Współczesna Gospodarka

IN MARI VIA CUA

Contemporary Economy
Electronic Scientific Journal
Współczesna Gospodarka (ug.edu.pl)

Vol. 18 Issue 1 (2024) 1-14
*ISSN*2082-677X
DOI 10.26881/wg.2024.1.01

OPERATING RISK AND FIRM'S PROFITABILITY: EVIDENCE FROM NON-LISTED MANUFACTURING FIRMS FROM V4 COUNTRIES

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Abstract

Purpose. This study contributes to the ongoing debate on determinants of firms' resilience strategies while facing a crisis, by referring to the operating risk. The purpose of our work is to examine the effects of operating risk on profitability of non-listed firms in manufacturing sector. Therefore, our study responds to the literature gap within investigating this problem at sector level, and among smaller firms.
Methodology. Our evidence is based on accounting-based data, covering four countries (Poland, Czechia, Slovakia and Hungary) and large number of non-listed firms. We apply WLS (Weighted Last Squared) regression to test two models of the impacts of operating risk on firm's profitability.
Findings. Our results indicate that firms exposed to higher operating risk, tend to be less profitable. While considering cross-effects of operating and financial risk in our model, we found strong and sound evidence that the interplay between operating and financial risk exposure exerts a negative impact on firm's profitability. These results have important implications, by demonstrating that during the period of crisis firms need equity financing to sustain resilience.

Keywords: operating risk, financial risk, firm performance, profitability

JEL classification: G32, G33, M21

Introduction

The operating risk (also referred to as business risk) increases dramatically if a firm faces the decrease in sales revenues and/or the increase of operating costs, in particular – the fixed costs. In such conditions, a firm loses its abilities to earn operating profit (Brigham, Ehrhardt, 2011). The COVID-19 pandemic outbreak has shown how disruptive could be the loss of income, that

numerous businesses faced in the period of lockdown. This experience has enhanced a discussion on business resilience strategies (Hillman, Guenther, 2021; Bryce et al., 2020), in this – the financial determinants of firm's resilience capabilities that are determined by continuity of sales and stability of prices and operating overheads.

Our study contributes to this on-going debate, by shedding some light on effects of operating risk on firm's performance. The major motivation behind our work is the existing literature gap identified by Grau and Reig (2020) who investigated the operating risk and performance of the SMEs (small and medium sized firms) operating in agrifood industry in Europe. They have called for further works to investigate this problem in other sectors, across EU countries. In response to this call, we also explore the link between operating risk and firms' performance among the SMEs, but operating in manufacturing sector and non-listed firms, and in the group of four Visegrad Group (hereafter the V4 countries): Poland, Slovakia, Czech Republic and Hungary. We designed our study to cover several gaps in the existing literature, in terms of problem and sample oriented context.

First of all, there is a rich body of the literature concerned about the effects of financial risk (and financial leverage) on firm's performance (see e.g. Myers, 1984; Graham, 2000, or Kayhan, Titman, 2007). Overall, the prevalent empirical evidence confirms a negative regression slope between firm's profitability and financial leverage, by this questioning the assumptions of trade-off theory. There is also a rich body of the literature that revises both financial and operating leverage, but from the cost of capital oriented perspective (betas and the expected yields of firm's shares, e.g. Mandelker, Rhee 1984; Zhang, 2005; García-Feijoo, Jorgensen, 2010; Novy-Marx, 2011; Houmes et al., 2012; Cao, 2015). In this discussion, the isolated operating risk effects on performance are regarded as unsearched (Grau, Reig, 2019). In our study, we revise the isolated effect of operating leverage on firm performance.

Second, in the existing literature there is also a gap in sample-oriented dimension. In the studies that have at least partially addressed the operating risk exposure, there is a prevalence of works that use data from listed (thus larger) firms. The studies on non-listed firms remain scarce, which is not surprising given the analytical constraints in data availability. In addition, the majority of non-listed firms could be regarded as the SMEs, due to the size of their assets or the volume of the annual revenues. Our study fills in this gap, as it covers a large panel of data for non-listed firms.

Third, also in sample oriented context, prior empirical works have confirmed that operating risk is determined by the industry (Novy-Markx, 2011). However, given the industry-specifics, the works tend to isolate non-financial sector and utilities (e.g. Chen et al., 2019). Guided by Grau and Reig (2020) approach, who revised the operating risk in agri-food sector, our attention is also attracted by a single sector, namely the manufacturing sector, and we tightly controlled the selection of firms by following their NAIC codes. In this regard, our work adds to the existing body of the literature by providing sound evidence on operating risk and performance at industry-specific level.

Finally, the sample-oriented gap is also connected with lack of international studies. Grau and Reig (2020) have confirmed that the country-effect is an important driver of the operating risk, given the relevance of institutional settings for the developments of technology and infrastructure, approaches to innovations, or the overall benefits from the economic growth or competitiveness. In this regard, our study contributes by providing evidence for a relatively homogenous international sample, that covers firms that operate in Czech Republic, Slovakia, Hungary and Poland (the Visegrad Group, hereafter referred to as the V4 countries). In numerous dimensions, these countries are still perceived as similar, given their former history of the performance under the regime of a command economy, similarities on their route to transition and accession to the EU, and finally, their similar level of economic development as a group of emerging European economies, against the core EU countries (Kowalska at al., 2018).

Guided by the above outlined literature gaps, the purpose of our study is to examine the effects of operating risk on the performance of non-listed firms that operate in manufacturing sector, in four emerging European countries of our interest. In methodical context, our work is guided by the recent studies of Grau and Reig (2020) and Chen et al. (2019), who applied regression model to explain profitability (proxied by return on firm's assets) and operating leverage, as the main explanatory variable and the proxy of firm's operating risk (consistently with O'Brien, Vanderheiden, 1987; Houmes et al., 2012; Harjoto, 2017). With a considerable panel of around 7300 firm-year observations, we have found sound evidence on the negative effects of operating risk on firm's performance.

The remainder of this study is organized as follows. In the first section we develop research hypotheses, with reference to the existing literature. In the second section we explain research design and method. Third section presents and discusses the results. In the final section we conclude, by addressing the implications of our work and outlining the avenues for further research.

1. Literature review

Firm's operating profitability depends on the interplay of its operating costs and sales revenues, which is clearly highlighted in the break-even point analysis (Brigham, Ehrhardt, 2011). If the firm faces the decrease of sales revenues, and/or increase in operating costs, the ability to achieve the operating profit is constrained. The operating risk itself results from the gearing effect of the structure of operating costs, if we consider the fixed and variable costs (also known as operating leverage effect) (Lev, 1974). The costs' structure is predominantly driven by the structure of assets, which remains determined by firm's investment decisions (O'Brien and Vanderheiden (1987), Houmes et al. (2012), Harjoto (2017)). In this regard, the operating risk is determined by the organisation of internal operating processes in the firm. However, there are branches that per se are more exposed to operating risk, as their performance requires high investments in fixed assets (e.g. heavy industry). Also, firms that operate in the branches where high volatility of demand is possible, are regarded as exposed to greater operating risk, due to the instability of sales revenues. The operating leverage effect demonstrates, that if sales revenues decrease, firms' with greater level of operating risk (determined by the interplay of fixed and variable assets), are exposed to greater loss of operating profits. The degree of operating leverage is helpful in capturing this effect and in quantifying operating risk exposure, as it measures of how much operating profits could be lost due to change in sales revenues (Brigham, Ehrhardt, 2011).

Prior literature provides rich evidence on the effects of operating leverage (and operating risk) on profits. Interestingly, Chen et al. (2019) have shown that operating leverage is significantly and positively associated with profitability, in the favourable and expansionary times. However, in accordance to the trade-off theory, the prevalent evidence confirms the negative impact of operating risk (and high degree of operating leverage) on firms' performance, if measured with profitability. In the SMEs context, prior works confirm the relevance of firm's size if the association of operating risk and profitability is considered (Lopez-Valeiras et al., 2016). Thus, in our study that is focused on non-listed (and thus not large) firms operating in manufacturing sector, our first hypothesis is:

H1: *Operating risk is negatively associated with firm's profitability*

The association between operating risk and firm's profitability is more complex, if we consider the total risk of a company by considering the impact of financial risk. Following Hamada (1972) observations, the decisions on how to finance firm's assets (structure of debt and equity) determine the financial leverage and the related financial risk, and add to the operating risk exposure. Greater degree of debt financing, relative to equity, adds to the gearing effect, due to the cost of interest rates. Thus, if the sales revenues decline, firms with greater burden of debt and

cost of interests to be covered, face more difficulties in achieving profitability (Brigham, Erhardt, 2011). The interplay between operating and financial risk has been widely researched, and in many instances confirmed the negative association between financial risk and profitability and the offset of these two types of risk (Kahl et al., 2014, Cao, 2015). However, Chen et al. (2019) have noted that firms control the level of their operating risk to avoid insolvency (which is the outcome of too high financial risk exposure). They observed that when facing the arrival of a crisis period, firms with higher operating risk exposure tend to minimize the financial risk exposure determined by their capital structure decisions. In this context, it is very important to properly understand the interplay between the increased operating risk and insolvency, that could be amplified by shortening of funds or more restricted conditions of obtaining additional funding. This interplay is critical for avoiding the bankruptcy threat, through conscious and well-thought managerial decision making while facing external difficulties. Following this observation, our second hypothesis we test in this work, with reference to non-listed firms operating in manufacturing sector, is that:

H2: *Operating risk is negatively associated with firm's relationship between financial risk and profitability.*

2. Research Design and Method

3.1. Sample and data

For the purposes of this work, we use the EMIS database that provides the accounting-based financial data from firms' financial statements, for firms that perform in Emerging European Economies (EMIS, 2023). The database covers the firms which perform i.a. in the four Visegrad Group countries of our interest (hereafter referred to as the V4 countries), namely: the Czech Republic, Hungary, Slovakia and Poland. EMIS database offers the option to request data for a single sector. Thus, we have filtered out financial data of firms that declared manufacturing sector as the main sector of their performance (following the NAICS codes 31-33).

From the EMIS database we have requested financial data in 2017-2019 time-span, to obtain a complete dataset for the pre-pandemic period. We excluded 2020 and 2021 from our analysis. The major reason was that there is some strong evidence that pandemic has caused serious disturbances in firms' performance, and this effect is visible in the firms' financial results for 2020 and 2021, regardless their sector belonging (Hu, Zhang, 2021; Shen et al., 2020). Furthermore, in numerous instances the EMIS dataset was incomplete for 2021 (due to the lagged process of data collection).

Nevertheless, in our request for financial data in 2017-2019 time span, we have controlled for the maximum records obtainable for manufacturing sector (NAICS 31-33), given the 2017 as the first year of our interest. We have also controlled for the overall number of firms that perform in the manufacturing sector in the period of our interest, given the Eurostat dataset (Eurostat, 2017). In Table 1 we explain on how we derived the final number of firm-year observations, under above specified terms of request. Data provided in Table 1 indicate, that there is a slight discrepancy between the number of observations provided in the EMIS database, and according to Eurostat dataset. The EMIS database covers a relatively higher number of records for Hungary and Poland (c.a. 14%), in comparison to Czech Republic and Slovakia (2% and 4.6%, respectively).

Table 1. The procedure of sample composition

Item	CZ	HU	SLO	PL	In total
Number of all firms recorded in EMIS data-	3692	7392	3364	27906	42354

base for manufacturing sector (NAICS 31-33)					
No of firms performing in manufacturing sector according to Eurostat, as on 2017 (the first year of observations)	175894	50809	72563	198757	498023
The percentage of firms in EMIS database, relative to Eurostat dataset	2.10%	14.55%	4.64%	14.04%	8.50%
Downloaded observations from EMIS database					
number of record, for each year	600	600	600	1500	3000
as a % of the number of all available firms	0.341%	1.181%	0.827%	0.755%	0.602%
Final sample (firms that offer complete set of variables, each year – without firms with missing or biased data)					
2019	580	392	491	1039	2502
2018	585	380	472	1015	2452
2017	578	376	433	997	2384
In total, as the number of firm-year observations	**1743**	**1148**	**1396**	**3051**	**7338**

Source: Own study.

However, the ultimate number of records we have downloaded from the EMIS database was guided by the specifics of the dataset. The EMIS database ranges the observations in accordance to the volume of sales revenues, and the number of missing records increases with the number of downloaded observations (at firm level). We have confirmed this for Poland, where the number of missing accounting based financial data was considerable for a sample exceeding 1500 records. In particular, we observed that although the major data was available (sales revenues or the volume of assets), the detailed accounting-based figures were missing. Thus, we have decided to apply the cut-off point, that offers the same number of entry records for Czech Republic, Hungary and Slovakia (guided by the number of available records for these countries in EMIS database), and slightly greater number of records for Poland, which has a considerable number of firms operating in manufacturing sector, according to the Eurostat, and is also widely covered by the EMIS database.

Further, we have carefully verified the number of missing records of the accounting-based financial data relevant to our examinations. We have also controlled for the potential bias in the dataset, by revising the balance between assets and total liabilities, or the components of assets (fixed and current) and the components of funds (equity and short and long term liabilities). As it can be seen in Table 1, the number of missing or biased records was considerable for Poland. After the data-controlling procedures we have implemented, we received 7338 firm-year observations, suitable for empirical analysis. At country level, the sample is relatively balanced, given the country representation in EMIS database and overall Eurostat statistics.

In Table 2 we provide the structure of our sample (on firm-year observation level), given the distribution of the sub-sectors of manufacturing industry. Transportation equipment manufacturing and food manufacturing firms are prevalent in our sample, with 16.38% and 15.85% share, respectively.

Table 2. Sample composition: structure of observations in sub-sector dimension

Sub-sector of manufacturing (31-33)	NAICS code	N	% of the sample
Food manufacturing	311	1163	15.85%
Beverage and Tobacco	312	167	2.28%
Textile Mills	313	26	0.35%

Textile product mills	314	39	0.53%
Apparel manufacturing	315	20	0.27%
Leather and allied product manufacturing	316	38	0.52%
Wood product manufacturing	321	144	1.96%
paper manufacturing	322	216	2.94%
printing and related support activities	323	59	0.80%
petroleum and coal product manufacturing	324	64	0.87%
chemical manufacturing	325	565	7.70%
plastic and rubber	326	671	9.14%
Nonmetalic mineral product manufacturing	327	448	6.11%
Primary metal manufacturing	331	282	3.84%
Fabricated metal	332	642	8.75%
Machinery manufacturing	333	540	7.36%
Computer and electronic product manufacturing	334	283	3.86%
Electrical Equipment, Appliance, and Component Manufacturing	335	474	6.46%
Transportation Equipment Manufacturing	336	1202	16.38%
Furniture and Related Product Manufacturing	337	194	2.64%
Miscellaneous Manufacturing	339	101	1.38%
In total		**7338**	**100.00%**

Source: own study.

3.2. Variables

We proxy firm's profitability with ROA (return on assets), computed as operating income to assets (consistently with Grau and Reig, 2020). We adjust the measurement of return on assets to the operating level, by applying operating income in the nominator, to capture the direct effects of firm's operating performance. Thus, we avoid the drawbacks of net income based ROA, which is the potential impact of tax policy at country-level, or extraordinary items. Adjusted ROA is also in line with the operating leverage measurement procedure and break-even-point analysis approach (Brigham, Ehrhardt, 2011).

The operating risk is our main explanatory variable. Following prior literature, we assume that a good measure of firm's operating risk is its operating leverage. However, measuring operating leverage for non-listed firms is quite challenging, as these firms in majority prepare simplified financial statements, where the structure of the operating costs is not detailed. Thus, for the non-listed firms we are not able to soundly use the cost-based measures (e.g. costs of goods sold (COGS), or sales, general and administrative expenses (SG&A)) to determine the level of operating leverage (e.g. Chan et al., 2019; Novy-Marx, 2011). However, in numerous empirical works the operating leverage is proxied with assets structure based measure, namely the share of fixed assets in total assets. The rationale behind is that high level of fixed assets generate high fixed costs (O'Brien, Vanderheiden, 1987; Houmes et al., 2012; Harjoto, 2017). Thus, our main explanatory variable – the operating risk – is proxied by a ratio of fixed assets to total assets ORISK. This approach was also adopted by Grau and Reig (2020), in their agri-food sector study. We also control for operating risk effect with dummy variable ORISK_dum. Firms with ORISK above the average measured at sub-sector level, are considered as those of higher operating risk, the remaining – as of lower operating risk.

Following Grau and Reig (2020), we control for a range of additional main explanatory variables. The first is the financial risk (FRISK), by considering financial leverage (debt to assets). Financial leverage is also a good indicator of firm's indebtedness, as it shows the share of debts in capital structure. The prevalent prior evidence indicates a negative regression slope between profitability and financial leverage. We also control for firm's size (SIZE), by applying

the natural logarithm of sales revenues as a proxy of firm's size. Sales revenues are also informative in the context of firm's market power (Grau, Reig, 2020). Further, we control also for firm's age (AGE), which is captured by the number of years since firm's performance. In our sample we included only the firms that perform min. for 4 years, to eliminate the very young firms, that have just entered the market. Young firms are regarded as those with good growth prospects and more dynamic on the market, which could stimulate their sales revenues, but on the other hand facing greater costs pressure (Martínez-Sola et al., 2014).

Finally, we incorporate three control variables. We control for firm's financial liquidity (LIQ_CR), as the firms of poor financial liquidity are financially constrained, which may exert an impact on their returns. The cash ratio (CASH) is a measure of the available financial slack, that informs on firm's available cash holdings that could be used as a buffer against the adverse market conditions. In this regard, cash ratio is an indicator of firm's resilience to negative impact of unforeseen external shocks. Finally, we control for operating profit margin (OPM) that explains the firm's earnings power, given the difference between the total operating costs and the level of sales revenues.

The definitions of the variables are provided in Table 3. Overall, the definitions of our control variables (see Table 3) are consistent with prior literature, in particular Rajan and Zingales (1995), Welch (2004), Kayhan and Titman (2007), and Lemmon, Roberts, and Zender (2008). The variables we control in this study are guided by prior empirical evidence, given their explanatory effect on profitability (e.g. Chaddad, Mondelli, 2013; Chen et al., 2019; Lopez-Valeiras et al., 2016; Grau, Reig, 2015; Yazdanfar, Öhman, 2015). In the appendix, we provide the descriptive statistics for the variables, and the detailed specification of means of our dependent and main . In Table 5 we additionally provide a detailed specification of the means of our dependent and main explanatory variable (ROA and ORISK), in cross-country dimension.

Table 3. Definitions of the variables

Variable	Definition
ROA	return on total assets, computed as operating profit to total assets
ORISK	operating risk, proxied by fixed assets to total assets (as a measure of operating leverage)
ORISK_dum	operating risk as dummy variable: 1 if ORISK is higher than the average at a subsector level; 0 – otherwise
FRISK	financial risk, proxied by debt to total assets (as a measure of financial leverage)
SIZE	firm's size, proxied by natural logarithm of sales revenues
AGE	number of years since firm's inception and the year of observations
LIQ_CR	current ratio of liquidity, computed as current assets to short-term debt
CASH	cash ratio, computed as cash and cash equivalents, relative to total assets
OPM	operating profit margin, computed as operating profit to sales revenues

Source: Own study.

2.3. Model and empirical approach

In methodical context, our work is guided by the sector-oriented study by Grau and Reig (2020). More specifically, we follow their procedure in terms of controlling the effects of operating risk on firm's performance. We estimate and contrast two models. Model 1 includes tests all variables – the operating risk; financial risk, size and age as three additional main explanatory variables, and the three control variables:

$$ROA = \beta_0 + \beta_1 ORISK + \beta_2 FRISK + \beta_3 AGE + \beta_4 SIZE + \beta_5 LIQ_{CR} + \beta_6 CASH + \beta_7 OPM + \varepsilon \quad (1)$$

Model 1 helps to verify the first hypothesis we posit in our investigation (H1).

Model 2 adds cross-effect ($FRISK * ORISK\_dum$), to better understand if the effect the main variable on profitability depends on whether a firm is of high or low level of operating risk:

$$ROA = \beta_0 + \beta_1 FRISK + \beta_2 (FRISK * ORISK\_dum) + \beta_3 AGE + \beta_4 SIZE + \ + \beta_5 LIQ_{CR} + \beta_6 CASH + \beta_7 OPM + \varepsilon \quad (2)$$

In Model 2, following Grau and Reig (2020) approach, we excluded ORISK. Model 2 is applied to verify our second hypothesis (H2). The cross-effect approach is consistent with prior literature in the field (Kestens et al., 2012; Baños-Caballero et al., 2012, 2014; Cen et al., 2015).

As our empirical investigations use accounting-based financial data, there are some limitations for using OLS (Ordinary Least-Squares) regression in modelling. Financial data are often heteroscedastic, thus OLS regression could provide biased estimations, as pointed by Strutz, 2016). We confirmed this problem for our dataset, by performing Breush-Pagan test (p-value<0.000). To handle this issue, we perform WLS (Weighted Last Squared) regression (Ozkan, Ozkan, 2004). We have also winsorised the data at 1%.

In Table 4 we present the Pearson's correlation between the examined variables. Similarly for Grau and Reig (2020) study, we have obtained strong correlation for two sets of variables. The first set are two measures of operating performance – ROA and OPM, as both indicate the cost pressures, relative to sales revenues. The second set are two measures of financial distress – financial leverage FRISK and financial liquidity LIQ_CR, that are interlinked with the debt level. Thus, while running WLS regression models we controlled for multicollinearity of the variables, by applying VIF (Variance Inflation Factor) test. The VIF test, however, has confirmed no multicollinearity (as VIF was below 5 for each set of variables in the tested models). Thus, the strength of correlation in our models was not biasing the results.

Table 4. Pearson's correlation coefficients between the examined variables

Variable	ROA	ORISK	FRISK	AGE	SIZE	LIQ_CR	CASH	OPM
ROA	1.0000	-0.0720	-0.3380	0.0711	0.0318	0.3594	0.2396	0.8525
ORISK	-0.0720	1.0000	-0.1331	-0.0252	-0.0721	-0.2011	-0.1473	0.0551
FRISK	-0.3380	-0.1331	1.0000	-0.1346	0.0435	-0.7333	-0.2600	-0.4496
AGE	0.0711	-0.0252	-0.1346	1.0000	0.0694	0.1215	0.0088	0.0898
SIZE	0.0318	-0.0721	0.0435	0.0693	1.0000	-0.0681	-0.0725	0.0052
LIQ_CR	0.3593	-0.2011	-0.7333	0.1215	-0.0682	1.0000	0.3713	0.3962
CASH	0.2396	-0.1473	-0.2600	0.0088	-0.0725	0.3713	1.0000	0.2257
OPM	0.8525	0.0551	-0.4496	0.0898	0.0052	0.3962	0.2257	1.0000

Notes: all correlations coefficients are statistically significant at 1%.

Source: Own study.

2.4. Results and discussion

The regression results are provided in Table 5. Model 1 was designed to test the effects of all variables we consider in this study. With 0,1% of statistical significance, this model shows that operating risk is a fundamental determinant of profitability in non-listed manufacturing companies, operating in V4 countries. The negative regression slope between ROA and ORISK indicates that the higher is the operating risk, the lower is firm's profitability. Thus, our first hypothesis (H1) found strong support. This observation is consistent with Grau and Reig (2020) findings for SMEs operating in agri-food industry. In addition, model 1 indicates that more profitable are the non-listed manufacturing companies that are younger, larger, of better finan-

cial liquidity, and have higher operating margin (all significant at 0,1%). We have also confirmed that financial risk is positively associated with firm's profitability in our sample. This suggests that the positive effects of financial leverage – more debt in capital structure, enhance firm's profitability.

Model 2 was designed to test the cross-effects of operating leverage and financial risk (one of the main explanatory variables). There is an interplay between the effects of operating leverage, and the effects of financial leverage. Typically, firms with a greater degree of operating leverage are exposed to greater operating risk, and for more risky firms, the required rate on return of debt financing could be higher. In our model the cross effect is statistically significant at 0,1%, and the negative regression slope for the cross effect ($FRISK * ORISK\_dum$) is negative. This suggest that the ultimate effect of operating and financial leverage on firm's profitability is negative. Our results confirm that if we study the financial risk effects in isolation, then there it has a positive impact on profitability (and positive effects of financial leverage). However, by considering the interplay of operating and financial risk in a company, embedded in cross-effects, the joint impact of the operating and financial risk on firm's performance is negative. It gives a strong support for our second hypothesis, stating that operating risk is negatively associated with firm's relationship between financial risk and profitability.

Table 5. WLS regression results for ROA

Explanatory variables	Model 1			Model 2		
	B coeff.	**t**	**ViF**	**B coeff.**	**t**	**VIF**
Main variables						
Intercept	-0,655 ***	-35,63		-1,349 ***	-180,22	
ORISK	-0,051 ***	-11,58	1,309			
FRISK	0,083 ***	20,67	2,697	-0,014 *	-2,09	2,232
Cross-effects						
FRISK*ORISKdum				-0,140 ***	-54,95	1,404
Control variables						
AGE	0,086 ***	29,48	1,025	-0,003 *	-2,40	1,024
SIZE	0,090 ***	43,52	1,108	0,000	1,47	1,096
LIQ_CR	0,144 ***	35,24	2,220	-0,009 ***	-3,50	2,504
CASH	0,006	0,92	1,088	0,000	-0,74	1,088
OPM	0,530 ***	91,32	1,293	2,398 ***	149,27	1,295
Diagnostic tests:						
R-squared	0,838			0,933		
F	5427 ***			14510 ***		

*Notes: In WLS regression, all data were inserted in their natural logarithms. Prior, the data has been winsorised at 1%. Statistically significant at ***0.1%; ** 1%, *5%*

Conclusions

In this work, we have revised the interplay between firm's profitability and operating risk. The problem is timely, as refers to the discussion on firm's resilience capabilities, in response to a shock (such as the pandemic outbreak and lockdown). The disturbances in firm's performance, that result in inability to generate sales revenues, and at the same time followed by the increased operating costs, are particularly difficult for firm's profitability, and in the longer run impact firm's ability to survive. In this regard, to develop the efficient resilience strategies, the effects of greater operating risk on firm's profitability, in terms of other determinants of financial performance, are critical.

Our empirical work contributes to this challenging endeavor, by revising a sample of non-listed manufacturing firms, that operate in four European emerging economies (the V4 coun-

tries). Our work fills in the important gap, by providing evidence for smaller firms (as non-listed companies are usually those who operate on smaller scale), which is rare. The prevalent evidence exists for large, listed firms. Moreover, we provide sound evidence at sector level, by investigating single isolated sector (manufacturing sector). Finally, in our study we provide evidence for the cross-effects of operating and financial risk, to capture the major determinants of firm's profitability.

Our findings indicate that firms exposed to higher operating risk tend to be less profitable (in line with our first hypothesis). We have also confirmed that higher operating risk is negatively associated with the relationship between firms financial risk and profitability. In other words, high operating risk is negatively associated with the potential positive effects of financial leverage.

Our study has several important implications. First of all, it confirms that the external shocks that result in the increase of firm's operating risk level (due to lower sales revenues and/or higher operating costs), threaten firm's profitability significantly, in two dimensions. The first dimension one is due to the direct impact of firm's operating risk on profitability, due to the effects of financial leverage. The second dimension confirms the interplay between operating risk and financial risk, that could be even more devastating for firm's profitability. Once the shock increases the operating risk and the first tensions, a company may seek financial support, by applying more debt financing. The potential positive financial leverage effects, however, are neutralized and reversed by the pressure of operating risk. Thus, the increase of debt financing is not leading to the improvement of firm's performance. This observation indicates that smaller firms, that perform in manufacturing sector, need strong equity financing support, to sustain resilient to external shocks.

Our study is limited to one sector (manufacturing), as this sector is the largest one. However, further investigations should be performed, as the operating risk depends strongly on the type of sector. Our study is also limited in regional context, as it focuses on four countries, which we treat as homogenous in terms of some features of their economic performance, being the non-core European countries. However, further inquires shall revise if similar observations stem from e.g. core European Union countries, to detect the possible impacts of country or cultural related variables. Our study is also limited to the smaller firms, that are not listed on the stock exchange. On one hand, this exerts further limitations in data availability and simplified empirical approach as regards the selection of variables. However, the existing literature evidence is scarce for smaller firms, thus adds value and relevance to our findings. To avoid biased results, we extracted a wide range of data, and adjusted the empirical procedure to obtain statistically sound results (by applying WLS instead of OLS regression, and controlling heteroscedasticity and multicollinearity of variables).

Our study is also limited by time horizon of the analysis. Our intention was to cover a period of relatively undisturbed firms' performance, with systemic shocks. Thus, we adopted the backward looking approach, by collecting data until 2019, as COVID-19 was very disruptive to firms' performance. Further studies could address the interplay between operating risk and firm performance during the shock, in line with Chen, et al. 2019, who covered the crisis 2008+ to confirm if the observed effects are stronger in unfavorable times. Also, the study could be replicated for post-COVID-19 period (starting from 2022 onwards), to confirm the impacts of operating risk on unlisted firms' performance.

Appendix

Table 1A. Descriptive statistics

Variable	mean	St.Dev.	min	25%	50%	75%	max
ROA_op	0.08	0.10	-0.71	0.03	0.07	0.12	0.92
ORISK	0.45	0.20	0.00	0.30	0.45	0.59	0.97
FRISK	0.52	0.26	0.02	0.32	0.52	0.69	5.38
AGE	17.60	8.06	4.00	13.00	17.00	22.00	107.00
SIZE*	153.15	505.69	4.55	41.88	66.53	130.76	17883.53
LIQ_CR	1.86	1.84	0.00	0.99	1.39	2.16	64.56
CASH	0.06	0.09	0.00	0.01	0.03	0.08	0.87
OPM	0.06	0.07	-0.66	0.02	0.04	0.08	0.79

Notes: *Size is proxied by natural logarithm of sales revenues, however, in this table we provide the value of sales revenues, in millions of EUR; the descriptive statistics are not provided for dummy variable (ORISK_dum)

Source: Own study.

Table 1B. Means of ROA and ORisk, at country and sub-sector level

sector NAICS code	ROA				ORISK			
	CZ	PL	SLO	HU	CZ	PL	SLO	HU
311	7.47%	8.68%	3.85%	5.72%	49.25%	47.03%	47.11%	42.67%
312	15.02%	9.16%	11.55%	10.10%	39.03%	43.39%	33.42%	40.40%
313	5.16%	6.81%	15.95%	12.81%	38.80%	19.16%	18.81%	25.29%
314	7.54%	8.23%	49.08%	8.33%	66.24%	48.75%	28.40%	41.89%
315	10.82%	14.17%	2.03%	n.a.	37.07%	18.05%	21.56%	n.a.
316	-3.38%	n.a.	9.22%	10.07%	26.31%	n.a.	38.76%	34.13%
321	11.81%	8.26%	8.12%	1.80%	46.58%	62.47%	62.30%	52.41%
322	13.17%	10.05%	4.64%	4.18%	55.77%	56.59%	53.40%	55.02%
323	10.66%	8.00%	3.19%	1.88%	66.14%	56.48%	65.47%	56.54%
324	12.17%	8.23%	9.50%	4.43%	51.78%	47.54%	29.00%	15.04%
325	11.86%	11.04%	9.01%	10.41%	46.91%	44.33%	35.30%	41.21%
326	10.74%	9.70%	5.56%	5.68%	43.49%	50.85%	47.01%	48.74%
327	14.08%	9.95%	9.38%	11.51%	51.56%	52.97%	54.70%	47.39%
331	7.22%	6.77%	7.96%	6.30%	43.15%	49.62%	48.86%	50.10%
332	7.55%	9.01%	5.14%	8.38%	46.10%	43.43%	40.01%	44.00%
333	7.63%	10.12%	8.89%	8.88%	39.60%	40.05%	44.05%	42.13%
334	6.16%	8.08%	5.91%	7.33%	31.50%	32.50%	30.33%	37.61%
335	10.57%	7.23%	7.03%	5.99%	38.49%	35.51%	39.91%	35.23%
336	6.61%	7.73%	5.35%	4.34%	43.53%	42.66%	43.07%	45.44%
337	8.37%	10.99%	1.43%	7.04%	43.16%	48.11%	48.08%	41.17%
339	9.10%	8.02%	5.81%	8.74%	54.98%	41.49%	38.54%	50.25%

Source: Own study.

Bibliografia

Brealey R. A., Myers S.C., Allen F. (2010). *Principles of Corporate Finance*, 10th ed. New York: McGraw-Hill Education.

Brigham E.F., Ehrhardt M.C. (2011). *Financial Management Theory and Practice*. London: South Western Cengage Learning Graphic World.

Baños-Caballero S., Garcia-Teruel P., Martinez-Solano P. (2012). *How does working capital management affect profitability of Spanish SMEs?* "Small Business Economics" 39, 517-529. DOI 10.1007/s11187-011-9317-8

Bryce C., Ring, P., Ashby S., Wardman J.K. (2020). *Resilience in the Face of Uncertainty: Early Lessons from the COVID-19 Pandemic*. "Journal of Risk Research", 23(7-8), 880–887. DOI: 10.1080/13669877.2020.1756379

Cao V. N. (2015). *What explains the value premium? The case of adjustment costs, operating leverage and financial leverage.* "Journal of Banking and Finance", 59, 350–366.

Cen L., Dasgupta S., Elkamhi R., Pungaliya R. (2015). *Reputation and loan contract terms: the role of principal customers.* "Review of Finance", 20(2), 1–33.

Chaddad F. R., Mondelli M. P. (2013). *Sources of firm performance differences in the US food economy*. "Journal of Agricultural Economics" 64, 382–404.

Chen Z., Harford, J. Kamara, A. (2019). *Operating leverage, profitability and capital structure*. "Journal of Financial and Quantitative Analysis", 54(1), 369–392

EMIS (2023). https://www.emis.com/

Eurostat (2017). https://ec.europa.eu/eurostat/data/database

García-Feijoo L., Jorgensen R. D. (2010). *Can operating leverage be the cause of the value premium?* "Financial Management" 39(3), 1127–1154.

Grau A., Reig A. (2020). *Operating leverage and profitability of SMEs: agri-food industry in Europe*. "Small Business Economics" 57, 221-242. DOI 10.1007/s11187-019-00294-y

Grau A. J., Reig A. (2015). *Vertical integration and profitability of the agrifood industry in an economic crisis context*. "Spanish Journal of Agricultural Research", 13(4), e0107. DOI 10.5424/sjar/2015134-7487.

Hamada R.S. (1972). *The effect of the firm's capital structure on the systematic risk of common stock*. "Journal of Finance" 27: 437-438.

Harjoto M. A. (2017). *Corporate social responsibility and degrees of operating and financial leverage*. "Review of Quantitative Finance and Accounting", 49, 487–513.

Hillmann J., Guenther E. (2021). *Organizational Resilience: A Valuable Construct for Management Research?* "International Journal of Management Reviews", 23(1), 7–44. DOI: 10.1111/ijmr.12239

Houmes R. E., MacArthur J. B., Stranahan H. (2012). *The operating leverage impact on systematic risk within a context of choice: an analysis of the USE trucking industry*. "Managerial Finance", 38(12), 1184–1202.

Hu S., Zhang Y. (2021). *COVID-19 pandemic and firm performance: Cross-country evidence*. "International Review of Economics and Finance", 74, 365-372. DOI 10.1016/j.iref.2021.03.016

Kahl M, Lunn J., Nilsson M. (2019). Operating Leverage and Corporate Financial Policies. AFA 2012 Chicago Meetings Paper. Available at SSRN: https://ssrn.com/abstract=1787184 or http://dx.doi.org/10.2139/ssrn.1787184

Kestens K., Cauwenberge P., Bauwhede H. (2012). *Trade credit and company performance during the 2008 financial crisis*. "Accounting and Finance" 52(4), 1125-1151

Kayhan A., Titman S. (2007). *Firms' Histories and Their Capital Structures*. "Journal of Financial Economics", 83, 1–32.

Kowalska A., Kovarnik J., Hamplova E., Prazak P. (2018). *The Selected Topics for Comparison in Visegrad Four Countries*. "Economies", 6(3) 50. DOI 10.3390/economies6030050

Lemmon M. L., Roberts M.R., Zender J.F. (2008). *Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure*. "Journal of Finance" 63, 575–1608.

Lev B. (1974). *On the association between operating leverage and risk*. "Journal of Financial and Quantitative Analysis", 9(4), 627–641.

Lopez-Valeiras E., Gomez-Conde J., Fernandez-Rodriguez T. (2016). *Firm size and financial performance: intermediate effects of indebtedness*. "Agribusiness", 32, 454–465.

Mandelker G.N., Rhee S.G. (1984). *The impact of the degrees of operating and financial leverage on systematic risk of common stock*. "Journal of Financial and Quantitative Analysis", 19(1), 45–57.

Martínez-Sola C., Garcia-Teruel P, Martinez-Solano P. (2014). *Trade credit and SME profitability*. "Small Business Economics" 42, 561-577.

Myers, S.C. (1984). *Capital structure puzzle.* NBER Working Paper Series No 1393. Available at: https://www.nber.org/papers/w1393. DOI 10.3386/w1393

Novy-Marx R. (2011). *Operating leverage*. "Review of Finance", 15, 103–134.

O'Brien T., Vanderheiden P. (1987). *Empirical measurement of operating leverage for growing firms*. "Financial Management", 16(2), 45–53.

Ozkan A., Ozkan N. (2004). *Corporate cash holdings: An empirical investigation of UK companies*. "Journal of Banking and Finance", 28(9), 2103-2134, DOI 10.1016/j.jbankfin.2003.08.003

Rajan R. G., Zingales L.(1995). *What Do We Know about Capital Structure? Some Evidence from International Data*. "Journal of Finance", 50, 1421–1460.

Shen H., Fu M., Pan H., You F., Chen Y. (2020). *The impact of the COVID-19 Pandemic on Firm Performance*. "Emerging Markets Finance and Trade". 56(10), 2213-2230. DOI 10.1080/1540496X.2020.1785863

Strutz T. (2016). *Data Fitting and Uncertainty (A practical introduction to weighted least squares and beyond)*. Wiesbaden: Springer Vieweg. ISBN 978-3-658-11455-8

Welch I. (2004). *Capital Structure and Stock Returns*. "Journal of Political Economy", 112, 106–131.

Zhang L. (2005). *The value premium*. "Journal of Finance", 60, 67–103.

Yazdanfar D., Öhman P. (2015). *Debt financing and firm performance: an empirical study based on Swedish data*. "The Journal of Risk Finance", 16(1), 102–118.

RYZYKO OPERACYJNE A RENTOWNOŚĆ DZIAŁALNOŚCI: ANALIZA NIE NOTOWANYCH FIRM SEKTORA PRODUKCYJNEGO KRAJÓW GRUPY WYSZEHRADZKIEJ

Streszczenie

Cel. Artykuł stanowi wkład w toczącą się debatę na temat determinantów strategii odporności firm w obliczu kryzysu, odnosząc się do ryzyka operacyjnego. Celem naszej pracy jest zbadanie wpływu ryzyka operacyjnego na rentowność firm nienotowanych na giełdzie, działających w sektorze produkcyjnym. Badania nasze wypełniają lukę badawczą w tym temacie, w zakresie badań na poziomie konkretnego sektora i w grupie mniejszych firm.
Metoda. Nasze badanie opiera się na danych księgowych dużej próby firm nienotowanych na giełdzie, dla czterech krajów (Polska, Czechy, Słowacja i Węgry). Zastosowana została regresja ważona (WLS - Weighted Last Squared) do testowania dwóch modeli wpływu ryzyka operacyjnego na rentowność firmy.
Wyniki. Badania wskazują, że firmy narażone na wyższe ryzyko operacyjne są mniej rentowne. Biorąc pod uwagę krzyżowy wpływ ryzyka operacyjnego i finansowego, potwierdziliśmy na poziomie istotnym statystycznie, że wzajemne oddziaływanie ryzyka operacyjnego i finansowego ma negatywny wpływ na rentowność firmy. Wyniki naszych badań mają ważne implikacje praktyczne. Wskazują, że w okresie kryzysu mniejsze firmy potrzebują finansowania własnego, dla wsparcia odporności na skutki kryzysu dla sytuacji finansowej firmy.

Słowa kluczowe: ryzyko operacyjne, ryzyko finansowe, działalność firmy, rentowność

Klasyfikacja JEL: G32, G33, M21

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