

Operating risk and financing working capital strategies in SMEs

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Abstract

Purpose – The objective of this study is to analyse the effects of operating risk on SMEs' working capital requirements (WCR) financing strategies. Since the literature has previously stated that operating and financial risk are compensated and that financial risk is related to debt maturity, our main research answers the question: Which strategies for financing WCR (greater use of short-term or long-term debt) should firms use based on their operating risk?

Design/methodology/approach – We measure firm's operating risk as the standard deviation of ROA (SD_{ROA}), and the financing strategy of WCR as the ratio of short-term debt to WCR (FWCR). We conduct econometric analyses using firm-, sector- and year-fixed effects. We also employ one-way clustered standard errors to control for unobserved heterogeneity and control for other factors that may affect operating risk, following previous literature.

Findings – Our results indicate a negative linear relationship between operating risk and the proportion of WCR financed with short-term debt, suggesting that firms with higher operating risk tend to adopt more conservative financing strategies (a higher proportion of long-term debt) in an attempt to limit their overall risk exposure.

Originality/value – This work provides several contributions to the literature on WCR management. It explores a topic that has not received enough attention in the debt maturity and working capital literature: the relationship between a firm's WCR financing and its operating risk. To the best of our knowledge, this is the first article to link both topics in the financial literature. As it focuses on SMEs, which are the backbone of the economy, the issue addressed is particularly important. Furthermore, Spain has a banking-oriented financial system, so these results can be extrapolated to countries with similar characteristics.

Keywords Working capital requirements, Leverage, Risk, SMEs

Paper type Research article

1. Introduction

One of the fundamental aspects of financial management is financing the resources necessary to cover the company's day-to-day operations, which is known as working capital requirements (WCR). Some authors have found that firms have an optimal level of working capital that enhances their performance (Aktas *et al.*, 2015; Baños-Caballero *et al.*, 2014, among others). Decisions on how to finance these needs have a direct impact on the company's profitability and financial risk, affecting its stability and growth capacity (Deloof, 2003; Smith, 1981).

Corporate finance literature has studied debt maturity extensively, explaining what makes a firm choose shorter or longer debt terms, what optimal targets they should aim for and how these decisions affect corporate performance (e.g. Antoniou *et al.*, 2006; Barclay and Smith, 1995; Brick and Ravid, 1985; D'Amato, 2020; Datta *et al.*, 2005; Diamond, 1991;

JEL Classification — G30, G31, G32

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González, 2015; Ozkan, 2000; Stohs and Mauer, 1996). Studies addressing the financing of WCR are still relatively scarce, focusing on how different financing strategies affect SMEs' profitability (Altaf and Farooq, 2019; Baños-Caballero *et al.*, 2016). According to traditional corporate finance literature, strategies for financing WCR influence both return and risk (e.g. Van Horne, 1969; Smith, 1981). An aggressive financing strategy, which implies funding WCR with a greater proportion of short-term debt, reduces funding costs but increases financial risk. On the other hand, a conservative strategy, which relies on funding WCR with longer-term resources such as equity or long-term debt, can increase funding costs but provides a less risky strategy.

The decision to finance WCR with short-term or long-term resources depends on the benefits and drawbacks of each type of leverage, but also on the company's current situation in terms of risk. The risk assumed by firms derives from investment decisions and financing decisions. The literature has explored how the degree of operating leverage (DOL) and the degree of financial leverage (DFL) interact with each other, and how they both act as substitutes to balance a firm's risk-taking (Chen *et al.*, 2019; Dotan and Ravid, 1985; Kahl *et al.*, 2019; Sarkar, 2020, among others). Particularly, when a company is highly leveraged in its economic structure, which is related to its investment decisions, it has to compensate for that high risk by using low financial leverage to reduce total risk-taking. This establishes a trade-off relationship between the DOL and DFL, which the literature calls the *substitution effect* (Chen *et al.*, 2019; Dotan and Ravid, 1985; Kahl *et al.*, 2019; Sarkar, 2020, among others). In this paper, we study whether the nexus between operating and financial risk, which is related to the DOL and DFL, can affect financing WCR policies. Our research question is: Does the level of firm's operating risk, through the DOL–DFL *substitution effect*, impact how firms finance their WCR?

The study focuses on a sample of small and medium-sized Spanish enterprises since, according to the Spanish Ministry of Industry, Energy and Tourism, they represent 99.8% of Spanish firms and account for more than 75% of employment in Spain (Lopez-Gracia and Mestre-Barberá, 2015). Moreover, according to Giannetti (2003), current assets and short-term liabilities carry greater weight in the balance sheets (66.7 and 52.06%, respectively) of these firms than in those of large companies. Due to their size, SMEs face more financial difficulties (Arráiz *et al.*, 2014; Fazzari and Petersen, 1993) and have less access to long-term financing (Kersten *et al.*, 2017; Petersen and Rajan, 1997), making efficient working capital management particularly important for small and medium-sized firms (Peel *et al.*, 2000). Furthermore, Spain has a banking-oriented financial system, with a large fraction of its economic activity driven by the SME sector. These companies are more bank-dependent than large enterprises (Bucă and Vermeulen, 2017), meaning that Spanish SMEs are strongly influenced by credit institutions in their financing decisions (Palacín-Sánchez *et al.*, 2013; Carbó-Valverde *et al.*, 2016).

The results of this study show a negative linear relationship between operating risk and the proportion of WCR financed with short-term financial debt, which is consistent with the idea that firms with higher operating leverage (and therefore, higher operating risk) tend to rely less on short-term financial leverage (therefore, lowering their financial risk) in an attempt to limit their overall risk exposure. To do so, they may issue longer-term debt, thus applying more conservative working capital financing strategies. The hypothesis is confirmed for the entire sample and individually for every industry represented in the sample. The econometric results are robust to the use of alternative operating risk proxies and several estimation methods.

This paper contributes to the literature in several ways. First, we add to the debt maturity and working capital literature by exploring topics that have traditionally been addressed separately, such as the relationship between operating and financial risk and working capital financing, and we integrate them to analyse how the former could impact the latter. Although an extensive body of literature has examined the impact of risk on debt maturity, to the best of our knowledge, this is the first article to explore the effect of operating risk on working capital financing. This relationship is essential for effective financial management in uncertain conditions. Firms with high operating leverage are more sensitive to sales fluctuations, which

increase their exposure to liquidity risk (Chen *et al.*, 2019). Using short-term financing without considering the firm's risk profile may exacerbate this vulnerability, potentially leading to financial solvency problems (D'Amato, 2020; Nicolas, 2022). As we focus on Spain, which is characterised by a banking-oriented financial system and a large proportion of SMEs in the economy, our results may extend to countries with similar institutional settings, being consistent with evidence on debt maturity choices in Belgian SMEs (Vermoesen *et al.*, 2013) and capital structure in Italian SMEs (Botta, 2019).

The structure of the paper is as follows: Section 2 provides the theoretical framework and literature review on WCR financing strategies, and Section 3 describes the data and methodology used in this study. Section 4 presents the analyses and results. In Section 5, we discuss the results.

2. Theoretical framework

2.1 Financing strategies for working capital requirements

WCR represent the net investment necessary to carry out the company's current operations, including inventories, accounts receivable and operating cash holdings, minus accounts payable (Baños-Caballero *et al.*, 2016). Previous literature has focused on how investment in working capital impacts firm value, finding that there is an optimal level that enhances firm performance (Aktas *et al.*, 2015; Baños-Caballero *et al.*, 2014). Once firms determine their optimal WCR level, they need to obtain the necessary financing to maintain it.

Merville and Tavis (1973) suggested that working capital investment can be divided into two components: funds committed permanently and those committed temporarily. The authors state that permanent working capital, which is required to service demand at the firm's minimum activity level, is generally financed with long-term resources only, whereas temporarily committed funds, which fluctuate with sales, can be financed through long-term, short-term or intermediate borrowing policies. Indeed, Baños-Caballero *et al.* (2016) suggest that firms may finance a large part of their WCR using long-term resources, such as long-term debt, equity and retained earnings, which are generally considered to be less risky. Conversely, firms may adopt a riskier strategy involving financing a large proportion of their WCR with short-term debt. An intermediate approach balancing both short- and long-term financing may also be adopted. Consequently, firms must strategically decide their mix of short- and long-term financing for their WCR, based on their risk aversion and financial objectives, as this decision can impact firm performance and value.

Choosing to finance WCR with short-term debt can benefit the company in various ways. It allows for better management and offers greater adaptability to the specific financial needs of each firm, as noted by Jun and Jen (2003). They further emphasise the fact that nominal interest rates and issuance costs are lower than those associated with long-term debt, making short-term debt considerably less expensive. In addition, because it is renewed annually, short-term debt helps to mitigate agency conflicts and enhances managerial discipline (Myers, 1977; Ozkan, 2000; Rajan and Winton, 1995, among others). However, excessive use of short-term debt also presents a series of drawbacks. This type of financing is subject to refinancing risk, that is potential challenges when renewing short-term credits, which may complicate the continuity of funding, and to credit risk, that is fluctuations in interest rates, which may lead to potential increases in the cost of financing (Jun and Jen, 2003). Too much short-term debt also creates liquidity risk, thereby increasing bankruptcy costs and constraining debt capacity (Childs *et al.*, 2005). Therefore, choosing an optimal WCR financing strategy is crucial to enhance firm value.

2.2 Operating leverage and the substitution effect

Corporate finance literature has extensively studied the relationship between the DOL and the DFL. This is because the DOL–DFL nexus involves some of the most important managerial

decisions in corporate finance, such as fixed investment (which impacts the DOL), capital structure (which determines the DFL) and risk management (which impacts both) (Sarkar, 2020).

This previously theoretical issue has been addressed empirically by Mandelker and Rhee (1984), who find that both the DOL and DFL impact firm risk and, most interestingly, that both types of leverage are interchangeable. This trade-off between the two types of leverage signals a conscious decision by corporate management aimed at offsetting or balancing total risk. More recently, Chen *et al.* (2019) argue that higher operating leverage leads to greater probabilities of default and, therefore, increased risk, rationalising managers' trade-off. The authors explain that since firms cannot reduce their operating costs one-for-one with their revenues in difficult times, higher operating leverage reduces their ability to pay their debt and increases the probability of default, which causes firms to choose lower financial leverage *ex ante*. Therefore, when operating leverage is higher, firms tend to reduce their financial leverage to compensate. This is called the *compensation or substitution effect* (Chen *et al.*, 2019). Without naming it directly, several authors have studied this effect, confirming an inverse relationship between financial and operating leverage (Chen *et al.*, 2019; Dotan and Ravid, 1985; Kahl *et al.*, 2019, among others). This effect arises when the DOL is exogenously defined, which, according to Chen *et al.* (2019) and Sarkar (2020), is common among firms. In such cases, operating leverage is largely exogenous and given by industry, and managers then endogenously choose financial leverage. Since both operating leverage and financial leverage increase the risk to shareholders, when the DOL is high, operating risk increases, and the firm may choose a low DFL to control the level of overall risk by decreasing financial risk (Sarkar, 2020). In this context, the literature (Dhaliwal *et al.*, 2011; McDaniel, 1984, among others) commonly treats operating leverage and operating risk as equivalent concepts, as a higher DOL increases the sensitivity of operating profits to changes in sales and therefore heightens operating risk (Dudycz, 2024). Likewise, financial leverage and financial risk are used interchangeably, given that greater financial leverage amplifies the volatility of equity returns and thus increases financial risk.

Financial risk depends on the DFL but also on debt maturity (Barclay *et al.*, 2003; Stohs and Mauer, 1996). Firms can control their financial risk either by increasing or decreasing their DFL, but also by controlling their debt maturity. More indebted firms, which face greater financial risk, try to control this risk by lengthening their average debt maturity (García-Teruel and Martínez-Solano, 2007). Dang (2011) and Huang and Shang (2019) find that long debt maturity is positively related to financial leverage, while Johnson (2003) states that short debt maturity is negatively related to leverage. Dangl and Zechner (2020) confirm this effect by showing that short debt maturities commit equity holders to leverage reductions. Actually, Morris (1976) argues that debt with a maturity shorter than asset life is considered riskier. Overall, the literature supports the idea that debt maturity is negatively related to the DFL and that a greater use of short-term debt increases financial risk. Therefore, we expect that firms with higher operating risk would try to reduce their financial risk, in line with the *substitution effect*. Since financial risk is negatively related to debt maturity, we expect firms with higher operating risk would adopt more conservative financing WCR strategies. Accordingly, our hypothesis is:

- H1. There is a negative relationship between firm operating risk and the use of short-term debt to finance WCR.

3. Data and methodology

3.1 Sample

This study uses data from the SABI (Iberian Balance Sheets Analysis System) database, which compiles financial information on Spanish companies, particularly their financial statements. The focus is on non-financial small and medium-sized enterprises (SMEs) operating in Spain,

identified in accordance with European Commission Recommendation 2003/361/EC of 6 May 2003. Specifically, SMEs are defined as entities with (1) fewer than 250 employees, (2) an annual turnover below €50 million and (3) total assets not exceeding €43 million.

Our dataset spans the period 2014–2020. To ensure the reliability and integrity of the analysis, only firms with audited annual accounts free of qualifications were selected. Several filtering criteria were applied to refine the sample. Observations with incomplete data, accounting inconsistencies or extreme values – specifically, those below the 1st percentile or above the 99th percentile – were removed. Furthermore, since only firms with positive WCR require additional financing, all cases with negative WCR were excluded.

Following this selection process, the final dataset comprises 7,139 SMEs, resulting in an unbalanced panel with a total of 26,661 firm-year observations.

3.2 Methodology and variables

To study the financing of WCR, the FWCR₁ variable was used, obtained by dividing short-term bank debt by WCR (Baños-Caballero *et al.*, 2016), where WCR are defined as current assets minus trade payables. This variable captures the proportion of WCR financed through short-term debt. Higher FWCR values denote an aggressive financing strategy, whereas lower values are associated with a more conservative approach. Since current assets include total cash holdings, we also created the variable FWCR₂, which excludes all cash.

We refer to operating leverage as operating risk. These terms can be interchangeable because they both refer to how deviations in sales affect operating profits (McDaniel, 1984), causing high earnings volatility (Monterrey, 2025). Since operating leverage is positively related to operating risk measured as stock return volatility (Lev, 1974), we measure a firm's operating risk as the standard deviation of the return on assets (ROA) of the current year and previous two-year ROA, following previous literature (Boubakri *et al.*, 2013; Chu *et al.*, 2020; Dhaliwal *et al.*, 2011; Peng *et al.*, 2019). This proxy is commonly used to measure corporate risk-taking (Cheng, 2008; Nakano and Nguyen, 2012, among others), especially for SMEs, although it has always been a controversial topic in corporate finance literature. In this regard, Dudycz (2024) conducted a literature review of the different methods for measuring operating leverage and found that there are several measures and definitions in the literature. The author proposed a standard measurement of operating leverage that measures the volatility of operating profit (ROA) and can be used in research on operating risk and its impact on debt structure. Therefore, although there are several measures of operating risk, given the seven-year span of our sample, we believe that the standard deviation of ROA in a moving three-year period is the most suitable measure for our study.

Equation (1) shows our measure of operating risk.

$$OPRISK = \sqrt{\frac{1}{N-1} \sum_{t=1}^N \left(ROA_{i,t} - \frac{1}{N} \sum_{t=1}^N mean ROA_{i,t} \right)^2}, N = 3 \quad (1)$$

We conduct an econometric analysis using panel data, regressing FWCR on OPRISK along with a set of control variables (Eq. 2). The regressions are estimated using firm-, sector- and year-fixed effects. We also cluster standard errors at the firm level.

$$FWCR_{i,t} = \beta_0 + \beta_1 OPRISK_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 AGE_{i,t} + \beta_4 GROWTH_{i,t} + \beta_5 LEV_{i,t} + \beta_6 AM_{i,t} + \beta_7 Z - SCORE_{i,t} + \beta_8 Z - SCORE_{i,t}^2 + \eta_i + \lambda_t + \delta_j + \varepsilon_{i,t} \quad (2)$$

where FWCR_{i,t} is the ratio of short-term financial debt to WCR; OPRISK_{i,t} is the operating risk, measured as the standard deviation of ROA of *t*, *t*–1 and *t*–2; while SIZE_{i,t}, AGE_{i,t},

GROWTH_{*i,t*}, LEV_{*i,t*}, AM_{*i,t*}, Z-SCORE_{*i,t*} and Z-SCORE²_{*i,t*} are control variables. η_i explains the unobservable heterogeneity in the fixed-effects estimation. Time (λ_t) and sectorial (δ_j) dummy variables have been included. In this way, we have attempted to account for the economic variables that firms cannot control but that can affect short-term debt decisions, such as interest rates and prices. $\varepsilon_{i,t}$ is the random error. Companies have been classified according to their main economic activity, following the Standard Industrial Classification of Economic Activities, into the following sectors: Agriculture and Mining, Manufacturing, Construction, Trade and Services and Transportation.

The fixed-effects estimator is used to control for time-invariant unobserved heterogeneity at the firm level that may be correlated with the explanatory variables. This approach offers better consistency of the estimates than ordinary least squares (OLS), which provides less precise estimates. The appropriateness of the fixed-effects model over the random-effects alternative is verified using the Hausman (1978) test, which determines whether the unobserved individual effects are correlated with the regressors. A rejection of the null hypothesis supports the use of fixed effects, as it implies that the random effects estimator would yield biased results. We also include sector and time effects.

To ensure robust inference, we then cluster standard errors at the firm level. Clustering by firm accounts for autocorrelation and heteroskedasticity within each company over time. This clustering approach provides more reliable standard errors than conventional methods, such as OLS, which may underestimate variability, leading to overconfident inference. By structuring the regression in this way, the analysis accounts for potential intra-group correlations and produces more accurate and credible standard error estimates, enhancing the robustness of the econometric findings.

The control variables are based on the main determinants of debt maturity identified in the literature (Barclay *et al.*, 2003; Barclay and Smith, 1995; González, 2015; Ozkan, 2000; Stohs and Mauer, 1996; among others). Specifically, we use SIZE, measured as the natural logarithm of a firm's sales; the firm's AGE is measured as the natural logarithm of the number of years since the company was founded; GROWTH is measured as the yearly growth rate of sales; LEVERAGE (LEV) is measured as the debt to equity ratio; ASSET MATURITY (AM) measures financial flexibility and Z-SCORE measures the degree of financial strength.

Following Jun and Jen (2003), we calculate asset maturity using Equation (3).

$$AM = p1 \frac{Net\ fixed\ assets}{Annual\ depreciation} + p2 \frac{Receivables}{Sales} + p3 \frac{Inventories}{Sales} + p4 \tag{3}$$

where p1, p2, p3 and p4 are the proportions of net fixed assets, receivables, inventories and other current assets except cash to total assets, respectively.

We calculate Z-Score using Begley *et al.*'s (1996) re-definition of Altman's (1968) Z-Score, following Equation (4).

$$ZScore = \frac{0.104 \times WCR + 1.010 \times RE + 0.106 \times EBIT + 0.169 \times Sales}{Total\ Assets} + 0.003 \times Market\ value\ of\ equity \tag{4}$$

where WCR is Working Capital Requirements; RE is Retained Earnings and EBIT is Earnings Before Interest and Taxes. Since SMEs have no access to capital market values, we use their book value instead (Scherr and Hulburt, 2001). We also introduce Z-SCORE² in the model, following Diamond (1991) and Scherr and Hulburt (2001), among others.

3.3 Summary statistics

Table 1 presents the main descriptive statistics for the data covering 7,139 SMEs from 2014 to 2020, where Panel A contains the primary variables, and Panel B includes the control

Table 1. Descriptive statistics

	No obs.	Mean	Std. dev.	10th perc.	Median	90th perc.
<i>Panel A: Main variables</i>						
FWCR ₁	26,661	0.3550	0.3531	0.0189	0.2490	0.8257
FWCR ₂	26,661	0.4843	0.5928	0.0293	0.3298	1.0141
OPRISK	26,661	0.0227	0.0212	0.0033	0.0162	0.0515
<i>Panel B: Control variables</i>						
SIZE	26,661	9.4437	0.6646	8.6634	9.4300	10.3392
GROWTH	26,661	3.2192	0.5612	2.4849	3.2958	3.8067
LEV	26,661	0.0647	0.1784	−0.1095	0.0504	0.2459
AGE	26,661	1.8439	2.3867	0.3241	1.1642	3.9538
AM	26,661	7.7318	24.6935	1.5821	4.3242	14.82
Z-SCORE	26,661	17.73	15.34	4.70	12.87	37.15
Z-SCORE ²	26,661	549.63	1117.12	22.08	165.55	1380.17

Note(s): FWCR₁: short-term bank debt divided by working capital requirements, including cash holdings; FWCR₂: short-term bank debt divided by WCR, without including cash; OPRISK: standard deviation of the company's return on assets in periods $t-2$, $t-1$ and t . SIZE: Napierian logarithm of firm's sales; GROWTH: annual percentage change in sales; LEV: debt to equity ratio; AGE: Napierian logarithm of the number of years of the company; AM: asset maturity; Z-SCORE: financial solvency using [Begley et al.'s \(1996\)](#) model

variables. The average value of FWCR is 35.50%, meaning that 35.50% of WCR are financed with short-term financial debt. This value increases to 48.43% if we exclude cash holdings in the FWCR variable. Regarding OPRISK, the average value for the sample is 2.27%. [Table 1](#) also provides descriptive statistics and the 10th, 50th and 90th percentiles of the control variables.

[Table 2](#) reports the correlation matrix. The main variables (both FWCR and OPRISK) have a negative and significant correlation, which matches our hypothesis. Operating risk, measured as the standard deviation of the ROA, has a negative relationship with the financing WCR strategy, regardless of the inclusion of cash holdings, meaning that when operating leverage, and therefore operating risk, increases, firms tend to decrease their financial risk by choosing more conservative WCR strategies. This finding calls for additional econometric analysis and a more thorough interpretation. The control variables do not show excessive correlation among themselves or with the main variables, except for Z-SCORE and its square, SIZE and LEV.

To ensure there is no multicollinearity in our analyses, the Variance Inflation Factor (VIF) has been calculated for each variable included in the model. Only Z-SCORE and its square exceed 3, but remain under 5, which is acceptable ([Akinwande et al., 2015](#)). Therefore, collinearity is not a concern in our sample.

4. Results

4.1 Univariate analysis

[Table 3](#) shows the average values for the mean variables, FWCR₁, FWCR₂ and OPRISK, in which Panel A presents the mean values for each year from 2014 to 2020. As reported in [Table 1](#) 35.50% of the sample's WCR are financed using short-term financial debt if including cash, and 48.43% otherwise, whereas the risk is 2.27%. There is little variation in either variable across years, given that these are years of economic stability following the crisis that affected Spain until 2013.

The industry sector plays a crucial role in shaping how firms manage and finance their WCR ([Filbeck and Krueger, 2005](#); [Singh and Kumar, 2014](#); [Weinraub and Visscher, 1998](#)). While companies operating within the same sector often adopt similar WCR strategies driven

Table 2. Correlation matrix

Variables	FWCR ₁	FWCR ₂	OPRISK	SIZE	GROWTH	LEV	AGE	AM	Z-SCORE	Z-SCORE2
FWCR ₁	1									
FWCR ₂	0.7524***	1								
OPRISK	−0.1693***	−0.0952***	1							
SIZE	0.0619***	−0.0055	−0.0411***	1						
GROWTH	−0.0768***	−0.0552***	−0.0666***	−0.0085	1					
LEV	0.3732***	0.2460***	−0.1220***	0.1122***	−0.2007***	1				
AGE	0.0263***	0.0164***	0.0138**	0.1421***	−0.0989***	0.0767***	1			
AM	0.0581***	0.0628***	−0.0233***	−0.0495***	−0.0032	−0.0232***	−0.0056	1		
Z-SCORE	−0.2431***	−0.1590***	−0.0003	0.3969***	0.1615***	−0.3539***	−0.0301***	0.0920***	1	
Z-SCORE2	−0.1820***	−0.1174***	−0.0146**	0.3109***	0.1070***	−0.2271***	−0.0292***	0.0802***	0.9277***	1

Note(s): *indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level

Table 3. Mean value of FWCR and OPRISK per year and sector

Panel A: Per year						
Year	FWCR ₁	FWCR ₂	OPRISK	N° obs		
2014	0.3548	0.4609	0.0191	3,340		
2015	0.3565	0.4731	0.0229	3,993		
2016	0.3544	0.5009	0.0222	4,340		
2017	0.3645	0.4982	0.0227	4,795		
2018	0.3692	0.4977	0.0232	4,903		
2019	0.3647	0.4903	0.0234	3,408		
2020	0.2797	0.4297	0.0279	1,882		
2014–2020	0.3550	0.4843	0.0232	26,661		

Panel B: Per sector						
	Agriculture and mining	Manufacturing	Construction	Trade	Services and transportation	Total
FWCR ₁	0.3489	0.3138	0.2406	0.39	0.4087	0.3550
FWCR ₂	0.4827	0.3909	0.4214	0.4958	0.7607	0.4843
OPRISK	0.0294	0.0239	0.0231	0.0199	0.0259	0.0232
No obs.	657	10,608	1,232	10,526	3,630	26,661

Note(s): Standard industrial classification according to CNAE 2009: Agriculture and Mining, codes 01 to 09; Manufacturing, codes 10 to 39; Construction, codes 40 to 43; Trade, codes 45 to 48; Services and Transportation, codes 49 to 96 (except 64 to 68)

by common industry traits and cyclical patterns, notable contrasts can be observed across different sectors. These variations are mainly due to differences in payment and collection terms, as well as the level of inventory investment specific to each industry (Gombola and Ketz, 1982; Singh and Kumar, 2014; Smith, 1987; Weinraub and Visscher, 1998). Panel B of Table 3 presents the average FWCR₁, FWCR₂ and OPRISK for each sector. The *Services and Transportation* and *Trade* sectors exhibit the highest FWCR values in both cases, meaning that firms in these sectors use more aggressive WCR financing policies, with 40.87 and 39% of their WCR financed with short-term financial debt, respectively, when using cash, and 76.07 and 49.58%, respectively, otherwise. These are the only sectors above the mean. On the other hand, the *Construction* sector shows a value 10 points below the mean, with only 24.06% of the WCR including cash financed by short-term costly debt. Thus, we can say that this sector has a more conservative financial policy, which could be explained by its longer operating cycle, making the sector more reliant on long-term debt. Regarding risk, the *Agriculture and Mining* sector has the highest standard deviation of ROA, at 2.94%. In contrast, the *Trade* sector exhibits the lowest value, with a risk of 1.99%.

Next, to better examine our hypothesis, we study the relationship between operating risk and financing WCR strategy. To do so, we have ordered the OPRISK variables from lowest to highest and have classified them into quartiles. OPRISK₁ refers to firms with lower operating risk, while OPRISK₄ refers to firms with higher levels of operating risk. OPRISK₂ and OPRISK₃ are firms with intermediate values.

Table 4 shows the average FWCR and its median value for each quartile of operating risk when including cash. Firms with lower operating risk, which are those of OPRISK₁, present a mean FWCR value of 44.18%, decreasing with each quartile. This means that when firms face greater operating risk, their financial strategy shifts from an aggressive to a more conservative one, which is consistent with the *substitution effect*. This relationship is also confirmed when considering the median of FWCR. A test for the difference of means is calculated between each quartile and the previous one, showing that all quartiles are statistically significantly

Table 4. Operating risk and financing of working capital requirements including cash

	FWCR ₁ (mean)	FWCR ₁ (median)
OPRISK ₁	0.4418	0.3699
OPRISK ₂	0.3854	0.2871
OPRISK ₃	0.323	0.2138
OPRISK ₄	0.2697	0.1594
t_1	8.82***	
t_2	10.28***	
t_3	9.51***	

Note(s): *indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level. t_1 is the value of the t-statistic for the mean difference between OPRISK₁ and OPRISK₂, t_2 is the value of the t-statistic for the mean difference between OPRISK₂ and OPRISK₃, t_3 is the value of the t-statistic for the mean difference between OPRISK₃ and OPRISK₄

different and have positive coefficients, which confirms the negative linear relationship. Table 5 shows the same analysis when excluding cash from the FWCR variable. Figure 1 illustrates both relationships graphically.

Figure 2 shows the relationship between OPRISK and FWCR by sector. The relationship between operating risk and financing strategy is negative and linear in every sector, showing decreasing values of FWCR when OPRISK increases. Again, this illustration aligns with the *substitution effect*, where firms with higher operating risk choose more conservative strategies to mitigate the trade-off between operating and financial risk. This relationship is also confirmed when using the median instead of the mean, although the *Agriculture and Mining* and *Construction* sectors show no differences between the two intermediate strategies. However, there are still significant differences between the first and last quartiles. Results remain similar when using FWCR without cash, although they are not shown.

4.2 Multivariate analysis

We argue that firms with higher operating risk would use more conservative WCR financing strategies. To confirm this hypothesis, in this subsection, we perform a multivariate analysis.

Table 6 presents the results of the estimations carried out for FWCR₁, including only firm and sector fixed effects in Column 1, and adding year effects in Column 2. We also cluster standard errors at the firm level in both and for FWCR₂ in Columns 3 and 4, respectively,

Table 5. Operating risk and financing of working capital requirements without cash

	FWCR ₂ (mean)	FWCR ₂ (median)
OPRISK ₁	0.5526	0.4473
OPRISK ₂	0.5176	0.3713
OPRISK ₃	0.4693	0.2963
OPRISK ₄	0.3976	0.2303
t_1	3.49***	
t_2	4.49***	
t_3	6.89***	

Note(s): *indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level. t_1 is the value of the t-statistic for the mean difference between OPRISK₁ and OPRISK₂, t_2 is the value of the t-statistic for the mean difference between OPRISK₂ and OPRISK₃, t_3 is the value of the t-statistic for the mean difference between OPRISK₃ and OPRISK₄

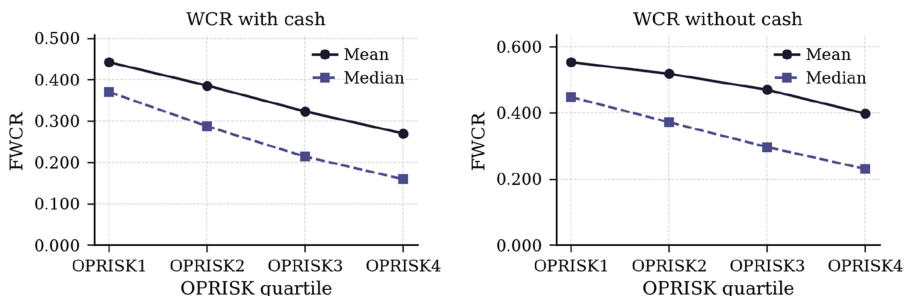


Figure 1. Operating risk and financing of working capital requirements. OPRISK: standard deviation of the company's return on assets in periods $t-2$, $t-1$ and t . FWCR: short-term bank debt divided by working capital requirements. *Source:* Authors' own work

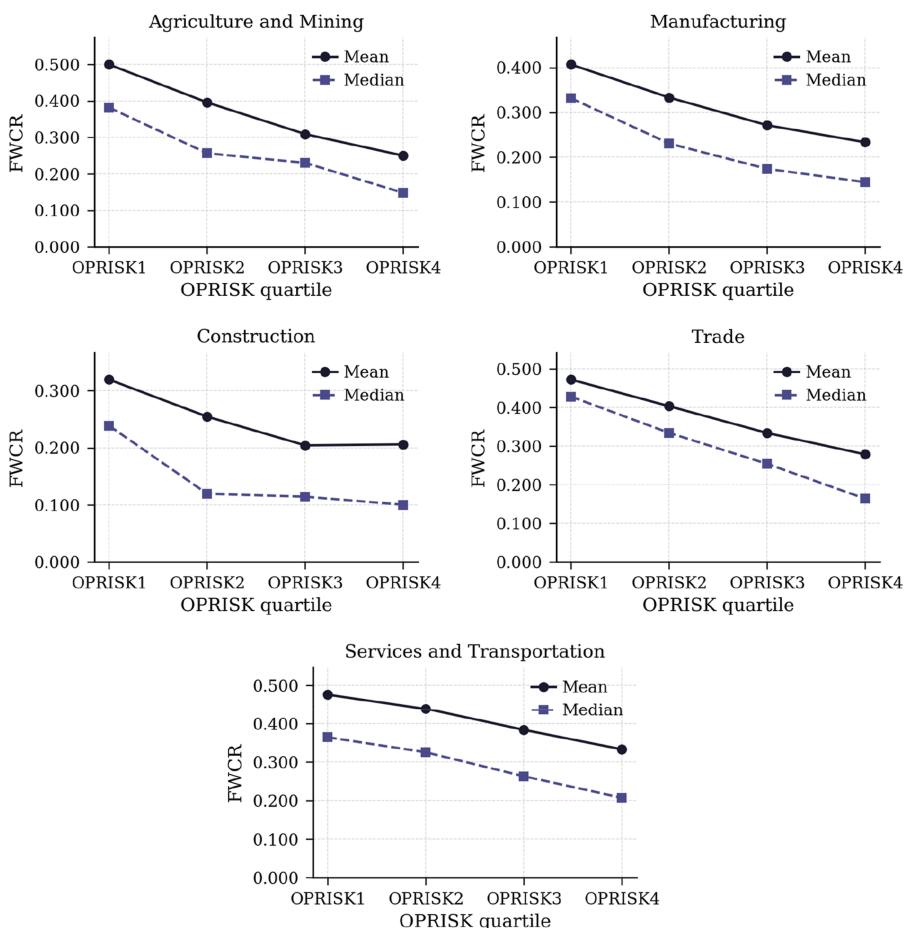


Figure 2. Operating risk and financing of working capital requirements by sector using cash. Standard Industrial Classification according to CNAE 2009: Agriculture and Mining, codes 01 to 09; Manufacturing, codes 10 to 39; Construction, codes 40 to 43; Trade, codes 45 to 48; Services and Transportation, codes 49 to 96 (except 64 to 68). *Source:* Authors' own work

Table 6. Effects of operating risk on the election of FWCR strategies

	FWCR ₁ (1)	FWCR ₁ (2)	FWCR ₂ (3)	FWCR ₂ (4)
OPRISK	−0.2935*** (−3.12)	−0.2023** (−2.15)	−0.2942* (−1.91)	−0.2645* (−1.71)
SIZE	0.0564*** (4.38)	0.0386*** (2.92)	0.0413** (2.35)	0.0234 (1.29)
AGE	0.0525*** (2.87)	0.0676*** (2.86)	0.1190*** (4.15)	0.0700* (1.79)
GROWTH	−0.0076 (−0.81)	−0.0142 (−1.48)	−0.0049 (−0.33)	−0.0022 (−0.14)
LEV	0.0156*** (4.61)	0.0162*** (4.78)	0.0260*** (9.60)	0.0258*** (9.52)
AM	0.0003* (1.70)	0.0003 (1.57)	0.0005*** (2.84)	0.0005*** (2.81)
ZSCORE	−0.0120*** (−10.04)	−0.0116*** (−9.49)	−0.0117*** (−7.48)	−0.0121*** (−7.66)
ZSCORE2	0.0001*** (7.85)	0.0001*** (7.55)	0.0001*** (4.16)	0.0001*** (4.29)
Intercept	−0.2036* (−1.88)	−0.0919 (−0.68)	−0.1650 (−1.09)	0.1688 (0.85)
Firm effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Time effects	No	Yes	No	Yes
Standard error clustered at firm level	Yes	Yes	Yes	Yes
F-test	31.70***	28.40***	14.51***	14.39***
Observations	26,661	26,661	26,661	26,661

Note(s): The dependent variable is the ratio of short-term bank debt to WCR, including cash in Columns (1) and (2), and without cash in Columns (3) and (4). OPRISK: standard deviation of the firm's economic return in periods $t-2$, $t-1$ and t . SIZE: Napierian logarithm of firm's sales; GROWTH: annual percentage change in sales; LEV: debt to equity ratio; AGE: Napierian logarithm of the number of years of the company; AM: firm's asset maturity; Z-SCORE: firm's financial solvency using [Begley et al.'s \(1996\)](#) model. F is an F -test that evaluates the joint significance of the model. The estimations include firm- and sector-fixed effects with standard errors clustered at the firm level in Columns (1) and (3) and firm, sector and year effects with standard errors clustered at the firm level in Columns (2) and (4)

*indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level

following the same methodology. The [Hausman \(1978\)](#) test yields a p -value of 0, which confirms the suitability of the fixed-effects method, although the test has not been included in the table. A joint significance F -test has also been conducted for all models.

The coefficient for operating risk is negative and statistically significant at standard test levels. This suggests that firms with higher operating risk tend to reduce their use of short-term financial debt to finance their WCR, which is consistent with the idea of a trade-off between operating and financial risk. This is confirmed when using only firm- and sector-fixed effects, but also when including year effects and for both FWCR measures.

Regarding the control variables, the signs remain constant when considering different methods, although the significance changes somewhat. Size is significantly and positively related to FWCR in the first columns, while it loses significance in the last column. This result indicates that larger firms follow a more aggressive strategy, thus issuing more short-term debt, as found by [Scherr and Hulburt \(2001\)](#). In any case, they indicate that the impact of firm size depends on several factors that may affect the statistical outcome. Age has a positive relationship with FWCR, indicating that older firms use more aggressive financing strategies. This is because older firms are more likely to have higher agency costs, as they may become

less efficient in managing their resources and controlling their expenses. To reduce these conflicts, they might use more short-term financial debt, since this type of leverage reduces agency problems, as shown by [Marchica \(2008\)](#). Growth presents no significant relationship. Leverage exhibits a positive relationship with FWCR, indicating that leveraged firms issue more short-term debt. Thus, they use more aggressive financing strategies, which is consistent with [Dang's \(2011\)](#) results. Asset maturity shows, contrary to [Myers \(1977\)](#) and [Ozkan \(2000\)](#), a positive coefficient, meaning that the longer the asset maturity, the greater the use of short-term financial debt to finance WCR. However, the significance is sensitive to the FWCR measure. The Z-score displays a convex and significant relationship, indicating that both firms with stronger and weaker financial positions use less short-term debt, which is consistent with previous literature ([Diamond, 1991](#); [Scherr and Hulburt, 2001](#)). However, the estimated turning point lies around the 98th percentile of the variable, regardless of the regression. Hence, although the specification is convex, the relationship is monotonically decreasing over nearly all of our sample, suggesting that the convexity is not empirically operative within the sample. Therefore, the economic result of this variable suggests that firms with greater financial strength rely less on short-term debt to finance their WCR. Results remain similar when using FWCR₂, which excludes cash.

Furthermore, we examine whether the relationship between operating risk and working capital financing is affected by firms' financial constraints. To this end, we use the Whited and Wu Index (WW) as a proxy for financial constraints ([Whited and Wu, 2006](#)), which we multiply by -1 for ease of interpretation. This index combines information on cash flow, dividends, leverage, size and industry and firm sales growth. We create a dummy variable to indicate that a firm is more financially constrained when the WW index is above the median value. This median split approach allows us to compare firms facing relatively high versus low financial frictions. We also verify robustness using the continuous specification of the index, which has also been multiplied by -1 . [Table 7](#) displays the results from these analyses. The

Table 7. Effects of financial constraints on the relationship between operating risk and FWCR strategies

	FWCR ₁ (1)	FWCR ₁ (2)	FWCR ₂ (3)	FWCR ₂ (4)
OPRISK	−0.6724*** (−5.52)	−0.5325*** (−4.34)	−0.7244*** (−2.83)	−0.6616*** (−2.59)
WW index	0.0248*** (3.77)	0.0251*** (3.84)	0.0339*** (2.74)	0.0337*** (2.72)
OPRISK * WW	−0.6723*** (−4.20)	−0.6109*** (−3.82)	−0.7702** (−2.50)	−0.7422** (−2.41)
Control variables	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Time effects	No	Yes	No	Yes
Standard error clustered at firm level	Yes	Yes	Yes	Yes
F-test	55.94***	53.67***	7.18***	7.14***
Observations	26,661	26,661	26,661	26,661

Note(s): The dependent variable is the ratio of short-term bank debt to WCR, including cash in Columns (1) and (2), and without cash in Columns (3) and (4). OPRISK: standard deviation of the firm's economic return in periods $t-2$, $t-1$ and t . WW: dummy for the [Whited and Wu \(2006\)](#) index multiplied by -1 , takes 1 if the firm has a value above the median, 0 otherwise. Control variables include the same variables used in the main analysis (SIZE, GROWTH, LEV, AGE, AM, Z-SCORE). F is an F -test that evaluates the joint significance of the model. The estimations include firm- and sector-fixed effects with standard errors clustered at the firm level in Columns (1) and (3) and firm, sector and year effects with standard errors clustered at the firm level in Columns (2) and (4). *indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level

coefficient of the operating risk measure remains similar, which matches the idea of a trade-off between operating and financial risk. The coefficient of the WW index is positive, meaning that financially constrained firms rely more heavily on short-term debt to finance their WCR, which supports the results for the Z-SCORE variable. More importantly, the interaction term is negative and significant. This suggests that, although all firms seem to follow more conservative strategies when they have higher operating risk, financially constrained firms exhibit a stronger adjustment in the financing structure of their WCR, becoming even more conservative. This result holds when cash is excluded from the measurement of FWCR.

Moreover, we perform some robustness tests to verify the validity of our results. Specifically, we add the variable OPCOST, which measures operating risk as operating costs to total assets, as defined by [Novy-Marx \(2011\)](#) in [Table 8](#), and lag all variables by one period for both operating risk variables in [Table 9](#).

Results from the alternative operating risk measure provide negative and significant coefficients, regardless of whether cash is included in the measurement of our dependent variable. This additional analysis provides similar conclusions: firms with higher operating risk follow more conservative strategies when financing their WCR. The control variables

Table 8. Effects of operating risk on the election of FWCR strategies – alternative risk measure

	FWCR ₁ (1)	FWCR ₁ (2)	FWCR ₂ (3)	FWCR ₂ (4)
OPCOST	−0.1104*** (−13.01)	−0.1176*** (−13.86)	−0.1828*** (−10.16)	−0.1854*** (−10.27)
SIZE	0.1361*** (9.53)	0.1240*** (8.54)	0.1728*** (7.19)	0.1577*** (6.44)
AGE	0.0104 (0.57)	0.0379 (1.60)	0.0523 (1.57)	0.0253 (0.58)
GROWTH	−0.0015 (−0.16)	−0.0092 (−0.97)	0.0055 (0.32)	0.0058 (0.34)
LEV	0.0078** (2.39)	0.0081** (2.50)	0.0132*** (2.69)	0.0131*** (2.67)
AM	0.0004** (2.17)	0.0003** (2.03)	0.0005** (1.99)	0.0005 (1.96)
ZSCORE	−0.0175*** (−13.47)	−0.0173*** (−13.08)	−0.0206*** (−7.96)	−0.0209*** (−7.88)
ZSCORE2	0.0001*** (10.89)	0.0001*** (10.71)	0.0001*** (4.81)	0.0001*** (4.82)
Intercept	−0.5791*** (−5.15)	−0.5456*** (−3.95)	−0.7900*** (−3.98)	−0.5518** (−2.24)
Firm effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Time effects	No	Yes	No	Yes
Standard error clustered at firm level	Yes	Yes	Yes	Yes
F-test	57.66***	58.44***	28.28***	28.16***
Observations	26,603	26,603	26,595	26,595

Note(s): The dependent variable is the ratio of short-term bank debt to WCR, including cash in Columns (1) and (2), and without cash in Columns (3) and (4). OPCOST: operating costs to total assets ratio; SIZE: Napierian logarithm of firm's sales; GROWTH: annual percentage change in sales; LEV: debt to equity ratio; AGE: Napierian logarithm of the number of years of the company; AM: firm's asset maturity; Z-SCORE: firm's financial solvency using [Begley et al.'s \(1996\)](#) model. F is an F-test that evaluates the joint significance of the model. The estimations include firm- and sector-fixed effects in Column (1), firm, sector and year effects in Column (2), and the same fixed effects but clustering standard errors at the firm level in Columns (3) and (4), respectively

*indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level

Table 9. Effects of operating risk on the election of FWCR strategies – one-period lagged variables

	FWCR ₁ (1)	FWCR ₁ (2)	FWCR ₂ (3)	FWCR ₂ (4)
OPRISK	–0.2371*** (–2.66)	–0.1551* (–1.68)	–0.4124* (–1.92)	–0.4597** (–2.14)
OPCOST	–0.0481*** (–5.15)	–0.0474*** (–5.08)	–0.0389** (–2.14)	–0.0387*** (–2.11)
Control variables	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Time effects	No	Yes	No	Yes
Standard error clustered at firm level	Yes	Yes	Yes	Yes
Observations	16,314	16,314	16,314	16,314

Note(s): The dependent variable is the ratio of short-term bank debt to WCR, including cash in Columns (1) and (2), and without cash in Columns (3) and (4). OPRISK: lagged standard deviation of the firm's economic return. OPCOST: operating costs to total assets ratio. Control variables include the same variables used in the main analysis (SIZE, GROWTH, LEV, AGE, AM, Z-SCORE). F is an *F*-test that evaluates the joint significance of the model. The estimations include firm- and sector-fixed effects in Column (1), firm, sector and year effects in Column (2), and the same fixed effects but clustering standard errors at the firm level in Columns (3) and (4), respectively

*indicates significance at the 10% level. **indicates significance at the 5% level. ***indicates significance at the 1% level

display similar coefficients, although the significance of some varies across different estimations. Furthermore, we perform the analyses using another alternative operating risk measure, calculated as the SD_ROA/SD_SALES ratio, which provides analogous results. The effect of financial constraints using these variables also provides similar results. These results are available upon request.

We also use [Petersen's \(2009\)](#) two-way clustering method, which controls the standard errors at the firm and year level, obtaining less biased errors. Additionally, we use [Fama and MacBeth's \(1973\)](#) estimation method, which controls for time. Results remain unchanged, and the main variables still hold significance, although the value of some control variables or their significance varies across methods. Results are not shown as there are few to no changes.

To assess potential endogeneity concerns, we conduct a Durbin–Wu–Hausman test based on a residual inclusion approach, which is standard in corporate finance literature to evaluate whether an instrumental variable (IV) estimation is required (for example, [Antia et al., 2010](#); [Duarte et al., 2016](#)). The test yields a *p*-value of 0.384 in the most restrictive specification. Therefore, the test fails to reject the null hypothesis, suggesting that there is no statistical evidence of endogeneity. Nevertheless, as an additional robustness check, we also estimate instrumental-variable specifications using lagged values of our main independent variable as instruments. The IV results are consistent with the baseline findings and do not alter the main conclusions.

5. Conclusion

When studying debt maturity, corporate finance literature has focused on the determinants of a firm's debt structure to understand how managers can improve their performance, either by increasing profitability or reducing risk. Recently, the so-called *substitution effect* has been examined, which involves investment, capital structure and risk management decisions ([Sarkar, 2020](#)). However, the literature on how these decisions affect the financing strategy of WCR has been scarce.

This paper aims to investigate how the firm's operating risk may affect the financing of WCR. When financing WCR, firms can choose aggressive strategies using more short-term financial debt, which is riskier, a conservative strategy using long-term resources, which reduces risk, or an intermediate position. Firms with higher levels of operating risk must find solutions to compensate for their total risk; thus, they may choose to reduce their financial risk. We focus on how this effect could impact the financing strategy of WCR, arguing that firms with higher operating risk may choose more conservative strategies, as they need to reduce their financial risk by issuing longer-term debt, which is less risky.

The results show a negative relationship between WCR financing strategies and operating risk, which is coherent with the presence of a *substitution effect* between operating and financial risk. Specifically, firms with higher operating risk tend to rely less on short-term debt to finance WCR, thereby adopting more conservative financing strategies. In contrast, firms with lower operating risk appear to follow more aggressive strategies, since they can increase their financial risk much more than those with high operating risk. The results are confirmed for the two operating risk approximations used and by several regression estimations and methods. Moreover, we find that this effect is more pronounced for financially constrained firms, which suggests that these firms become even more conservative when their operating risk is high, and that they exhibit a stronger adjustment in the financing structure of their WCR.

This work highlights the importance of cohesive business management. Managers should assess their DOL to better understand the extent of their operating risk. In this way, they may be able to determine the best financial option when the time comes to borrow. Managers who do not take operating risk into consideration when selecting the debt maturity to finance WCR may expose the firm to higher overall risk, which could potentially affect its financial stability.

Our findings may assist managers in evaluating their DOL, thereby enhancing their understanding of operational risk exposure. This, in turn, can support more informed and strategic financial decision-making, particularly when selecting the most appropriate borrowing options. Future research could extend the analysis to SMEs in other countries with similar bank-oriented financial systems, such as Mediterranean and European economies, to assess whether the mechanisms hold across comparable institutional settings.

Our work has some limitations. The first one is that the sample mainly presents years of economic expansion and low interest rates in Spain, which may facilitate the ability of firms to shift between financing strategies. Thus, we are unable to study the effects of operating risk on financing WCR strategies during periods of economic downturn, when increased risk exposure could jeopardise the firm's financial stability. Although similar results may be inferred, future research could address working capital financing strategies under such economic conditions. Moreover, our sample may be subject to selection bias, as it only includes firms with audited financial statements and complete data. This may not be representative of the overall population of Spanish SMEs. Relating WCR financing and financial reporting quality could be another future line of research.

Ethical considerations

This article does not contain any studies with human or animal participants.

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