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COVID-19 and the cost of bond debt: The role of corporate diversification

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ABSTRACT
We examine whether diversification is valuable in reducing the cost of debt for COVID-19-exposed firms. We find that although the pandemic has increased firms’ borrowing costs, both business and geographic diversifications reduce bond yield spreads for COVID-19-exposed firms. This highlights that the coinsurance features and enhanced investment opportunities of diversified firms are valuable during difficult times. We also find that unrelated diversification and diversification in countries with low COVID-19 uncertainty have a more substantial effect on reducing the bond spreads of COVID-19-exposed firms. These findings are essential for building a complete picture of the effect of COVID-19 on borrowing costs.

1. Introduction

The disruptions to economic activities due to the ongoing COVID-19 pandemic have resulted in a lower value of firms’ assets and a reduction in the value of the collateral against which they can borrow (Hasan et al., 2021). Moreover, these circumstances caused adverse cash flow shock that increased firms’ default risk (Liu et al., 2021), reduced the liquidity of the corporate bond market (Acharya and Steffen, 2020; Haddad et al., 2021; Hasan et al., 2021; Kargar et al., 2021), and increased borrowing costs. Consistent with this, prior studies have documented that exposure to COVID-19 is associated with higher loan and bond spreads (Arnold and Rhodes, 2021; Hasan et al., 2021; Liu et al., 2021; Nozawa and Qiu, 2021). However, not all industries and countries are equally hit by the pandemic as its effect on market risk vary between industries and countries (e.g., Alfaro et al., 2020; Baek et al., 2020; Liu et al., 2021; Ramelli and Wagner, 2020). As such, firms may be able to reallocate resources internally—for example, between divisions in different industries or countries—to ameliorate the effects of the pandemic.

Corporate diversification provides the coinsurance effect, which results from the imperfect correlation of the cash flows among diversified firms’ divisions. This coinsurance effect reduces diversified firms’ overall cash-flow volatility and default risk and enhances their debt capacity compared to single-segment firms (Lewellen, 1971; Stein, 2003). Moreover, diversification enhances investment opportunities, allowing diversified firms to allocate resources more efficiently than stand-alone firms by reducing investment in less productive segments and directing funds to more productive segments (Kuppuswamy and Villaglonga, 2016; Matvos and Seru, 2014; Stein, 1997, 2003). Consistent with these two effects of diversification, Reeb et al. (2001) find that geographic diversification, on average, reduces bond yield spreads. Li et al. (2011) find that geographically diversified firms pay lower loan spreads than their domestic counterparts. Hann et al. (2013) document that firms with business diversification pay a lower cost of capital than focused firms due to the reduction in systematic risk resulting from the coinsurance effect. More recently, Aivazian et al. (2015) find that firms operating in different business segments pay lower loan spreads.

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Therefore, the disruptions to economic activities and the resulting cash flow shock induced by the pandemic suggest that diversified firms may be better able to overcome it and pursue investment opportunities than single-segment firms and, hence, obtain external financing at lower costs. For example, firms operating in multiple business (or geographic) segments can overcome shock by diversifying cash flow sources and overcoming disruptions to activities in an industry (country) by taking advantage of investment opportunities in less affected industries (countries).

Despite the potential positive effect of diversification, the complex structure and high information asymmetry of diversified firms might increase their risk exposure (Olibe et al., 2008). Consistent with this, Sikochi (2020) documents that firms with complex corporate structures pay higher loan spreads. Managers of diversified firms also have more discretion over resource allocation in business segments that enable them to engage in self-serving activities (Alivazian et al., 2015; Fuente and Velasco, 2020; Li et al., 2011). Moreover, in geographic diversification, international activities can expose firms to foreign exchange risks (Reeb et al., 1998), and disrupt business activities due to the closure of countries’ borders. This raises the question of the role of corporate diversification in the cost of borrowing during the pandemic. In this study, we address this question.

This study contributes to two streams of literature. First, it adds to the results of studies on the debt market effects of COVID-19 exposure (e.g., Acharya and Steffen, 2020; Haddad et al., 2021; Kargar et al., 2021; Nozawa and Qiu, 2021), particularly those documenting that the pandemic has increased borrowing costs (Arnold and Rhodes, 2021; Hasan et al., 2021), by providing novel evidence that the increase in borrowing costs for COVID-19-exposed firms depends on the firms’ diversification. Second, it contributes to the contradicting evidence of prior studies on the effect of diversification on borrowing costs (e.g., Aivazian et al., 2015; Li et al., 2011; Sikochi, 2020) by documenting that, under extreme market conditions and in the presence of external capital market frictions, internal capital markets of diversified firms become valuable. The study’s findings also have policy implications and are essential for building a complete picture of the effect of COVID-19 on the costs of borrowing.

2. Research design

We form our sample using all bonds issued by US firms included in Thomson ONE Banker between January 2019 and March 2021. We start the sample period from January 2019 to cover issues before the pandemic in line with Hasan et al. (2021), and we end the sample period in the first quarter of 2021 (March 2021) due to data availability. We merge Thomson ONE Banker with Compustat to obtain firms’ financial data and Compustat Historical Segment database to obtain segment-related data. We refine the data by excluding firms with incomplete division information on total sales and SIC codes. The resulting sample contains 7997 bond issues.

To address our research questions, we rely on the following baseline model:

\[
\text{Cost of debt}_{it} = \beta_0 + \beta_1 \text{DiseaseExposure}_it + \beta_2 \text{Diversification}_{it-1} + \beta_3 \text{Diversification}_it \times \text{Diversification}_{it-1} + \beta_4 \text{Third}_{it} + \beta_5 \Phi_{it} + \epsilon_{it},
\]

where \( \text{Cost of debt} \) is the natural logarithm of the basis point spread over a Treasury bond with the nearest maturity. We rely on nearest maturities as US Treasury bonds are only available for a limited number of the sample bonds’ maturities (e.g., Almaghrabi et al., 2021; Bradley et al., 2016; Huang et al., 2016; Liu and Magnan, 2016; Waisman et al., 2015).

\( \text{COVID}_{19} \text{ Exposure} \) is a firm’s exposure to COVID-19 obtained from Hassan et al. (2020), based on the proximity of COVID-19 related words to either positive or negative tone in quarterly-earnings conference calls divided by the number of sentences in the transcript. \( \text{Diversification} \) is one of six measures of corporate diversification. We rely on three measures of business diversification (\( \text{Business Diver.}, \text{Num. Business Seg.}, \text{and} \text{1 HHI Business Sales} \)) and three measures of geographic diversification (\( \text{Geographic Diver.}, \text{Num. Geographic Seg.}, \text{and} \text{1 HHI Geographic Sales} \)) (e.g., Aivazian et al., 2015; Fuente and Velasco, 2020; Kuppuswamy and Villaglonga, 2016; Matvos et al., 2018). \( \Phi \) is a vector of firm-specific variables, including \( \log(\text{Size}), \text{MB}, \text{Leverage}, \text{ROA}, \text{and} \text{Free Cash} \). It is a vector of issue-level variables, including \( \log(\text{Amount}), \log(\text{Maturity}) \) and \( \text{Bond Rating} \) (e.g., Almaghrabi et al., 2021; Bradley et al., 2016; Huang et al., 2016; Waisman et al., 2015). The Appendix provides a detailed explanation of all variables.

To control for industry-specific effects and shifts in debt financing over time, we include time-fixed effects, \( \beta_4 \) and industry fixed-effects, \( \beta_{\text{ind}} \) based on the Fama–French 30 Industry classification.

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1 We only included bonds that could be linked to Compustat.
2 The unit of our regression is bond-issue.
3 The Appendix provides detailed information on the matching of maturities.
4 Hassan et al. (2020) developed three measures of firm exposure to COVID-19: DiseaseExposure, which is based on the number of times that firms mention COVID-19 related terms in conference calls divided by the length of the transcript; DiseaseRisk, which is based on the proximity of words pertaining COVID-19 to risk and uncertainty, divided by the length of the transcript; and DiseaseSentiment, which is based on the proximity of COVID-19 related words to either positive or negative tone divided by the length of the transcript. We rely in our main analyses on the third measure, DiseaseSentiment, as it distinguishes between firms that expect to gain from COVID-19 from those that expect to lose (Hassan et al., 2020, p. 3). It measures the net effect of COVID-19 for a given firm (by subtracting negative words from positive words). Hence, DiseaseSentiment enables us to test whether corporate diversification helps dispel the net negative effect of COVID-19. Our results are qualitatively similar if we rely on DiseaseExposure or DiseaseRisk.
5 Business (industrial diversification) captures the types and ranges of activities that the firm conducts, while geographic diversification captures the span of affiliated entities across countries.
Table 1 presents the descriptive statistics. As Panel A shows, there is a large variation in bond spreads, offering amounts and maturities. Hence, in line with prior studies, we rely on the natural logarithm of these variables. Furthermore, as shown in Panel B, based on the variable Business Diver., 53% of the sample firms have two or more business segments, and based on the variable Geographic Diver., 52% of the sample firms have two or more geographic segments.

Table 2 presents the multivariate results. The results show that, consistent with the findings of prior studies, COVID_19 Exposure is positively associated with the cost of debt. Moreover, the interactions between all measures of corporate diversification and COVID_19 Exposure are negative and significantly associated with the cost of debt. Specifically, the interactions between COVID_19 Exposure and the measures of business diversification in columns 1, 2, and 3 indicate that business diversification reduces the cost of debt for COVID-19-exposed firms. For example, the interaction between COVID_19 Exposure and Business Diver. indicates that diversified firms with high COVID-19 exposure pay 46% lower cost of debt than focused firms with high exposure to the pandemic. In economic terms, this equates to around $2.2 million reductions in borrowing costs for the average size of a bond issue in the sample.

The interactions between COVID_19 Exposure and the measures of geographic diversification in columns 4, 5 and 6 indicate that geographic diversification reduces the negative effect of exposure on the cost of debt. For example, the interaction between COVID_19 Exposure and Geographic Diver. indicates that diversified firms with high COVID-19 exposure pay a 51% lower cost of debt than diversified domestic firms exposed to the pandemic. In economic terms, this equates to a $2.4 million reduction in borrowing costs for the average size of a bond issue in the sample.7 In terms of the control variables, they load as expected. These results indicate that both types of diversification are associated with a reduction in the cost of debt for COVID-19-exposed firms.

We next test whether the two types of diversification have different effects on borrowing costs. Table 2 shows that while the existence of geographic diversification reduces the cost of debt at a higher level than the existence of business diversification (columns 1 and 4), the number and extent of business diversification has a larger effect than that of geographic diversification in reducing borrowing costs (columns 2, 3, 5, and 6). The Chi-squared tests, reported at the bottom of Table 2, indicate that the differences are statistically significant.8

This finding is explained by the large variation in the severity of the effect of the pandemic between industries (e.g., Alfaro et al., 2020; Baek et al., 2020; Liu et al., 2021; Ramelli and Wagner, 2020). Therefore, as the level of industry diversification increases, the correlation between the cash flows of the firm’s business units largely decreases, and the benefit of diversification increases. In other words, the benefits of business diversification are better utilized as firms’ level of diversification increases. This enabled firms operating in multiple industries to better overcome the shock caused by the pandemic, which is reflected in better pricing terms of their bond issues. Since the pandemic has had a significant effect globally, the findings suggest that the increase in the level of geographic diversification has had a lower effect on the cost of debt for COVID-19-exposed firms than the effect of the increase in the level of business diversification.

These inferences are qualitatively similar when we combine the two types of corporate diversification into one regression in columns 7, 8, and 9 of Table 2.

3.1. Characteristics of diversification

We next test the role of the relatedness of business diversification and COVID_19 uncertainty in countries of geographic diversification. Firms with unrelated diversification have different investment opportunities of different divisions and greater debt coinsurance due to the low correlation among the cash flows of their segments. This enables them to transfer resources from cash-rich to cash-poor segments and better utilize the coinsurance effect (Kuppuswamy and Villaglonga, 2016; Matvos and Seru, 2014). Moreover, while the COVID-19 pandemic affected all countries, some governments adopted stricter measures and economic restrictions to reduce the transmission of the virus than others. These measures and restrictions disrupted business activities due to the closure of borders and exacerbated uncertainty (Hasan et al., 2021). If a firm operates internationally in countries with strict measures, the benefits of its geographic diversification will be limited. Therefore, if diversification reduces borrowing costs for COVID-19-exposed firms, we should observe a higher reduction for firms with unrelated diversification and those operating in countries with less COVID-19 uncertainty.

We classify business diversified firms as unrelated diversifiers (Unrelated Business Diver.), if they reported two or more business segments in different two-digit SIC codes in a given year, and as related diversifiers (Related Business Diver.), if they reported segments in the same two-digit SIC codes (Kuppuswamy and Villaglonga, 2016). Among geographically diversified firms, we measure the uncertainty of each firms’ country of diversification based on the stringency index developed by Hale et al. (2021).9 We classify firms as diversified in countries with high (low) COVID-19 uncertainty if the average stringency index of its countries of geographic diversification is above (below) the sample mean level.

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6 0.46*118 = 45.3bps; (45.3*402.68)/10,000 = 2.2 million.
7 0.51*118 = 60.2bps; (60.2*402.68)/10,000 = 2.4 million.
8 The differences are also economically significant.
9 These analyses are performed as follows. First, we obtain data on countries of geographic diversification from Compustat Segment database (we exclude geographic segments without information on the specific country of diversification). We then match each firm-year-country of diversification with the stringency index from Hale et al. (2021). To proxy for a firm’s geographic COVID-19 uncertainty in a given year, we aggregate the data at the firm-year level by taking the average stringency index of its countries of diversification.
Panel A presents the descriptive statistics for issue-specific variables. Spread (in bps) is the basis point spread over a benchmark government bond. Debt Amount is the amount of bond issue in million US$ and is used to calculate the variable Log(Amount). Maturity is the number of months to final maturity and is used to calculate the variable Log(Maturity). Bond Rating is a numerical conversion of Moody’s credit rating based on a scale of 2–7 for ratings Aaa to C and 8 for missing rating. Panel B presents the descriptive statistics for firm-specific variables. Business Diver. is a dummy variable that takes the value of one if the firm reported two or more business segments in different four-digit SIC codes in a given year. Num. Business Seg. is the number of four-digit SIC business divisions the firm operates in a given year. Geographic Diver. is a dummy variable that takes the value of one if the firm operated in two or more geographic segments in a given year. Num. Geographic Seg. is the number of geographic segments where the firm operates in a given year. Geographic Sales is one minus the Herfindahl-Hirschman Concentration Index of geographic sales for the firm in a given year. Geographic Diver. is a dummy variable that takes the value of one if the firm operates in two or more geographic segments in a given year. Num. Geographic Seg. is the number of geographic segments where the firm operates in a given year. 1_HHI Geographic Sales is one minus the Herfindahl-Hirschman Concentration Index of geographical sales for the firm in a given year. COVID_19 Exposure is the natural logarithm of total assets. MB is a firm’s market value to book value. Leverage is interest-bearing debt divided by total assets. ROA is earnings before interest and taxes divided by total assets. Free Cash is free cash flow divided by total assets.

Table 3 presents the results for interacting COVID_19 Exposure with these decomposed measures of diversification. Column 1 shows that the interactions between both related and unrelated diversifications and COVID-19 exposure are negative and significant. This implies that firms with high COVID-19 exposure with related or unrelated diversification incur lower borrowing costs than stand-alone firms. However, the effect of unrelated diversification is significantly higher (based on the F-stat given at the bottom of the table). Column 2 shows that the interactions between both the high and low stringencies of the countries of diversification and COVID-19 exposure are negative and significant. This implies that firms with high COVID-19 exposure that are either diversified in countries with high or low uncertainty incur lower borrowing costs than domestic firms. However, the effect of diversification in countries with low pandemic uncertainty is significantly higher. Hence, consistent with our conjecture, firms with unrelated divisions and those globally diversified in countries with low COVID-19 uncertainty benefit more in terms of reduction in bond spreads.

4. Sensitivity tests

We apply multiple sensitivity checks. First, we develop an alternative measure of COVID-19 exposure inspired by the literature on exposure to policy uncertainty (e.g., Francis et al., 2014). Specifically, we estimate each firms’ COVID-19 exposure based on time-series regressions of its daily stock returns (over the risk-free rate) on daily changes in the Number of Covid-19 Deaths, Market Returns, SMB, and HML, over the 60 days before bond issuance where Market Return, is the monthly CRSP value-weighted market return over the risk-free rate, and SMB, and HML, are the Fama-French factors for size- and value-weighted portfolios. We then rely on the absolute value of the changes in the number of COVID-19 deaths as an alternative measure of a firm’s COVID-19 exposure. Second, to account for firms’ non-random decision to diversify (Hann et al., 2013), we implement an endogenous switching model and a propensity score matching technique. Third, to control for the firm time-invariant effect, we incorporate firm-fixed effects into all regressions. Fourth, we consider that the dataset used contains multiple bond issues for a single firm during a given year, which could bias the standard errors of OLS regression; hence, we apply hierarchical linear modeling estimation (Almaghrabi, 2021). Fifth, to account for the self-selection issue in obtaining bonds, we apply Heckman’s selection model. Lastly, we include additional time-variant firm and issue covariates to ensure that the results are not sensitive to model specifications. Untabulated results, for the sake of brevity show, that our findings are robust to these tests.

5. Conclusion

The extreme market conditions that resulted from the COVID-19 pandemic significantly increased borrowing costs. As a reflection...
Table 2
Main results.

|                          | (1)                | (2)                | (3)                | (4)                | (5)                | (6)                | (7)                | (8)                | (9)                |
|--------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| **COVID_19 Exposure**    | 0.48*** (6.11)     | 0.63*** (6.31)     | 0.47*** (6.54)     | 0.48*** (6.37)     | 0.46*** (6.90)     | 0.47*** (6.73)     | 0.49*** (5.79)     | 0.59*** (5.74)     | 0.48*** (6.21)     |
| Business Diver.          | −0.06 (−0.96)      | −0.01 (−0.19)      |                    |                    |                    |                    |                    |                    |                    |
| **COVID_19 Exposure*Business Diver.** | −0.46*** (−3.80) | −0.27*** (−2.41)  |                    |                    |                    |                    |                    |                    |                    |
| Num. Business Seg.       | −0.04** (−1.97)    | −0.03 (−1.51)      |                    |                    |                    |                    |                    |                    |                    |
| **COVID_19 Exposure*Num. Business Seg.** | −0.17*** (−4.02) | −0.11*** (−2.58)  |                    |                    |                    |                    |                    |                    |                    |
| 1_HHI Business Sales     | −0.28** (−2.05)    | −0.20 (−1.52)      |                    |                    |                    |                    |                    |                    |                    |
| Geographic Diver.        | −0.16* (−1.91)     | −0.15* (−1.89)     |                    |                    |                    |                    |                    |                    |                    |
| **COVID_19 Exposure*Geographic Diver.** | −0.51*** (−4.32) | −0.33*** (−3.00)  |                    |                    |                    |                    |                    |                    |                    |
| Num. Geographic Seg.     | −0.02** (−2.06)    | −0.02* (−1.74)     |                    |                    |                    |                    |                    |                    |                    |
| **COVID_19 Exposure*Num. Geographic Seg.** | −0.10*** (−4.04) | −0.06** (−2.56)   |                    |                    |                    |                    |                    |                    |                    |
| 1_HHI Geographic Sales   | −0.31** (−2.09)    | −0.24* (−1.69)     |                    |                    |                    |                    |                    |                    |                    |
| **COVID_19 Exposure*1_HHI Geographic Sales** | −0.91*** (−4.00) | −0.56*** (−2.62)  |                    |                    |                    |                    |                    |                    |                    |
| Log(Size)                | −0.18*** (−7.63)   | −0.18*** (−7.67)   | −0.18*** (−7.63)   | −0.18*** (−7.65)   | −0.18*** (−7.60)   | −0.17*** (−7.43)   | −0.18*** (−7.59)   | −0.18*** (−7.57)   | −0.17*** (−7.41)   |
| MB                       | −0.20*** (−6.09)   | −0.21*** (−6.25)   | −0.21*** (−6.33)   | −0.19*** (−6.30)   | −0.19*** (−5.77)   | −0.18*** (−5.28)   | −0.19*** (−5.36)   | −0.20*** (−5.89)   | −0.19*** (−5.54)   |
| Leverage                 | 0.00 (0.02)        | 0.00 (−0.05)       | 0.00 (−0.14)       | 0.00 (−0.27)       | 0.00 (−0.12)       | 0.00 (−0.30)       | 0.00 (−0.17)       | 0.00 (−0.12)       | 0.00 (−0.06)       |
| ROA                      | −2.12*** (−2.66)   | −2.05*** (−2.58)   | −2.08*** (−2.63)   | −2.21*** (−2.76)   | −2.08*** (−2.61)   | −2.26*** (−2.81)   | −2.19*** (−2.83)   | −2.04*** (−2.57)   | −2.20*** (−2.74)   |
| Free Cash                | 1.92*** (2.84)     | 1.90*** (2.80)     | 1.92*** (2.82)     | 2.05*** (2.99)     | 1.95*** (2.85)     | 2.07*** (2.87)     | 1.97*** (2.97)     | 2.04*** (2.63)     | 1.93*** (2.86)     |
| Bond Rating              | 0.17*** (6.53)     | 0.17*** (6.51)     | 0.17*** (6.58)     | 0.17*** (6.58)     | 0.17*** (6.49)     | 0.17*** (6.54)     | 0.18*** (6.63)     | 0.17*** (6.65)     | 0.17*** (6.64)     |
| Log(Maturity)            | 0.36*** (2.81)     | 0.36*** (2.80)     | 0.36*** (2.82)     | 0.36*** (2.83)     | 0.36*** (2.84)     | 0.36*** (2.84)     | 0.36*** (2.85)     | 0.36*** (2.86)     | 0.36*** (2.87)     |
| Log(Amount)              | 0.02 (0.74)        | 0.02 (0.72)        | 0.02 (0.76)        | 0.02 (0.82)        | 0.02 (0.84)        | 0.02 (0.89)        | 0.02 (0.82)        | 0.02 (0.84)        | 0.02 (0.90)        |
| Constant                 | 4.20*** (6.48)     | 4.27*** (6.59)     | 4.25*** (6.55)     | 4.26*** (6.61)     | 4.18*** (6.43)     | 4.21*** (6.54)     | 4.23*** (6.62)     | 4.22*** (6.65)     | 4.22*** (6.61)     |
| Industry FE              | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                |
| Year FE                  | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                | Yes                |
| Observations             | 7997               | 7997               | 7997               | 7997               | 7997               | 7997               | 7997               | 7997               | 7997               |
| Adjusted R²              | 0.590              | 0.590              | 0.590              | 0.590              | 0.590              | 0.590              | 0.590              | 0.591              | 0.591              | 0.591              |

The table presents the results for Eq. (1). Column 1 presents the results for business diversification measured based on the variable Business Diver., column 2 presents the results for business diversification measured based on the variable Num. Business Seg., column 3 presents the results for business diversification measured based on the variable 1_HHI Business Sales., column 4 presents the results for geographic diversification measured based on the variable Geographic Diver., column 5 presents the results for geographic diversification measured based on the variable Num. Geographic Seg., column 6 presents the results for geographic diversification measured based on the variable 1_HHI Geographic Sales, column 7 presents the results for combining the two measures of diversification Business Diver. and Geographic Diver., column 8 presents the results for combining the two measures of diversification Num. Business Seg. and Num. Geographic Seg., while column 9 presents the results for combining the two measures of diversification 1_HHI Business Sales. and 1_HHI Geographic Sales. All variables are defined in the Appendix. All continuous variables are winsorized at the 1st and 99th percentiles. In parentheses, we report the t-statistics based on firm-year clusters and heteroskedasticity-corrected standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

Coefficients for **COVID_19 Exposure*Business Diver.** and **COVID_19 Exposure* Geographic Diver.** are significantly different (Chi2= 3.03) in columns 1 and 4.

Coefficients for **COVID_19 Exposure*Num. Business Seg.** and **COVID_19 Exposure*Num. Geographic Seg.** are significantly different (Chi2= 6.09) in columns 2 and 5.

Coefficients for **COVID_19 Exposure*1_HHI Business Sales and COVID_19 Exposure*1_HHI Geographic Sales** are significantly different (Chi2= 2.99) in columns 3 and 6.

Coefficients for **COVID_19 Exposure*Business Diver.** and **COVID_19 Exposure* Geographic Diver.** are significantly different (F-stat= 3.01) in column 7.

Coefficients for **COVID_19 Exposure*Num. Business Seg.** and **COVID_19 Exposure*Num. Geographic Seg.** are significantly different (F-stat= 4.80) in column 8.
of such an increase, this study examines the effect of corporate diversification on borrowing costs for COVID-19-exposed firms. We find that diversification across different business units and countries reduces borrowing costs for these firms. We also find that unrelated business diversification and geographic diversification in countries with low COVID-19 uncertainty are more valuable than related diversification and diversification in countries with high COVID-19 uncertainty.

Given the ongoing pandemic, the results have an implication for firms and policymakers in utilizing the role of corporate diversification in reducing the negative effect of the pandemic on borrowing costs.

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| Table 3 | Characteristics of diversification. |
|---------|-------------------------------------|
|         | (1) Related vs. unrelated business diversification | (2) High vs. low uncertainty of country of diversification |
| **COVID_19 Exposure** | 0.48*** | 0.48*** |
|                         | (22.25) | (22.87) |
| **Related Business Diver.** | -0.04 | -0.12* |
|                         | (-1.34) | (-1.87) |
| **Related Business Diver. × COVID_19 Exposure** | -0.44*** | -0.44*** |
|                         | (-7.68) | (-7.68) |
| **Unrelated Business Diver.** | -0.12* | -0.53*** |
|                         | (-1.87) | (-4.28) |
| **Unrelated Business Diver. × COVID_19 Exposure** | -0.53*** | -0.53*** |
|                         | (-4.28) | (-4.28) |
| **High Stringency Diver.** | -0.35*** | -0.35*** |
|                         | (-5.19) | (-5.19) |
| **High Stringency Diver. × COVID_19 Exposure** | -0.42*** | -0.42*** |
|                         | (-3.53) | (-3.53) |
| **Low Stringency Diver.** | -0.12*** | -0.12*** |
|                         | (-2.76) | (-2.76) |
| **Low Stringency Diver. × COVID_19 Exposure** | -0.57*** | -0.57*** |
|                         | (-8.21) | (-8.21) |
| **Log(Size)** | -0.18*** | -0.17*** |
|                         | (-19.63) | (-19.48) |
| **MB** | -0.20*** | -0.18*** |
|                         | (-9.37) | (-8.51) |
| **Leverage** | 0.00 | -0.06 |
|                         | (-0.04) | (-1.00) |
| **ROA** | -2.17*** | -2.18*** |
|                         | (-4.54) | (-4.62) |
| **Free Cash** | 1.96*** | 1.96*** |
|                         | (4.40) | (4.40) |
| **Bond Rating** | 0.17*** | 0.18*** |
|                         | (15.99) | (16.11) |
| **Log(Maturity)** | 0.36*** | 0.36*** |
|                         | (21.53) | (21.49) |
| **Log(Amount)** | 0.02* | 0.02* |
|                         | (1.66) | (1.77) |
| **Constant** | 4.22*** | 4.23*** |
|                         | (19.70) | (20.05) |
| **Industry FE** | Yes | Yes |
| **Year FE** | Yes | Yes |
| **Observations** | 7997 | 7997 |
| **Adjusted R²** | 0.590 | 0.592 |

Column 1 presents the results for the relatedness test (i.e., when we differentiate between related and unrelated diversification), while column 2 presents the results for the exposure of countries of geographic diversification (i.e., when we differentiate between firms with geographic segments in countries with high COVID-19 uncertainty and firms with geographic segments in countries with low COVID-19 uncertainty). All variables are defined in the Appendix. All continuous variables are winsorized at the 1st and 99th percentiles. In parentheses, we report the t-statistics based on firm-year clusters and heteroskedasticity-corrected standard errors. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

Coefficients for **Related Business Diver. × COVID_19 Exposure** and **Unrelated Business Diver. × COVID_19 Exposure** are significantly different (F-stat = 3.42). Coefficients for **High Stringency Diver. × COVID_19 Exposure** and **Low Stringency Diver. × COVID_19 Exposure** are significantly different (F-stat = 2.96).
## Appendix. : Variable Definitions

| Firm-specific variables                          | Description                                                                                          |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| COVID\_19 Exposure                              | A firm’s exposure to COVID-19 obtained from Hassan et al. (2020). It is based on the proximity of COVID-19 related words to either positive or negative tone in quarterly-earnings conference calls divided by the number of sentences in the transcript multiplied by 100 for the ease of interpretation. |
| Business Diver.                                 | A dummy variable that takes the value of one if the firm reported two or more business segments in different four-digit SIC codes in a given year (Source: Compustat Historical Segment). |
| Num. Business Seg.                              | The number of four-digit SIC business divisions the firm reported in a given year (Source: Compustat Historical Segment). |
| 1\_HHI Business Sales                           | One minus the Herfindahl-Hirschman Index of division sales for the firm in a given year. The Herfindahl-Hirschman Index of division sales of the firm is defined as $HHI Business Sales = \sum_{j=1}^{8} \left( \frac{Sales_{j}}{\sum_{j'=1}^{8} Sales_{j'}} \right)^2$ where $Sales_{j}$ represents the sales of division $j$ of firm $f$ at time $t$ and $J_f$ is the set of divisions of firm $f$ at time $t$ (Source: Compustat Historical Segment). |
| Geographic Diver.                               | A dummy variable that takes the value of one if the firm operated in two or more geographic segments in a given year (Source: Compustat Historical Segment). |
| Num. Geographic Seg.                            | The number of geographic segments the firm reported in a given year (Source: Compustat Historical Segment). |
| 1\_HHI Geographic Sales                        | One minus the Herfindahl-Hirschman Index of geographical sales for the firm in a given year. The Herfindahl-Hirschman Index of division sales of the firm is defined as $HHI Geographic Sales = \sum_{j=1}^{7} \left( \frac{Sales_{j}}{\sum_{j'=1}^{7} Sales_{j'}} \right)^2$ where $Sales_{j}$ represents the sales of geographic segment $j$ of firm $f$ at time $t$ and $J_f$ is the set of geographic segments of firm $f$ at time $t$ (Source: Compustat Historical Segment). |
| Log(Size)                                        | The natural logarithm of total assets (item at) (Source: Compustat). |
| MB                                              | A firm’s market value to book value (items (dlc-dltt+(prev_jt*cbx)+pskl))/at (Source: Compustat). |
| Leverage                                        | Interest-bearing debt divided by total assets (items (dltt/at) (Source: Compustat). |
| ROA                                             | Earnings before interest and taxes divided by total assets (items ib/at) (Source: Compustat). |
| Free Cash                                       | Free cash flow divided by total assets (items ((oibdp-xint–txt–dvp–dvc)/at) (Source: Compustat). |
| Related Business Diver.                        | A dummy variable that takes the value of one if all the segments of the firm belong to the same two-digit SIC codes in a given year (Source: Compustat Historical Segment). |
| Unrelated Business Diver.                      | A dummy variable that takes the value of one if the firm reported two or more business segments in different two-digit SIC codes in a given year (Source: Compustat Historical Segment). |
| High Stringency Diver.                         | A dummy variable that takes the value of one if the average stringency index of a firm’s countries of diversification is above the sample mean level (Hale et al., 2021). |
| Low Stringency Diver.                          | A dummy variable that takes the value of one if the average stringency index of a firm’s countries of diversification is below the sample mean level (Hale et al., 2021). |
| Bond-specific variables                        |                                                                                                        |
| Log(Debt Amount)                                | The natural logarithm of the amount of bond issue in US$ (Source: Thomson ONE Banker).                |
| Log(Maturity)                                   | The natural logarithm of the number of months to final maturity (Source: Thomson ONE Banker).          |
| Bond Rating                                     | A numerical conversion of Moody’s credit rating based on a scale of 2-7 for ratings Aaa to C and 8 for missing rating (Source: Thomson ONE Banker). |
| Cost of debt                                    | The basis point spread over the benchmark treasury bond (Source: Thomson ONE Banker; Federal Reserve Economic Data-FRED). In line with Bradley et al. (2016) and Huang et al. (2016), and since US Treasury Bonds are only available for a limited number of the sample bonds’ maturities, the maturities are matched as follows. One-year US Treasury bond is used if the bond maturity is less than 1.5 years; two-year bond is used if the bond maturity is higher than 1.5 and less than or equal to 2.5 years; three-year bond is used if the bond maturity is higher than 2.5 and less than or equal to 4 years; five-year bond is used if the bond maturity is higher than 4 and less than or equal to 6 years; seven-year bond is used if the bond maturity is higher than 6 and less than or equal to 8.5 years; ten-year bond is used if the bond maturity is higher than 8.5 and less than or equal to 20 years, and 30-year bond is used if the bond maturity is higher than 20 years. |

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