | 31,454 |
| $\sigma(\text{Risk Expo.})$ | 0.02 | 0.06 | 0.04 | 0.06 | 0.11 | 31,454 |
| Compustat: | | | | | | |
| Fraction of ST Debt (3yrs) | 0.35 | 0.38 | 0 | 0.26 | 1 | 33,691 |
| Fraction of ST Debt (5yrs) | 0.36 | 0.56 | 0 | 0.55 | 1 | 35,328 |
| Leverage | 0.23 | 0.23 | 0 | 0.17 | 0.90 | 50,886 |
| $\text{Ln}(\text{Assets})$ | 2.69 | 5.47 | 0.01 | 5.66 | 10.95 | 54,704 |
| $\text{Ln}(\text{Assets})^2$ | 29.36 | 37.15 | 0 | 32.02 | 119.89 | 54,704 |
| Market-to-Book | 2.66 | 2.09 | 0 | 1.24 | 17.60 | 48,684 |
| Profitability | 0.41 | -0.05 | -2.17 | 0.08 | 0.41 | 50,738 |
| Cash | 0.27 | 0.25 | 0 | 0.14 | 0.97 | 50,877 |
| ExecuComp: | | | | | | |
| High CEO Ownership | 0.43 | 0.25 | 0 | 0 | 1 | 16,335 |
| High Total Exec. Ownership | 0.43 | 0.25 | 0 | 0 | 1 | 17,187 |
| Mergent FISD: | | | | | | |
| Cov. Index (Normalized) | 0.19 | 0.36 | 0.07 | 0.33 | 0.73 | 6,205 |
| $\text{Ln}(\text{Maturity})$ | 0.69 | 2.1 | 0 | 2.08 | 4.60 | 5,735 |
| $\text{Ln}(\text{Yield})$ | 0.46 | 1.61 | 0 | 1.66 | 4.13 | 4,191 |
| $\text{Ln}(\text{Amount})$ | 0.93 | 13.16 | 0.13 | 13.20 | 18.58 | 5,738 |

This table reports the descriptive statistics for the final sample used to examine risk exposure concentration on debt maturity structure choices. REC is the Herfindahl–Hirschman index of the 44 risk exposures measured at the firm-year level; see section 3.1. $\sigma(\text{Risk Expo.})$ is the standard deviation of the 44 risk exposures. Fraction of ST Debt is the ratio of debt maturing in 3 years or less, or five years or less, over total debt, respectively. $\text{Ln}(\text{Assets})$ and $\text{Ln}(\text{Assets})^2$ is the natural log of firm size and size squared after adjusting for inflation, respectively. Profitability is (oibdp / at), and Cash is (che / at). High CEO Ownership and High Total Exec. Ownership are indicators taking the value of 1 if the percentage ownership (including restricted stocks) is in the top quartile of the industry distribution (Fama-French 49 industry classification), and zero otherwise. Cov. Index is the firm's covenant index measure for its total public debt outstanding using the method presented by Billett et al., 2007. $\text{Ln}(\text{Maturity})$ is the natural log of years to maturity for the new debt issue. $\text{Ln}(\text{Yield})$ is the natural log of (1+ offering yield). $\text{Ln}(\text{Amount})$ is the natural log of the issue amount after adjusting for inflation. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile.

Table 3: Risk Exposure Concentration and Debt Maturity

| | ≤ 3 yrs | | | ≤ 5 yrs | | |
|-------------------------|--------------------|----------------------|----------------------|--------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| REC | 0.22*** (8.29) | 0.09*** (3.68) | 0.08** (2.49) | 0.17*** (6.69) | 0.11*** (4.49) | 0.07** (2.23) |
| Leverage | | -0.23*** (-17.91) | -0.23*** (-17.43) | | -0.15*** (-11.04) | -0.15*** (-11.18) |
| Ln(Assets) | | -0.08*** (-12.75) | -0.08*** (-11.74) | | 0.03*** (5.03) | 0.04*** (5.49) |
| Ln(Assets) ² | | 0.00*** (5.30) | 0.00*** (4.31) | | -0.01*** (-12.22) | -0.01*** (-12.61) |
| Market-to-Book | | -0.01*** (-2.88) | -0.00 (-1.45) | | -0.00 (-0.32) | 0.00 (0.55) |
| Profitability | | 0.02 (1.14) | 0.02 (1.14) | | 0.02 (1.55) | 0.02 (1.36) |
| Cash | | 0.10*** (5.91) | 0.11*** (5.50) | | -0.02 (-1.06) | -0.01 (-0.74) |
| Constant | 0.34*** (58.32) | 0.85*** (37.76) | 0.83*** (36.23) | 0.55*** (98.79) | 0.66*** (29.73) | 0.65*** (29.06) |
| Observations | 18,549 | 17,545 | 17,545 | 19,763 | 18,691 | 18,691 |
| Industry FE | | | Yes | | | Yes |
| Year FE | | | Yes | | | Yes |
| R-squared | 0.00 | 0.16 | 0.18 | 0.00 | 0.07 | 0.09 |

This table reports the OLS regression from estimating equation 3. The dependent variable in columns 1-3 is the fraction of debt maturing in 3 years or less ($dd1 + dd2 + dd3 / dlc + dltd$), while the dependent variable in columns 4 - 5 is the fraction of debt maturing in 5 years or less. REC is the Herfindahl–Hirschman index of the 44 risk exposures measured at the firm-year level; see section 3.1. Ln(Assets) and Ln(Assets)² is the natural log of firm size and size squared after adjusting for inflation, respectively. Profitability is ($oibdp / at$), and Cash is (che / at). All independent variables are lagged one period. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are robust for heteroscedasticity.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t-statistics in parentheses.

Table 4: Variation in Risk Exposures and Debt Maturity

| | ≤ 3 yrs | | | ≤ 5 yrs | | |
|-----------------------------|--------------------|----------------------|----------------------|--------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\sigma(\text{Risk Expo.})$ | 1.33*** (8.25) | 0.55*** (3.60) | 0.37** (1.97) | 0.94*** (6.24) | 0.62*** (4.13) | 0.27 (1.43) |
| Leverage | | -0.23*** (-17.89) | -0.23*** (-17.39) | | -0.15*** (-11.00) | -0.15*** (-11.12) |
| Ln(Assets) | | -0.08*** (-12.71) | -0.08*** (-11.71) | | 0.03*** (5.09) | 0.04*** (5.53) |
| Ln(Assets) ² | | 0.00*** (5.26) | 0.00*** (4.27) | | -0.01*** (-12.28) | -0.01*** (-12.66) |
| Market-to-Book | | -0.01*** (-2.89) | -0.00 (-1.48) | | -0.00 (-0.34) | 0.00 (0.50) |
| Profitability | | 0.02 (1.11) | 0.02 (1.08) | | 0.02 (1.49) | 0.02 (1.28) |
| Cash | | 0.10*** (5.93) | 0.11*** (5.58) | | -0.02 (-1.01) | -0.01 (-0.63) |
| Constant | 0.30*** (29.73) | 0.83*** (34.96) | 0.82*** (33.18) | 0.52*** (54.48) | 0.64*** (27.37) | 0.65*** (26.58) |
| Observations | 18,549 | 17,545 | 17,545 | 19,763 | 18,691 | 18,691 |
| Industry FE | | | Yes | | | Yes |
| Year FE | | | Yes | | | Yes |
| R-squared | 0.00 | 0.16 | 0.18 | 0.00 | 0.07 | 0.09 |

This table reports the OLS regression from estimating equation 3. The dependent variable in columns 1-3 is the fraction of debt maturing in 3 years or less ($dd1 + dd2 + dd3 / dlc + dltd$), while the dependent variable in columns 4 - 5 is the fraction of debt maturing in 5 years or less. $\sigma(\text{Risk Expo.})$ is the standard deviation of the 44 risk exposures measured at the firm-year level; see section 3.1. Ln(Assets) and Ln(Assets)^2 is the natural log of firm size and size squared after adjusting for inflation, respectively. Profitability is ($oibdp / at$), and Cash is (che / at). All independent variables are lagged one period. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are robust for heteroscedasticity.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t-statistics in parentheses.

Table 5: Risk Exposure Concentration and Debt Covenants

| | (1) | (2) | (3) |
|-------------------------|--------------------|--------------------|--------------------|
| REC | 0.05 (0.54) | 0.15** (2.17) | 0.17*** (2.60) |
| Leverage | | 0.09*** (6.74) | 0.09*** (6.47) |
| Ln(Assets) | | -0.05** (-2.40) | -0.04** (-1.98) |
| Ln(Assets) ² | | 0.00*** (3.50) | 0.00** (2.40) |
| Market-to-Book | | 0.00 (0.21) | -0.00 (-0.37) |
| Profitability | | 0.03** (2.20) | 0.03** (2.17) |
| Cash | | 0.03 (1.55) | 0.02 (0.97) |
| Constant | 0.35*** (18.01) | 0.40*** (4.65) | 0.42*** (4.78) |
| Observations | 4,464 | 3,964 | 3,964 |
| Firm FE | Yes | Yes | Yes |
| Industry FE | | Yes | |
| Year FE | | | Yes |
| R-squared | 0.00 | 0.83 | 0.83 |

This table reports the OLS regression from estimating equation 3. The dependent variable in the regression models of this table is the covenant index. We follow Billett et al., 2007 in constructing the covenant index for each firm at time t . Specifically, an issuer's covenant index during the period is calculated by counting the occurrences of 15 covenant categories in the firm's outstanding public bonds during the calendar year, then dividing the sum by 15. REC is the Herfindahl–Hirschman index of the 44 risk exposures measured at the firm-year level; see section 3.1. Ln(Assets) and Ln(Assets)² is the natural log of firm size and size squared after adjusting for inflation, respectively. Profitability is (oibdp / at), and Cash is (che / at). All independent variables are lagged one period. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are robust for heteroscedasticity.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t-statistics in parentheses.

Table 6: Risk Exposure Concentration and Debt Offering Price

| | Concentration | | | Variation | | |
|--------------------------------|--------------------|----------------------|----------------------|--------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| REC | 0.95*** (14.47) | 0.56*** (8.40) | 0.19** (2.15) | | | |
| $\sigma(\text{Risk Expo.})$ | | | | 5.37*** (13.19) | 3.31*** (8.31) | 1.08** (2.07) |
| Ln(Amount) | | 0.01 (1.09) | 0.04** (2.53) | | 0.01 (1.08) | 0.04** (2.53) |
| Covenant Index | | -0.08* (-1.91) | -0.00 (-0.03) | | -0.08* (-1.92) | -0.00 (-0.04) |
| Leverage | | 0.39*** (10.26) | 0.44*** (10.93) | | 0.39*** (10.38) | 0.44*** (11.00) |
| Ln(Size) | | -0.09*** (-15.78) | -0.08*** (-12.32) | | -0.09*** (-15.88) | -0.08*** (-12.33) |
| Market-to-Book | | -0.10*** (-7.65) | -0.08*** (-6.34) | | -0.10*** (-7.65) | -0.08*** (-6.34) |
| Ln(Maturity) | | 0.22*** (24.61) | 0.22*** (24.72) | | 0.22*** (24.60) | 0.22*** (24.72) |
| Profitability | | 0.06 (0.76) | -0.08 (-1.11) | | 0.06 (0.77) | -0.08 (-1.13) |
| Cash | | -0.33*** (-5.98) | -0.11* (-1.79) | | -0.33*** (-6.07) | -0.11* (-1.78) |
| $\sigma(\text{Profitability})$ | | 0.08* (1.93) | 0.06 (1.63) | | 0.08* (1.95) | 0.06 (1.64) |
| Constant | 1.43*** (98.46) | 1.80*** (13.08) | 1.36*** (8.97) | 1.29*** (50.11) | 1.71*** (12.40) | 1.33*** (8.71) |
| Observations | 4,191 | 3,777 | 3,775 | 4,191 | 3,777 | 3,775 |
| Industry FE | | | Yes | | | Yes |
| Year FE | | | Yes | | | Yes |
| R-squared | 0.04 | 0.36 | 0.47 | 0.03 | 0.36 | 0.47 |

This table reports the OLS regression from estimating equation 4. The dependent variable is the natural log of $(1 + \text{offering yield})$. REC is the Herfindahl–Hirschman index of the 44 risk exposures while $\sigma(\text{Risk Expo.})$ is the standard deviation of the risk exposures; see section 3.1. Definitions for the rest of the variables are reported in section 3.2. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are robust for heteroscedasticity.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t-statistics in parentheses.

Table 7: Risk Exposure Concentration on Debt Maturity Structure (High Managerial Ownership)

| | Short-term Debt | | | | Cov. Index | |
|-----------------------------------|------------------|-------------------|------------------|-------------------|------------------|------------------|
| | ≤ 3 yrs | | ≤ 5 yrs | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| REC | 0.01 (0.12) | -0.02 (-0.29) | -0.00 (-0.00) | -0.02 (-0.23) | 0.09 (0.87) | 0.15 (1.49) |
| High CEO Ownership | -0.03 (-1.30) | | -0.04 (-1.44) | | 0.01 (0.17) | |
| High CEO Ownership \times REC | 0.23* (1.88) | | 0.30** (2.21) | | -0.04 (-0.21) | |
| High Exec. Ownership | | -0.05* (-1.82) | | -0.05* (-1.80) | | 0.04 (0.96) |
| High Exec. Ownership \times REC | | 0.31** (2.55) | | 0.35*** (2.72) | | -0.21 (-1.15) |
| Observations | 6,962 | 7,350 | 7,496 | 7,911 | 2,361 | 2,491 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| No. Firms | 1,303 | 1,331 | 1,335 | 1,361 | 472 | 482 |
| R-squared | 0.14 | 0.15 | 0.12 | 0.12 | 0.31 | 0.32 |

This table reports the OLS regression from estimating equation 5. The dependent variable in columns 1-4 is the fraction of debt maturing in 3 (5) years or less, while the dependent variable in columns 5 - 6 is the firm's covenant index. We follow Billett et al., 2007 in constructing the covenant index for each firm at time t . Specifically, an issuer's covenant index during the period is calculated by counting the occurrences of 15 covenant categories in the firm's outstanding public bonds during the calendar year, then dividing the sum by 15. REC is the Herfindahl-Hirschman index of the 44 risk exposures measured at the firm-year level; see section 3.1. High CEO Ownership and High Total Exec. Ownership are indicators taking the value of 1 if the percentage ownership (including restricted stocks) is in the top quartile of the industry distribution (Fama-French 49 industry classification), and zero otherwise. All independent variables are lagged one period. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are clustered at the firm level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t-statistics in parentheses.

Table 8: Risk Exposure Concentration on the Unexplained Portion of Debt Maturity Structure (High Managerial Ownership)

| | ≤ 3 yrs | ≤ 4 yrs | ≤ 5 yrs | ≤ 3 yrs | ≤ 4 yrs | ≤ 5 yrs | Cov. Index | |
|-------------------------|------------------|------------------|--------------------|--------------------|-------------------|------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| REC | 0.01 (0.07) | -0.31 (-1.56) | -0.33* (-1.71) | -0.04 (-0.24) | -0.30 (-1.58) | -0.24 (-1.30) | 0.22** (2.08) | 0.20** (2.10) |
| CEO Own. | -0.02 (-0.49) | -0.04 (-1.13) | -0.06** (-2.03) | | | | 0.06*** (3.53) | |
| CEO Own. \times REC | 0.26 (1.62) | 0.32* (1.86) | 0.49*** (3.06) | | | | -0.26*** (-3.45) | |
| Exec. Own. | | | | -0.08** (-2.19) | -0.06* (-1.75) | -0.04 (-1.38) | | 0.06*** (2.85) |
| Exec. Own. \times REC | | | | 0.55*** (3.12) | 0.35* (1.86) | 0.33* (1.93) | | -0.24** (-2.46) |
| Observations | 6,000 | 6,232 | 6,486 | 6,364 | 6,611 | 6,876 | 2,063 | 2,186 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.37 | 0.37 | 0.44 | 0.37 | 0.37 | 0.43 | 0.81 | 0.82 |

This table reports the estimation results for equation 8. The dependent variable in columns 1 and 4 (2 and 5, 3 and 6) is the *unexplained* fraction of debt maturing in 3 (4, 5) years or less, respectively. The dependent variable in columns 7 and 8 is the firm's *unexplained* covenant index. See section 6 on the construction of the dependent variable. REC is the Herfindahl–Hirschman index of the 44 risk exposures measured at the firm-year level; see section 3.1. CEO Own. (Exec. Own.) is an indicator taking the value of 1 if the percentage ownership, including restricted stocks, is in the top quartile of the industry distribution, and zero otherwise, respectively. All independent variables are lagged one period. Companies with SIC codes (6000-6999, 4900-4999) are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentile. Error terms are robust for heteroscedasticity.

* p < 0.1, ** p < 0.05, *** p < 0.01. t-statistics in parentheses.

A Appendix

A.1 Risk Factors & Exposures

Risk factors, and their associated terms, are obtained from Davis et al., [2021](#). They are copied from the appendix of their paper and listed here for reference:

1. Advertizing: ['advertisers', 'advertiser', 'audience', 'audiences', 'advertising', 'advertising revenue', 'digital media', 'marketers', 'advertising expenditures']
2. Alternative Energy: ['biodiesel', 'ethanol', 'fuels', 'corn', 'biomass', 'diesel', 'biofuels', 'alternative fuel', 'alternative energy sources', 'renewable']
3. Card Payments: ['card', 'cards', 'credit card', 'visa', 'mastercard', 'debit', 'merchant', 'merchants', 'credit cards', 'cardholder', 'card issuers', 'card transactions', 'cardholders', 'atm', 'american express', 'electronic payment', 'interchange', 'payment services', 'pos', 'check', 'gift', 'interchange fees', 'pci', 'atms', 'point of sale']
4. Clearing Houses: ['clearing house', 'clearing', 'futures']
5. Commercial Property: ['hotels', 'hotel properties', 'hotel', 'properties', 'resorts', 'retail properties', 'property', 'such properties', 'shopping centers', 'commercial property', 'rooms', 'new properties', 'land parcels', 'such property', 'real properties', 'other properties', 'suites', 'management companies']
6. Display Technology: ['display', 'displays', 'format', 'digital', 'signage', 'displayed', 'screens', 'navigation', 'ads', 'interactive', 'radar', 'video', 'film', 'multimedia', 'cameras', 'films']
7. Financial Management: ['unrealized loss position', 'unrealized losses', 'fixed maturity securities', 'unrealized loss', 'fixed maturity', 'unrealized', 'investment portfolio', 'otti', 'fixed income securities', 'temporary impairments', 'loss position', 'market value', 'fair value', 'decline in value', 'portfolio']
8. Foreign Exchange: ['yen', 'canadian dollar', 'british pound sterling', 'rupee', 'dollar value']
9. Franchising: ['franchisees', 'franchisee', 'franchise', 'franchisors', 'franchised', 'franchise agreements', 'landlords', 'lessees', 'franchisor', 'franchise agreement', 'tenants', 'franchising', 'anchor tenants']
10. Gambling: ['gaming', 'casino', 'slot', 'horse', 'native']
11. Gold & Silver: ['gold', 'silver']
12. Healthcare Providers: ['surgeons', 'hospitals', 'dentists', 'dental', 'clinics', 'pathology']

13. Insurance: [‘reinsurance’, ‘reinsurers’, ‘reinsurance agreements’, ‘reinsurance’, ‘arrangements’, ‘ceded’, ‘reinsurance contracts’, ‘reinsured’, ‘reinsurer’, ‘commercial insurance’, ‘catastrophe’, ‘insurers’, ‘insurance policies’, ‘mortgage insurance’, ‘coverages’, ‘insurer’, ‘captive’, ‘insurance policy’, ‘insureds’, ‘cost of reinsurance’, ‘casualty’, ‘statutory surplus’, ‘insurance company’, ‘insurance operations’]
14. Mortgages: [‘mortgage’, ‘residential mortgage’, ‘mortgages’, ‘mortgage loan’, ‘commercial mortgage’, ‘certain mortgage’, ‘mortgage loans’, ‘other mortgage’, ‘residential mortgage loan’, ‘rmbs’, ‘loan’, ‘cmbs’, ‘mbs’, ‘abs’, ‘federal home loan mortgage corporation’, ‘ginnie mae’, ‘mortgage lending’, ‘federal national mortgage association’, ‘commercial mortgage loan’, ‘mortgage financing’, ‘other loans’, ‘subprime’, ‘securitized’, ‘first mortgage’, ‘such loans’, ‘first lien’, ‘agency securities’, ‘mortgage origination’, ‘securitization’, ‘mortgage market’, ‘originations’, ‘loan sales’, ‘origination’, ‘securitizations’, ‘asset’, ‘borrowers’, ‘mortgage banking’, ‘servicer’, ‘gse’, ‘backed’, ‘mortgaged’, ‘mortgage industry’, ‘federal housing administration’, ‘fha’]
15. REITs: [‘reit’, ‘ric’, ‘reits’, ‘reit status’, ‘reit qualification’, ‘taxable reit subsidiary’, ‘taxable reit subsidiaries’, ‘trss’, ‘gross income test’, ‘trs’, ‘bdc’, ‘reit income’, ‘internal revenue’, ‘income test’, ‘reit distribution’, ‘partnership’, ‘income tests’, ‘taxable years’, ‘qualify’, ‘asset tests’, ‘hedge accounting treatment’, ‘gross income tests’, ‘gross income’, ‘reit gross income’, ‘investment company’, ‘income tax’, ‘distribution requirement’, ‘taxable year’, ‘spin’]
16. Residential Construction: [‘homebuilding’, ‘residential construction’, ‘land development’, ‘housing’]
17. Restaurants: [‘restaurants’, ‘restaurant’]
18. Traditional Retail: [‘retail’, ‘outlet’, ‘retail sales’, ‘retailers’, ‘specialty stores’, ‘convenience stores’, ‘automotive’, ‘department stores’, ‘retail business’, ‘retailer’, ‘furniture’, ‘beauty’, ‘retail outlets’, ‘retail operations’, ‘other retailers’, ‘new vehicle’, ‘shopping center’, ‘branded’, ‘club’, ‘casual’, ‘establishments’, ‘cosmetics’, ‘building products’, ‘upscale’, ‘retail space’, ‘recreational’]
19. Workforce: [‘workforces’, ‘labor force’]
20. Aircraft & Airlines: [‘aircraft’, ‘commercial aircraft’, ‘boeing’, ‘flight’, ‘airlines’, ‘faa’, ‘jet’, ‘flights’, ‘fly’, ‘passenger’]
21. Travel: [‘travel’, ‘air travel’, ‘business travel’, ‘travelers’, ‘tourism’, ‘airline’, ‘vacation’, ‘airline industry’, ‘destinations’, ‘traveling’, ‘traffic’]
22. Communications: [‘satellite’, ‘satellites’, ‘cable’, ‘band’, ‘broadband’, ‘frequencies’, ‘cable television’, ‘signals’, ‘gateway’, ‘carriage’, ‘wireless broadband’, ‘wireline’, ‘gps’, ‘microwave’, ‘data communications’, ‘programming’, ‘station’, ‘spectrum’, ‘broadcasters’, ‘fcc’, ‘transmitter’, ‘voip’]

23. Traditional Media: ['newspapers', 'newspaper', 'television', 'circulation', 'movie', 'outlets', 'publications', 'radio', 'other media', 'print', 'advertising revenues', 'news', 'publishing', 'tv', 'broadcast', 'entertainment', 'pages', 'los angeles', 'stations', 'hd']
24. Energy Infrastructure: ['pipelines', 'pipeline systems', 'pipeline', 'gathering systems', 'pipeline system', 'processing plants', 'storage tanks', 'processing facilities', 'terminals', 'storage facilities', 'gathering', 'refineries', 'gas pipeline', 'terminal', 'downstream', 'transmission facilities', 'gas processing', 'common carrier', 'gas gathering', 'fractionation', 'refinery', 'ferc', 'wells', 'transmission system', 'midstream', 'generation facilities']
25. Oil & Gas: ['oil', 'ngls', 'ngl', 'oils', 'liquids', 'natural gas', 'petroleum', 'hydrocarbon', 'hydrocarbons', 'marcellus shale', 'exploration']
26. Drug Trials: ['preclinical', 'nonclinical', 'preclinical studies', 'preclinical testing', 'preclinical development', 'clinical testing', 'clinical studies', 'clinical', 'clinical development programs', 'clinical trials', 'trials', 'toxicology', 'validation', 'clinical development', 'clinical data', 'development programs', 'confirmatory', 'trial results', 'clinical research', 'drug development', 'research and development', 'research programs', 'vivo', 'research', 'clinical trial', 'stage clinical trials', 'investigator', 'clinical study', 'drug candidates', 'clinical trial results', 'vitro', 'efficacy', 'product candidates', 'progress', 'commercialization activities', 'commercial use', 'collaborative', 'drug candidate', 'submission', 'antibody', 'compounds', 'inconclusive', 'investigational']
27. E-commerce: ['ecommerce', 'e commerce', 'online', 'electronic commerce', 'direct marketing', 'payment processing', 'amazon', 'network', 'pc', 'pcs', 'website', 'online services']
28. Electronic Components & Devices: ['optics', 'optical', 'sensor', 'ray', 'filter', 'graphics', 'high performance', 'coating', 'electronic components', 'electronics', 'sensors', 'magnetic', 'chips', 'substrates', 'laser', 'micro', 'memory', 'analog', 'photovoltaic', 'fiber', 'coatings', 'thin', 'composites', 'logic', 'flash', 'chip', 'polymer', 'handheld', 'fibers', 'serial', 'surfaces', 'ir', 'lighting', 'industrial applications', 'boxes', 'glass', 'portable', 'cables', 'electrical', 'transformers', 'appliances', 'audio', 'printers', 'intel', 'tech', 'assemblies', 'biomedical', 'appliance', 'data storage', 'drives', 'valve', 'valves', 'peripheral', 'consumables', 'stack', 'industrial', 'hvac', 'matrix', 'power systems', 'wired', 'modular', 'phones', 'libraries', 'chamber', 'embedded', 'catalyst', 'reagents', 'batteries', 'plumbing', 'furnaces', 'bio', 'radiation', 'finishing', 'graphic']
29. Food: ['wheat', 'grains', 'sugar', 'fruit', 'milk', 'grain', 'coffee', 'dairy', 'protein', 'proteins', 'sodium', 'powder', 'wine', 'packaging materials', 'crops', 'foods', 'fresh', 'agricultural products', 'synthetic', 'additives', 'enzymes', 'salt', 'ingredients', 'specialty', 'additive', 'organic', 'ingredient']
30. Foreign Countries: ['china', 'india', 'taiwan', 'chinese', 'south africa', 'asia', 'russia', 'beijing', 'shanghai', 'hong kong', 'asia pacific region', 'united arab emirates', 'countries', 'the philippines', 'korea', 'chinas', 'mexico', 'west-

ern europe', 'egypt', 'switzerland', 'overseas', 'latin america', 'unitedstates', 'united kingdom', 'europe', 'belgium', 'asian', 'germany', 'singapore', 'france', 'ukraine', 'indonesia', 'norway', 'finland', 'asia pacific', 'japan', 'certain countries', 'iceland', 'japanese', 'sweden', 'operations in mexico', 'operations in china', 'north america', 'peru', 'korean', 'australia', 'dubai', 'world', 'european', 'thailand', 'european union', 'industrialized', 'other countries', 'russian', 'england', 'many countries', 'worldwide', 'foreign countries', 'central bank', 'globally', 'german', 'chinese government']

31. Health Insurance: ['medicare', 'medicaid', 'cms', 'payers', 'prescription drug', 'partd', 'health plans', 'physician', 'payors', 'reimbursement', 'health insurance', 'health care', 'healthcare', 'third party payers', 'hospital', 'health plan', 'payment system', 'hhs', 'payer', 'clinical laboratory', 'third party payors', 'reimbursement levels', 'department of health and human services', 'payor', 'subsidy', 'prescription drugs', 'ppaca', 'mma', 'care organizations', 'coding', 'federal government', 'patients', 'private insurers', 'care programs', 'reimbursement policies']
32. Investment Funds: ['investment funds', 'private equity funds', 'hedge funds', 'private equity fund', 'investment managers', 'private equity', 'limited partnerships', 'separate accounts', 'pooled', 'advisers', 'investment management', 'other investment', 'clo', 'investment advisers', 'asset managers']
33. Manufacturing: ['manufacturing', 'manufacture', 'product manufacturing', 'manufacturing process', 'manufacturing operations', 'manufacturing processes', 'manufacturing activities', 'production processes', 'manufacturing capabilities', 'commercial manufacturing', 'manufacturing facilities', 'production process', 'third party manufacturing', 'manufacturing equipment', 'assembly', 'wafer fabrication', 'contract manufacturers', 'third party manufacturers', 'contract manufacturing', 'product development', 'manufacturing capacity', 'commercial supply', 'manufacture of products', 'technical', 'new manufacturing', 'manufacturing facility', 'product components', 'production facilities', 'process technology', 'manufacturing services', 'commercial scale', 'contract manufacturer', 'volume production', 'finished products', 'manufacturers']
34. Metal Products: ['steel', 'aluminum', 'metal', 'copper', 'titanium', 'metals', 'stainless', 'pulp', 'plastics', 'resin', 'scrap', 'rubber', 'iron', 'rolled', 'raw materials', 'mill', 'mills', 'fabricated', 'raw material', 'diamond', 'hot']
35. Power Generation: ['coal', 'electricity', 'ash', 'coke', 'steam', 'sand', 'power plants', 'power plant', 'electric power', 'energy sources', 'electric generating', 'water', 'tons']
36. Raw Metals & Minerals: ['tantalum', 'tin', 'tungsten', 'conflict minerals', 'democratic republic of congo', 'minerals', 'zinc', 'precious metals', 'such minerals', 'oxide', 'platinum']
37. Semiconductors: ['semiconductor', 'semiconductors', 'silicon', 'semiconductor manufacturing', 'ic', 'semiconductor industry', 'semiconductor products', 'network equipment', 'consumer electronics', 'oems', 'technology']

- industry', 'wafers', 'original equipment manufacturers', 'capital equipment', 'technology companies']
38. Video Games: ['games', 'game', 'titles', 'players', 'app', 'consoles', 'movies', 'android', 'windows', 'player', 'mobile devices', 'streaming', 'facebook', 'studios', 'smartphones', 'music', 'handsets', 'smartphone', 'handset', 'console', 'subscribers', 'mobile phones']
 39. Web-Based Services: ['cloud', 'saas', 'cloud computing', 'web', 'hosted', 'server', 'internet', 'premise', 'virtual', 'data center', 'networking', 'messaging', 'browser', 'mobility', 'wireless networks', 'hosting', 'subscription', 'network security', 'wireless', 'telephony', 'data centers', 'centric', 'bandwidth']
 40. Banking: ['bank', 'banks', 'bank subsidiary', 'state bank', 'savings bank', 'financial institution', 'bank subsidiaries', 'national bank', 'bank holding company', 'institution', 'subsidiary bank', 'financial institutions', 'the corporation', 'ots', 'institutions', 'depository institution', 'national banks', 'bank holding companies', 'savings banks', 'banking', 'prudential', 'fhlb', 'banking institutions', 'savings institutions', 'community banks', 'financials', 'financial companies', 'depository', 'federal home loan bank', 'extensions of credit', 'bank regulators', 'chartered', 'wells fargo bank', 'federal bank', 'wells fargo', 'bhc act', 'bhca', 'corporations', 'bank of america', 'holding companies']
 41. Deposits: ['fdic', 'fdics', 'deposit insurance', 'occ', 'insured institutions', 'frb', 'dif', 'insured depository institutions', 'special assessment', 'restoration plan', 'comptroller of the currency', 'assessment rate', 'assessment rates', 'reserve ratio', 'insurance assessments', 'federal banking regulators', 'federal banking agencies', 'loss sharing', 'loss share', 'federal banking agency']
 42. Shipping Containers: ['vessels', 'vessel', 'cargo', 'rigs', 'tank', 'fleets', 'drilling rigs', 'containers', 'trailers', 'engines', 'tractors']
 43. Transportation: ['freight', 'trucking', 'shipping', 'delivery services', 'ocean', 'carriers', 'shipping costs', 'other transportation', 'shipments', 'railroads', 'haul', 'fuel costs', 'railroad', 'inbound', 'transportation industry', 'ports', 'fuel surcharges', 'carrier', 'container', 'port', 'transit']
 44. Software Services: ['solutions', 'solution', 'software solutions', 'technology solutions', 'platform', 'technology platform', 'communications services', 'service offerings', 'platforms', 'intelligent', 'analytics', 'tools', 'technologies', 'product offerings', 'edge', 'technology platforms', 'capabilities', 'modules', 'architectures', 'business solutions', 'functionality', 'devices', 'crm', 'innovative products', 'connectivity', 'new solutions', 'suite of products', 'automation', 'ecosystem', 'network services', 'new technologies', 'new services', 'module', 'management products', 'enterprise', 'functionalities', 'product line', 'next generation', 'scalability', 'professional services', 'applications', 'agile', 'new features', 'management system', 'new technology', 'testing services',

'service delivery', 'electronic devices', 'wireless carriers', 'business model', 'enabled', 'seamless', 'enterprise customers', 'technical services', 'support services', 'new applications', 'new business models', 'integrated', 'lte', 'range of services', 'health information technology', 'diagnostic tests', 'enhanced products', 'additional services', 'technical support services']

45. Software & Hardware Products = ['software', 'software products', 'software applications', 'hardware', 'software systems', 'operating system', 'third party software', 'proprietary software', 'interfaces', 'interface', 'it infrastructure', 'architecture', 'other technology', 'computer hardware', 'operating systems', 'computer', 'software vendors', 'third party technology', 'hardware products', 'servers', 'new software', 'software development', 'proprietary technology', 'digital content', 'it systems', 'algorithms', 'data management', 'customization', 'analytic', 'open source', 'malware', 'information systems', 'technology infrastructure', 'firewalls', 'open source software', 'such technologies', 'bugs', 'communications systems', 'integrations', 'open source code', 'computers', 'compatibility', 'information management', 'proprietary', 'algorithm', 'source code', 'technology systems', 'internal systems', 'customized', 'provisioning', 'computer systems', 'encryption', 'optimized', 'business processes', 'proprietary technologies', 'undetected errors']