Proceedings of the 8th North American International Conference on Industrial Engineering and Operations Management, Houston, Texas, USA, June 13-16, 2023

E-Delphi Prioritization of Capital Structure Determinants in Small and Medium Size Business in Puerto Rico

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Abstract

Puerto Rican SMEs (Small-to-Medium Enterprises) represented 80.8% of the total enterprises in 2020, contributing to 38.6% of formal jobs. One main management goal is defining how the business will leverage its regular operation, also known as determining its Capital Structure (CS). It has been identified that one of the significant SME causes of failure is its financial leverage decisions and having to find a feasible CS composition that fits in with its current chart of capabilities and business structure. Thus, this investigation generalizes the CS variables based on a qualitative e-Delphi approach, concluding which variables are essential to SMEs CS in Puerto Rico. The expected investigation outcome is to obtain a list of focus variables that enable academically oriented SME investigators and financial decision-makers to optimize their resources and efforts.

Keywords
Capital Structure, SMEs, e-Delphi, Financial Leverage.

1. Introduction
The research route of CS throughout time has experienced different paths, and it has caused the existence of plenty of literature that does not exactly agree with each other. Consequently, no single capital structure theory incorporates all relevant factors and assumptions (Abeywardhana, 2017). In addition, given that there is no consensus through approaches, the results obtained from mathematical models can substantially change when manipulating their underlying conditions and assumptions (Ardalan, 2017)—presenting a gap in the literature on a general theory encompassing financial and strategic management (Norton, 1991). The results of theoretical and empirical studies on CS investigation focus on large corporations, which have created a particular omission in Small-to-Medium-size Enterprises (SMEs) research (Jordan et al., 1998)

1.1 Objectives
The main objective of the research is to identify and prioritize the determinants of capital structure for small and medium-sized enterprises (SMEs) in Puerto Rico. To achieve this, the study uses the e-Delphi technique and economic validation to analyze the impact of various variables that affect the decision-making process related to SME capital structures. The research begins by conducting a literature review on optimal capital structures to identify the impact variables that influence the behavior and environment of decision-making processes for SMEs. Then, an e-Delphi analysis is performed on the previously identified variables to determine experts' relevant variables and prioritize the decision factors of capital structure for SMEs in Puerto Rico. Through this process, the study aims to provide insights that can inform the development of effective capital structure strategies for SMEs in Puerto Rico.

2. Literature Review

As a result of the broad research related to Capital Structure (CS) done over the years, many theories attempt to explain the variables and objectives involved in solving this problem. This literature review aims to understand different views related to CS to identify its common points and make a chronological tour through the approaches, seeking to determine relevant variables associated with Capital Structure decisions.

The first CS hypothesis, originated by Modigliani and Miller (M&M), sought to demonstrate that financial decisions related to CS are irrelevant. The principal question in its theorem analyzes firm owners' capital cost when developing a new project or acquiring assets (Modigliani & Miller, 1958). To construct its theorem, M&M had to build a robust set of assumptions with which they attempted to demonstrate that the average cost of capital on a firm is independent of its CS. It only equals the capitalization rate of its pure equity stream for any given class. The first supposition of M&M (Modigliani & Miller, 1958) consists of creating risk classes by which companies can be segmented into an equivalent-return type, meaning that all firms in the same category are perfect substitutes for one another and have the same expected return. Followed by the second premise, where all transactions are made under ideal market conditions, which implies that if two commodities are perfect substitutes for each other, they must be sold in equilibrium, at the same price, in addition to the existence of global information and lack of friction between the parties involved (Pagano, 2005). In addition, investors and companies have the same access to financial information, including no additional fees for buying and selling securities, such as transfer fees and commissions (Ahmeti & Prenaj, 2015). In further works in 1961 and 1963, M&M included tax effect in their considerations, proposing that the tax rate would equal the current value of saving from taxes, causing the Weighted Average Cost of Capital (WACC) to decrease, and consequently, firms value to increase.

As a response to M&M 1963's amendment to irrelevance theory, a series of approaches also considered the effect of the US tax code on CS. A company's optimum CS was studied interacting realistic tax codes with companies' development. DeAngelo & Masulis (1980) created a model that predicts that the firm's leverage choice will be negatively related to the level of available tax shields such as depreciation and investment tax credits. Years later, Bradley et al., (1984) considered the existence of an optimum when the tax advantage of debt is balanced with the present value of bankruptcy costs. Additionally, to acknowledge the adjustment and financial distress costs impact in the trade-off theory, Myers (1984) stated that firms would find their maximum firm value by iteratively balancing their equity and debt structure. By including these costs, it claimed that whether they are large, they are the source of the disruption from the optimal CS target.

After the principal CS theories were developed, different approaches were used to find which firm factors are involved in CS decision-making. In the review of these factors and variables, there are two main streams: economic-specific and subjective-managerial factors. The identified economic variables depend on firm conditions and country-related factors. Titman et al., (1988) pinpointed a series of firm factors involved in CS decisions: asset structure, meaning the percentage of tangible and intangible company assets; non-debt tax shields explained as non-debt financial strategies to pay less tax, size, and growth of the company, how unique is the offered product or service, the industry classification, how profitable is the company and how volatile are its earnings. Other reviews considered tax rates, how risky a firm is, the magnitude of bankruptcy costs, their payout rates, and whether there are legal agreements to protect involved parties when issuing debt (LELAND, 1994). Also, what is the magnitude of investments in research and development, the financial distress costs, and whether firms are subject to governmental regulations (Bradley et al., 1984)

In further work, in a survey made by Norton (1991) where he asked several Chief Financial Officers (CFOs) what the considerations are when deciding the future of the company in terms of CS, he evaluated if the variables developed thus far in the financial literature were considered: Bankruptcy costs and the financing pecking order, debt and non-debt tax shields, the agency costs, the signaling to financial markets when issuing debt or equity, the information asymmetries between financial parties, the uniqueness of a firm's product and included organizational factors as the use of debt to maintain managerial discipline, the relationship between managerial ownership and the debt or equity choice and what are the management motivations when making CS decisions, also proposing new variables such as corporate wealth and financial slack.

To summarize all variables gathered through literature review, Table 1 contains the factors involved in CS decisions.

Table 1. Literature Review of factors considered in CS decisions.

Literature Review Variables				
Industry Classification	Intangible Assets (Includes R&D)	Agency Costs	Firm's Age	Standardized Stock Market
Earnings Volatility	Interest Rates	Signaling	CEO's Age	Efficiency of judicial system
Non-debt Tax Shields	Growth	Information Asymmetries	CEO's Tenure	Legality
Bankruptcy costs	Profitability	Debt as managerial discipline	CEO's Professional Background	Corruption
Firm Size	Variability of Firm Value	Proportion of managerial Ownership	Financial Flexibility	Creditor Right Protection
Financial Distress Costs	Regulated and non-regulated firms	Current Financial Status	Asset Structure	Bond Market Development
Firm Risk	Payout Rates	Corporate Wealth	Equity Valuation	Shareholder Right Protection
Taxes	Bond Covenants	Management Motivations	Tangibility of Assets	Capital Formation
Uniqueness	Debt tax shields	Credit Rating	Product Competitiveness	Gross Domestic Product Growth
Transaction Costs	Financing pecking order	Dividend Policy	Advertising Expenses	Liquidity

3. Methods

This investigation sought to develop a Delphi prioritization process to identify expert consensus over what variables are essential to Capital Structure determination in SMEs in Puerto Rico. Therefore, the investigation was divided into three stages: a Data Gathering process, the Determinants Prioritization phase, and a final phase of validation that will be done in subsequent steps of the investigation but will not be covered in this paper. Figure 1 includes the research methodology proposed to complete the investigation objectives.

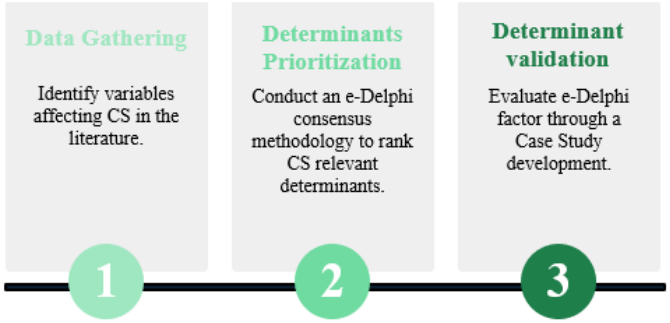

Figure 1. Research Methodology

The first stage consists of a literature review, focusing the research on variables involved in the decisions related to optimal capital structures, including different theorems and theories aimed at this objective. This stage encompasses different views to gather all significant variables affecting CS decisions in theory and practice.

After contemplating all the literature variables, the prioritization process was conducted with the e-Delphi technique. The e-Delphi technique has been demonstrated to be a convenient and practical methodology to achieve consensus without physically reuniting experts (Okoli & Pawlowski, 2004) —also promoting faster feedback in geographically spread groups with better data management compared to pen-and-paper versions (Toronto, 2017). The determinants prioritization process, illustrated in Figure 2, comprises the stages in the e-Delphi methodology considered in this investigation. The process begins with population requirements definition, survey characteristics establishment, and the performance of a filtering phase to develop an iterative process of ranking and feedback.

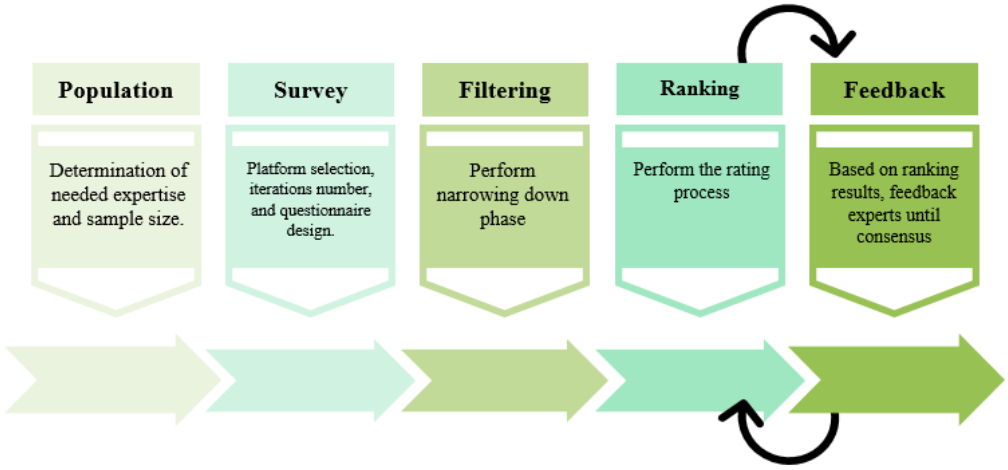

Figure 2. e-Delphi Prioritization Process

The interviewed population contemplated the investigation needed expertise (Drumm et al., 2022). As done by van de Wetering et al., (2019), the respondents consulted were academic and industry experts with topic-related experience in SMEs. In this case, Capital Structure-related experience. The sample size selection considered a population participant's reduction (attrition) between rounds of 5% to 28% and the literature recommendation of maximum and minimum number of experts, being 12 and 6, respectively, to determine the number of experts consulted in this study (Toronto, 2017). This way, an initial convenience expert sample of 10 contemplated that the minimum number of experts would still be covered if attrition of 5% or 28% occurred. A Knowledge Resource Nomination Worksheet (KRNW) was constructed to nominate experts considering the investigation needed skills to select the Delphi population. Pinpointing the required skills to contact and define the experts' qualifications and sources for rank and invite them (Okoli & Pawlowski, 2004). The survey was a hybrid between Google Forms and email communications with experts based on the availability and versatility of questions. Questionnaires had an appendix explaining every variable meaning, and a qualitative-quantitative classification, with calculus explanations for quantitative ones.

The online Delphi methodology was designed in three rounds since three are enough to achieve result stability (Linstone & Turoff, 1975). It is proven that more than this number fatigues the participants (Drumm et al., 2022). Habitual Delphi methodologies tend to initiate the first round with open-ended questions to gather which variables should be under study. However, since this investigation conducted a variable-gathering process with a literature review, the open-ended section was used for experts to include new variables that were not considered in the literature review. In the first phase, contestants selected with Likert scales which of the given variables they agree to maintain in the study (Humphrey-Murto et al., 2016), known as filtered variables. The number of filtered variables consisted of a combination of two criteria, the included variables meet one or more than one criterion; the first one was that more than 50% of the experts considered the variable to be included or to be possibly included. The second one consisted of the numerical average of inclusion categories.

The next phase consisted of an iterative process of experts ranking filtered variables and receiving feedback from group opinion. In these stages, experts had to rank variables from most to least relevant, giving a numeric scale where

the most important had the smallest value. Group opinion feedback displayed rank average, the percentage of experts who ranked the variable in their first half, and graphical summaries.

4. Data Collection

The investigation had two methods to retrieve information. The first one was the literature review of Capital Structure research. To reach a consensus over relevant CS variables, the second one was via e-Delphi questionnaires, through three questionnaires corresponding to the e-Delphi phases. The first phase asked which variables from the literature pull were considered as crucial to the investigation to experts through a Likert scale evaluating the categories "Include," "Possibly Include," "Neutral," "Possibly Exclude," and "Exclude." The second phase asked which variables from the filtered list were more critical to the CS study by asking experts to rank them. And the validation phase is still in progress, therefore, no data is included in this paper.

5. Results and Discussion

After a variable classification process, filtered variables were classified as managerially controllable and intrinsic to a Firm, Country, or Market. The results from the first Delphi phase are summarized in Table 2, Table 3, Table 4,and Table 5 In general terms, it has been noted that contestants abstained from firmly excluding variables since only, on average, 1.8% of variables were excluded, contrasted by 36.6% of variables with solid inclusion. It can be observed from Table 2 that the categories with the highest relevant inclusion rates are Firm-Specific and Managerial variables. Alternatively, Country Specific variables constitute the category with a lower inclusion rate. However, it was also noted that all categories had a higher inclusion rate than other actions on the Likert scale (Possibly include, neutral, possibly exclude, and exclude) except for the Country-Specific variables that were more considered neutral than the other categories.

Table 2. First Round Delphi Results: Country-Specific Variables

Variable	1. Include	2. Possibly include	3. Neutral	4. Possibly exclude	5. Exclude
Country-Specific	**21.4%**	**19.6%**	**28.6%**	**26.8%**	**3.6%**
Capital Formation	14.3%	0.0%	57.1%	28.6%	0.0%
Corruption	14.3%	0.0%	42.9%	28.6%	14.3%
Creditor Right Protection	28.6%	42.9%	0.0%	28.6%	0.0%
Efficiency of judicial system	14.3%	0.0%	57.1%	28.6%	0.0%
Gross Domestic Product Growth	14.3%	14.3%	14.3%	42.9%	14.3%
Legality	14.3%	28.6%	28.6%	28.6%	0.0%
Shareholder Right Protection	28.6%	28.6%	14.3%	28.6%	0.0%
Taxes	42.9%	42.9%	14.3%	0.0%	0.0%

Table 3. First Round Delphi Results: Firm-Specific Variables

Variable	1. Include	2. Possibly include	3. Neutral	4. Possibly exclude	5. Exclude
Firm-Specific	**46.4%**	**28.6%**	**17.9%**	**5.4%**	**1.8%**
CEO's Age	14.3%	28.6%	14.3%	28.6%	14.3%
CEO's Professional Background	42.9%	28.6%	28.6%	0.0%	0.0%
Earnings Volatility	28.6%	14.3%	57.1%	0.0%	0.0%
Firm Risk	57.1%	42.9%	0.0%	0.0%	0.0%
Firm Size	57.1%	42.9%	0.0%	0.0%	0.0%
Firm's Age	57.1%	28.6%	0.0%	14.3%	0.0%
Industry Classification	85.7%	14.3%	0.0%	0.0%	0.0%

Regulated and non-regulated firms	28.6%	28.6%	42.9%	0.0%	0.0%

Table 4. First Round Delphi Results: Managerial Variables

Variable	1. Include	2. Possibly include	3. Neutral	4. Possibly exclude	5. Exclude
Managerial	**39.3%**	**38.4%**	**17.0%**	**4.5%**	**0.9%**
Advertising Expenses	28.6%	42.9%	14.3%	14.3%	0.0%
Asset Structure/Intangibility of Assets	28.6%	42.9%	28.6%	0.0%	0.0%
Asset Structure/Tangibility of Assets	42.9%	28.6%	28.6%	0.0%	0.0%
Credit Rating	57.1%	14.3%	14.3%	14.3%	0.0%
Current Financial Status	42.9%	57.1%	0.0%	0.0%	0.0%
Debt tax shields	28.6%	28.6%	28.6%	14.3%	0.0%
Financing pecking order	42.9%	28.6%	28.6%	0.0%	0.0%
Growth	42.9%	57.1%	0.0%	0.0%	0.0%
Liquidity	71.4%	14.3%	14.3%	0.0%	0.0%
Management Motivations	28.6%	71.4%	0.0%	0.0%	0.0%
Non-debt Tax Shields	14.3%	28.6%	57.1%	0.0%	0.0%
Payout Rates	42.9%	28.6%	14.3%	14.3%	0.0%
Product Competitiveness	57.1%	28.6%	14.3%	0.0%	0.0%
Profitability	42.9%	57.1%	0.0%	0.0%	0.0%
Proportion of managerial Ownership	28.6%	28.6%	14.3%	14.3%	14.3%
Uniqueness	28.6%	57.1%	14.3%	0.0%	0.0%

Table 5 First Round Delphi Results: Market Variables

Variable	1. Include	2. Possibly include	3. Neutral	4. Possibly exclude	5. Exclude
Market	**36.7%**	**20.4%**	**26.5%**	**14.3%**	**2.0%**
Bond Covenants	57.1%	14.3%	0.0%	28.6%	0.0%
Bond Market Development	14.3%	14.3%	42.9%	14.3%	14.3%
Financial Distress Costs	42.9%	28.6%	14.3%	14.3%	0.0%
Information Asymmetries	14.3%	42.9%	14.3%	28.6%	0.0%
Interest Rates	42.9%	28.6%	28.6%	0.0%	0.0%
Signaling	42.9%	0.0%	57.1%	0.0%	0.0%
Transaction Costs	42.9%	14.3%	28.6%	14.3%	0.0%

As done with initial variable classification in content classification, the distribution of selected variables was analyzed per variable type: quantitative and qualitative. Finding that 61.1% of the selected variables are quantitative, and the other 38.9% are qualitative. Additionally, based on experts' answers, Management motivation was the least uncertain variable according to media values since its variation coefficient has the smallest value compared to the rest of the variables. As a result of the Filtering Phase and the variables added by experts that were not considered within literature review, Table 6, shows the final variable list of 20 variables, resulting by considering that more than 50% of the experts considered the variable to maintain in the study, which will be the input for the iterative ranking phase.

Table 6. Final Variable List

Variable				
Industry Classification	Industry Performance	Firm Risk	Profitability	Government Incentives
Bond Covenants	Management Motivations	Taxes	Firm's Age	Firm Size
Financing pecking order	Credit Rating	Uniqueness	Product Competitiveness	Growth
Solvency	CEO's Professional Background	Interest Rates	Asset Structure/Tangibility of Assets	Liquidity

After contemplating all variables, experts were asked to rank variables from the most to the least relevant variable related to CS in SMEs in Puerto Rico, assigning a unique numerical value to each variable. As a result of this phase, an average and mode per variable were calculated, allowing the construction of group ranking and more statistical measures. After the statistical analysis, the feedback process took place to inform experts about group behavior in the previous phase, allowing them to change their responses based on group ranking or leave their answers like the last round. To illustrate round 2 and 3 experts' opinions, a graphical summary of responses was constructed, displaying a Boxplot in. Figure 3. Boxplots can describe data considering dispersion and central tendency; the boxes draw quartiles one to three (Q1 to Q3), which contains position 25% and 75% of ascendent ordered data. The larger the boxes, it implies that data had more variability between ranking, in this case.

In phase 2, Management Motivations, Product Competitiveness, Interest Rates, Government Incentives, and CEO's Professional Background were the most dispersed. In the same way, the most accurate variables (the ones with smaller boxes) were Industry Classification, Profitability, Liquidity, Taxes, and Industry Performance. In the same way, in phase 3, the most accurate variables were Industry Classification, Profitability, Solvency, Taxes, and Credit Rating.

In Boxplots, asterisks represent data outliers, a point that does not behave like the rest of the data—noting that in phase 1, Industry Performance and Industry Classification are the variables with outliers. Following the same idea, in phase 2, Growth, Industry Classification, Uniqueness, Solvency, and Credit Rating presented data outliers. However, three of these variables were the most accurate in this phase.

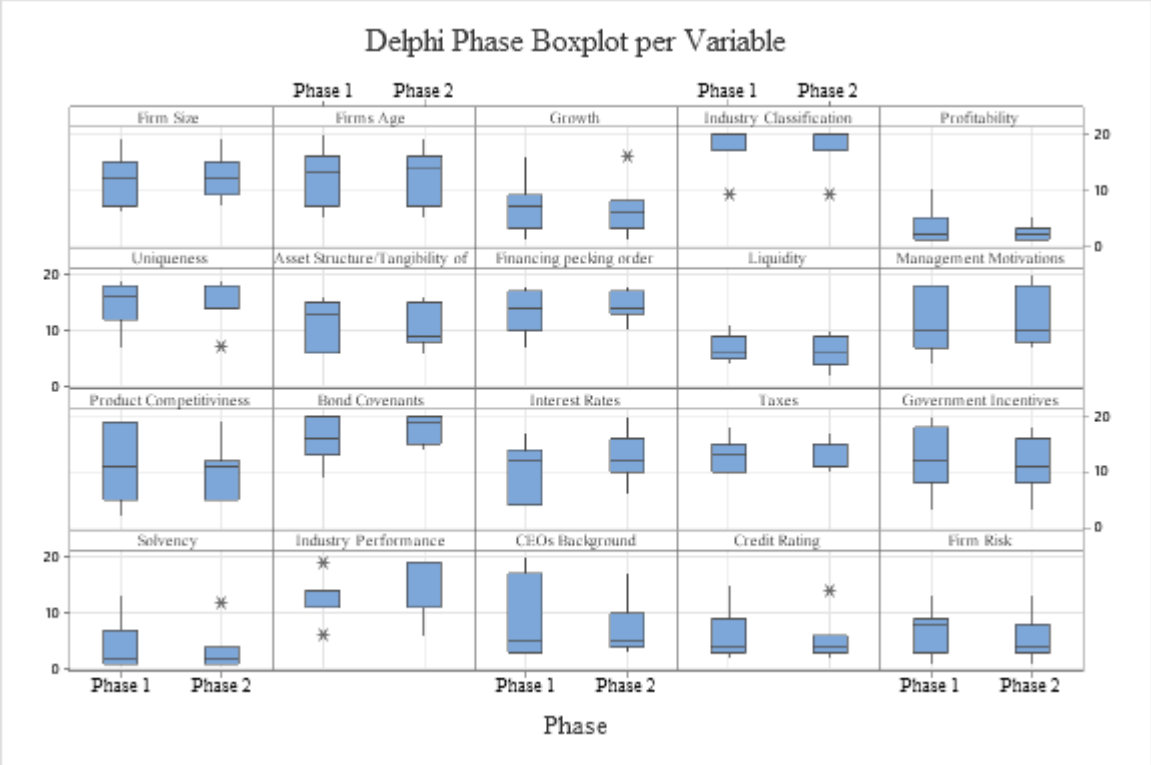

Figure 3. Delphi Phases Boxplot

A consensus analysis was performed to determine whether the expert population agreed in the prioritization process. To understand and measure whether the experts agreed on their rankings Kendall's was calculated (Schmidt, 1997). It is a measure of agreement between ranked ordered entities, as a correlation within classes, it represents the observed variance of the total ranks to the maximum possible variance in ranks (Field, 2005). Kendall's W is used because rankings distribution cannot be defined as a priori within the known distributions.

Table 7 shows the needed data to calculate Kendall's coefficient on each round. The columns include the sum of rankings per variable, named as Rank Variance $\boldsymbol{R_i}$ **,** where **Average Rank Variance** $\boldsymbol{\bar{R}}$ was calculated, the next column shows the squared deviation of rank variance and average variance per variable $\boldsymbol{(R_i - \bar{R})^2}$, which sum corresponds to **Total Variance** $\boldsymbol{S_R}$ and the group average rank per variable.

To calculate the **Maximum Variance** $\boldsymbol{S_{RMax}}$, it was considered that all experts agreed on every variable ranking R_{Max}. For example, if all experts agreed that Firm Risk is the most important variable to CS, then they ranked it as 1, therefore its Ranked Variance R_i equals to 7, following that idea, if again, experts agreed on Firm Size as the second most important variable, they would rank it as 2, and its correspondent Ranked Variance equals to 14, to finally calculate the Maximum Variance S_{RMax} as the square deviation of the Maximum Rank Variance and the Average Rank Variance. These calculations are shown in the following equations:

$$R_i = \sum_{j=1}^{k} r_{ij} \;\; \forall i = 1, \dots, n$$

$$\bar{R} = \frac{1}{n} \sum_{i=1}^{n} R_i$$

$$S_R = \sum_{i=1}^{n} (R_i - \bar{R})^2$$

$$S_{RMax} = \sum_{i=1}^{n} (R_{Max} - \bar{R})^2$$

$$W = \frac{S_R}{S_{RMax}}$$

Where r_{ij} is the ranking expressed by judge j for variable i; n is the total quantity of variables, in this case 20; and k is the total quantity of experts that evaluated the variable, in this case 7.

Table 7. Kendall's W calculation

	Round 2			Round 3		
Variable	**Group Ranking Average**	R_i	$(R_i - \bar{R})^2$	**Group Ranking Average**	R_i	$(R_i - \bar{R})^2$
Firm Size	11.86	83	90.25	12.00	84	110.25
Firm's Age	12.29	86	156.25	12.86	90	272.25
Growth	7.14	50	552.25	6.57	46	756.25
Industry Classification	17.00	119	2070.25	16.86	118	1980.25
Profitability	3.14	22	2652.25	2.14	15	3422.25
Uniqueness	14.86	104	930.25	15.71	110	1332.25
Asset Structure/Tangibility of Assets	11.14	78	20.25	10.86	76	6.25
Financing pecking order	13.71	96	506.25	14.57	102	812.25
Liquidity	6.86	48	650.25	6.29	44	870.25
Management Motivations	11.57	81	56.25	12.14	85	132.25
Product Competitiveness	10.86	76	6.25	10.14	71	6.25
Bond Covenants	16.00	112	1482.25	17.57	123	2450.25
Interest Rates	10.71	75	2.25	12.86	90	272.25
Taxes	13.29	93	380.25	13.71	96	506.25
Government Incentives	12.29	86	156.25	10.86	76	6.25
Solvency	4.00	28	2070.25	3.43	24	2450.25
Industry Performance	11.86	83	90.25	13.00	91	306.25
CEO's Professional Background	8.86	62	132.25	7.14	50	552.25
Credit Rating	6.00	42	992.25	5.57	39	1190.25
Firm Risk	6.57	46	756.25	5.71	40	1122.25

$$\bar{R} = \frac{1}{n}\sum_{i=1}^{n} R_i = 73.5$$

$$S_R = \sum_{i=1}^{n} (R_i - \bar{R})^2 = \ 13{,}753.00$$

$$S_{RMax} = \sum_{i=1}^{n} (R_{Max} - \bar{R})^2 = 32{,}585.00$$

$$W = \frac{S_R}{S_{RMax}} = 0.422$$

Kendall's W is the ratio representing the **Total Variance** S_R in the **Maximum Variance** $\boldsymbol{S_{RMax}}$ and evaluates the agreement between ranking variables. In the second phase of the study, Kendall's W was calculated to be 0.422, as shown in previous equations. The same process was repeated for phase 3, resulting in an agreement coefficient of 0.569. The increase in agreement coefficient by34.8% suggests that the feedback process was successful. According to Schmidt (1997), coefficients near 0.1 indicates very weak agreement, around 0.3 weak agreement, near 0.5 moderate agreement, and near 0.7 and 0.9 strong and unusually strong agreement, respectively. Therefore, the results represent reasonable agreement among experts in both research stages.

5.3 Proposed Improvements

To fully integrate descriptive statistics into the ranking phase analysis there are two main proposed improvements for further research. The first one is to perform a dispersion analysis since the ordinal dispersion within rankings must be treated differently than nominal data type. For doing so, it is proposed to analyze the index of ordinal variation. The second proposed improvement is to analyze the variation range of Kendall's W coefficient for larger samples and if it is a reliable measurement of agreement given the experts sample size.

6. Conclusion

Until this investigation phase, according to experts' opinions and with a moderate agreement coefficient, the top five variables affecting SME Capital Structure decisions are Profitability (de Jong et al., 2008; Titman et al., 1988; ZHAO & LI, 2012), Solvency, Credit Rating(Graham & Harvey, 2002), Firm Risk (de Jong et al., 2008; LELAND, 1994; ZHAO & LI, 2012), and Liquidity (de Jong et al., 2008; ZHAO & LI, 2012), with more than 86% of experts ranking them in their first top half. From the filtered variable list, it was encountered that the first half had 80% quantitative variables and 70% were Managerially controllable, 20% were intrinsic to the Firm, and 10% were relative to the Market. In addition, 90% were contemplated in the initial literature review, and experts added 10% of the top. Remarkably, this investigation is still in progress, and further steps are needed to validate determinants prioritization and continue the investigation.

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