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From "0 to 1" – What is the "Financial Sophistication" level of a CEO?

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Abstract

Objective: The literature reports evidence regarding the importance of CEOs' financial expertise to support decision-making and maximize companies' value. Thus, this study's objective was to theoretically ground the creation of the construct "Financial Sophistication", proposing three metrics and sharing recent studies' propositions.

Method: Previous studies supported the development of the construct Financial Sophistication. After identifying and collecting academic and professional characteristics, Principal Components Analysis was used to compose the indexes.

Results: The characteristics concerning academic and professional experience in the financial field and which based the development of this construct were: International and Financial Training; and Experience: in the Sector, Financial Sector, as CFO, CEO, International Experience, and Top-level Position in Another Company. Based on these, three indexes were developed: Professional Financial Sophistication, Academic Financial Sophistication, and Professional and Academic Financial Sophistication (in which both dimensions are combined).

Contributions: The literature lacked a complete metric to measure CEOs' expertise, which would capture its impact on decision-making. Hence, this study focused on advancing science and anticipated studies applicable to the Brazilian context.

Keywords: Academic Knowledge, Professional Knowledge, Financial Sophistication, CEO, Expertise.

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1. Introduction

The chief executive officer (CEO) is responsible for a company's major decisions so that s/he should be aligned with maximizing value to shareholders. Murphy (1999) suggests that, according to agency relationship, shareholders, known to be the principal, try to strengthen ties with CEOs through contractually established benefits. The remuneration of a CEO is a way to equalize this interaction. Custódio, Ferreira, and Matos (2013) and Song and Wan (2017) indicate that the remuneration established in contracts should vary according to the CEO's professional and academic experiences. Aivazian, Lai, and Rahaman (2013) note that, in a competitive market, a manager's skills are priced, considering that his/her decisions reflect in profits. Given a context of continuous internationalization of markets, it is natural that the knowledge and experiences of candidates to management positions are increasingly required.

The need to recruit increasingly qualified professionals in the academic and professional milieus to work in top-level positions results in increasingly sophisticated professionals (Leite, 1997; Manfredi, 1998; Kuenzer, 2002; Rezende, 2002), considering all the preparation required for the desired position. Hence, hiring more financially qualified professionals tends to generate benefits for the agent and principal: the agent obtains a remuneration consistent with his/her intellectual capital, while the principal absorbs the benefits accruing from this hiring (in the form of better results). Rezende (2002) shows that hiring sophisticated intellectual capital is advantageous for a company, impacting its survival in a competitive economy. Therefore, the professionals assuming top-level positions tend to improve knowledge and professional experiences related to finances, which is called in this study "Financial sophistication".

Among the factors interfering in executives' decisions, studies report: international training (Li, Sun & Ettredge, 2010; Li, Wei& Lin, 2016); academic training (Barros, 2005; Paton & Wagner, 2014; Saxena & Bendale, 2014; Torres & Augusto, 2017; Li et *al*, 2016); operating sector (Custódio *et al*., 2013); experience as CEO (Antia, Pantzalis & Park, 2010; Custódio *et al*., 2013; Dauth, Pronobis & Schmid, 2017); experience as CFO (Li et *al*., 2010; Li *et al*., 2016; Dauth*et al*., 2017); experience in top-level positions (Liderman, Schroeder & Sanders, 2010; Custódio *et al*., 2013); and internationalization (Li *et al*., 2010; Dutta, Malhotra & Zhu, 2016; Dauth*et al*., 2017). Hence, the literature indicates that the professional and academic experience of a CEO influences the quality of decisions (Huang, 2014).

Empirical studies show the need for a CEO to present high academic and professional knowledge related to finances. Faulconbridge, Beaverstock, Hall, and Hewitson (2009) and Dauth *et al*. (2017) highlight the importance of having a background in the business field in the international context to obtain greater knowledge about controls, international standards, and good governance practices. Custódio and Metzger (2014) and Duan, Hou, and Ress (2020) state that professional financial experience favors CEOs when selecting the best investment and financing policies, while international experience in the business field develops their ability to establish and implement international relationships and enter other markets. Training in the business field contributes to the development of expertise required to assume a CEO position (Torres & Augusto, 2017) because experience promotes a greater ability to reflect upon ways and potential outcomes to maximize value.

Knowledge related to financial management, whether it accrues from academic training or professional experiences, may be essential in a CEO's decision-making due to the need to make decisions quickly (Barros, 2005; Curi & Lozano-Vivas, 2020). However, studies published thus far consider aspects related to the training and financial experience separately, ignoring how a CEO's background can enhance results. Given this context, it is pertinent to measure CEOs' Financial Sophistication to identify how these characteristics interfere in decision-making. Therefore, this study's objective was to theoretically ground the construct "Financial Sophistication", proposing three metrics, and share recent studies' propositions.

This study's relevance lies upon the complementation of existing literature, as some authors express difficulties in measuring expertise, that is, both knowledge and experience. Huang (2014) highlights that even though researchers know that management skills vary among agents and affect organizational decisions and a company's value, few studies investigate the managers' expertise, which shows there is a need for studies to contribute to the literature and propose measurements. As highlighted by the author, researchers find difficulties in measuring such characteristics. In this sense, this study focused on proposing metrics that numerically dimension the set of expertise related to the financial field acquired throughout a CEO's academic and professional life. This set of expertise is called here "Financial Sophistication". The contribution of such measures to the business field in general, specifically for the financial field, is that these measures can be used in future studies to promote a greater understanding of decision-making at the companies' level.

2. Theoretical framework

2.1 Human Capital

The socio-economic development from the 1950s and 1960s exalted the need for qualification, in the sense that human resources needed to be capable to operate in an industrial system (Manfredi, 1998). The author considers that professional qualification narrows the relationship between occupational and educational systems, while the construct "qualification" is observed in applied social sciences. He defends that training and how knowledge is developed are critical for forming human capital and are the solution for the scarcity of people who master specific skills to develop activities in the modernization process. This understanding ended up leading to the theory of human capital, widely known by the rapid modernization at the time, which was seen as the adoption of a capitalist industrial model. The qualification process started drawing greater attention due to a lack of trained professionals to occupy certain positions, and for this reason, a national training system was deemed necessary.

The establishment of national training systems at different hierarchical levels was called formal qualification (Manfredi, 1998). Barbosa Filho, Pessoa, and Veloso (2010) recognize that human capital comprises educational levels and professional experience. In this context, Manfredi (1998) notes that the organizations desired several graduated employees for a specific area of expertise because they believed that formal qualification would promote companies' development. Considering that formal qualification involves knowledge at different levels, some authors called over-education or over-qualification the effect of popular confidence on high-qualified individuals. This fact results in qualification, which in general is higher than what would be needed to perform the tasks of a given position (Manfredi, 1998).

The parameters established to introduce an individual in a position and the understanding of formal job market is that qualification is privatized; that is, each individual is responsible for accumulating technical-scientific knowledge, skills, abilities, knowledge, and experiences that are acquired throughout academic and professional life (Manfredi, 1998). Professional education can be achieved in three ways: academic knowledge, professional experience, or the combination of both (Kuenzer, 2002). Leite (1997), Godoy, and D'Amélio (2012) understand competence academic and professional knowledge, which develop capacity and skills (technical and cognitive), respectively, and when companies identify flaws in private qualification that can affect performance, alternatives to recycle knowledge considered necessary for a company need to be devised.

Companies depend on their collaborators' knowledge to perform activities the best way possible, which makes apparent the need to implement internal training processes. Even though some companies and fields do not address collaborators' training to be an essential aspect of competitiveness, the importance assigned to training and knowledge recycling has gradually increased (Barzegar & Farjad, 2011; Batalla-Busquets & Martínez-Argüelles, 2014). Based on business returns accruing from continuing education, the literature in economics complement the literature in education in terms of professional training (Grip & Sauermann, 2013). The authors report three lines of research in the literature in the economic field that refer to contributions of continuing education: (1) the effects of the recycling process on productivity; (2) the returns of recycling when this is hired; and (3) which is considered a "black box", the effect of training on the collaborators' actual performance. If an individual's training can impact a company's performance (Nakabashi& Figueiredo, 2008), it seems logical to consider training when hiring a professional, especially if the candidate aspires to a top-level position.

2.2 Financial Sophistication

A company's future success can be significantly influenced by its ability to find, recruit, and retain the most talented executives, who can promote inspiring, innovative, and profitable management in a knowledge-based economy (Faulconbridge *et al.*, 2009; Dickel Moura, 2016). Faulconbridge *et al.* (2009) highlight the importance of candidates to top-level administrative positions to be a "global citizen", whether because they assumed important positions in big international companies or because they acquired a degree in an international business school, which are seen as a differential. International expertise among top-level administrative positions is considered by companies as an alternative to improve their controls, as these individuals tend to be more familiar with international standards regarding reporting practices and governance that are common among countries more economically developed.

The managers' characteristics are usually associated with the quality of financial statements. This understanding guides various studies. Li *et al.* (2016) seek to understand aspects considered in the decision-making process of investors and market analysts. Dauth *et al.* (2017) consider that an executive's international profile, in terms of nationality, educational background, professional experience, and remaining commitments concerned with international committees, might be associated with financial statements' quality. Fran, Gui, Li & Zhu (2016) also highlight empirical evidence that the internationalization of a CEO or CFO adds to their ability to make financial decisions, as they have greater knowledge of international businesses, culture, and standards. Therefore, it may be advantageous for companies to use financial incentives for executives to constantly seek knowledge, maximizing shareholders' interests (Trejo, Gutiérrez & Guzman, 2016).

A CEO's academic and professional knowledge tends to reflect on performance so that a remuneration that is equivalent to these professionals' intellectual repertoire is due. Custódio*et al.* (2013) investigated whether the remunerations of CEOs with general skills were higher than those of individuals with specific skills. To measure these skills, they used information in resumes such as positions in different companies, specific sectors, conglomerates, and experience in the same position. These aspects reveal that generalist CEOs are risk-averse. Davis, DeBode, and Ketchen Jr. (2013) note that more qualified CEOs perform better, thus obtained better results. Hence, evidence suggests that companies prefer CEOs with greater expertise and offer superior remuneration as a mechanism to compensate knowledge that can be used to solve problems and promote improvements.

Executives are the individuals primarily responsible for two aspects: promote improvements and solve problems. The first is based on knowledge, and the second is driven by leadership (Liderman*et al.*, 2010). Problems are solved in two ways: by controlling situations and re-establishing the original state of things the fastest as possible using accumulated knowledge, or changing the original state of things, by impeding the occurrence of new problems (based on the experience acquired in the solution of a given problem), leading to improvements (Coho, Nag & Xia, 2015). Paraskos, Altima, McLean, and Cooper (2013) report that tacit knowledge (i.e., individual experiences, ideas, values, and emotions) is of companies' interest. Managing a company requires not only technical but also behavioral skills, primarily focusing on competence (academic knowledge and professional experience) (Saxena & Bendale, 2014).

Individuals aspiring to a CEO position should pursue the competence necessary. Paton and Wagner (2014) report these individuals are concerned with the curriculum of engineering schools that provide little or no courses related to strategic management. Therefore, to improve business-management skills, the candidates to a CEO position have complemented their training with MBAs or equivalent programs (Saxena & Bendale, 2014). Torres and Augusto (2017) return to the original notion that academic knowledge and knowledge acquired with professional experience, especially those linked to the business, accounting, economy, or financial fields, contribute to the development of knowledge and skills needed to work as a CEO. Additionally, the author reveals that such knowledge can be acquired through experiences. Hence, Financial Sophistication can be defined as the set of knowledge acquired throughout academic life and financial-related professional experiences.

3. Method

The construct Financial Sophistication (FS) is based on a logic that is similar to what is proposed by Barros (2005), Faulconbridge*et al.* (2009), Li*et al.*(2010), Custódio*et al.*(2013), Davis*et al.* (2013), Dauth*et al.* (2017), Torres and Augusto (2017) and Li*et al.*(2016), that is, an understanding that financial-related academic knowledge and professional experience are characteristics expected by those hiring a CEO, as such knowledge enables CEOs to maximize the shareholders' interests. Shareholders deposit their beliefs on managers' knowledge and experience, understating that these lead to more rational decisions and consequently improve the likelihood of a company's success (Kahneman, 2012).

In this sense, it seems appropriate to consider that expertise acquired both in the academic and professional milieus leads to three indexes: i) Academic Financial Sophistication Index (AFSI); ii) Professional Financial Sophistication Index (PFSI), andiii)Financial Sophistication Index (ISF). The latter comprises academic and professional expertise together. The motivation to consider the academic the professional dimensions separately is that there are situations in which both indexes, AFSI and PFSI, contradict each other, so that if there are analyzed together, they may totally or partially cancel the construct. Indexes are scored between "0" and "1", and the points are distributed according to the level of importance of each item, measured through Principal Components Analysis (PCA). PCA was chosen to measure the Financial Sophistication Indexed scored between "0" and "1", given the level of importance of this item in the factor. SPSS was used.

Based on previous studies, expertise items were identified and used in the composition of the following indexes: International and Financial Academic Training dimension; and dimension Professional Experience in the Sector, in the Financial Sector, as CFO, as CEO, International Experience, and Top-Level Position in Another Company. This information can be collected from secondary sources such as the CEO's resume available in Reference Forms (items 12.6 and 12.8), resumes available at IAN – Annual Information (the previous report was published up to 2008, replaced in 2010 by Reference Form), the company's website, LinkedIn, Lattes Platform, and from the news or magazines that published interviews related to a given CEO. Table 1 presents information to understand better how the indexes were developed.

Table 1

Financial Sophistication Index

Dimension	Variable	Item Measurement	Sign
Academic	International Training	Academic training (undergraduate and/or postgraduate studies) in international universities	+
	Financial Training	Academic training (undergraduate and/or postgraduate studies) in the field of finances (Business Administration, Accounting, Economy of Finances)	+
Professional	Experience in the Sector	Professional experience (in years) in the same sector as the company in which current works.	+
	Experience in the Financial Sector	Professional experience in companies in the financial sector.	+
	Experience as CFO	Professional experience as CFO.	+
	Experience as CEO	Experience (in years) as CEO in the current company.	+
	International Experience	Professional experience in international companies.	+
	Top-level position in another company	Top-level position in another company simultaneously to the CEO position.	+

Source: Developed by the authors.

Table 1 presents the ISF, composed of the academic dimension (2 items) and professional dimension (6 items). Only the expertise that corresponds to the academic and professional dimensions is needed to compose the AFSI and PFSI, respectively. Additionally, the column "Item Measurement" presents the description of information collected, while items "Experience in the Sector" and "Experience as CEO" are continuous variables and the remaining are dichotomous variables, in which 1, if the characteristic is present and 0, otherwise.

4. Metrics Proposed

A CEO's Financial Sophistication is composed of expertise acquired both in the academic and professional spheres and contributes to a business' management. Based on the eight items reported in the literature, data were collected and organized on an electronic spreadsheet (considering how each of the characteristics of the academic and professional dimensions described in Table 1 is measured). Later, the descriptions (answers) were coded as dichotomic variables (0 and 1), keeping only the items "Experience in the Sector" and "Experience as CEO" as continuous variables. Principal Components Analysis (PCA) was considered suitable to construct the ISF so that the distribution of scores would be coherent with each of the items considered to compose the index.

The following methodological procedures were adopted according to the sequence below (Field, 2009):

a. Pearson's Correlation Matrix – Factor analysis assumes a correlation between items; however, these should not be perfectly correlated. Lack of correlation of an item with the remaining may result in its exclusion, while the need for such exclusion can be confirmed with the following two tests.
b. Kaiser-Meyer-Olkin (KMO) and Bartlett– These tests are necessary to validate factor analysis. KMO ranges from 0 and 1, indicating that correlation patterns are relatively compact when values are relatively close to 1. Additionally, Kaiser established criteria to measure confidence on the factors; values above 0.7 are desirable. If any problems are identified in these two tests, one item will probably be deleted, which can be identified with greater precision in the Anti-Image Correlation Matrix.
c. Anti-Image Correlation Matrix – This test presents the individual KMO of items in the matrix diagonal; values above 0.7 are desirable. Hence, if relatively low values are found, the item needs to be eliminated, considering the lowest KMO. The tests and analysis previously performed are successfully repeated until acceptable parameters are obtained to grouping the factors (as recommended by Kaiser-Meyer-Olkin and Bartlett).

A database of 179 [B][3] listed companies from 2011 to 2015 was used (convenience sampling), which correspond to 326 different CEOs and 810 observations. Data were collected according to the recommendations in methodology. Note that when the initial tests (items "a", "b"and"c" above) showed the need to exclude item "Top-level position in another company".

According to the theoretical framework, Financial Sophistication was considered according to the items grouped in the academic and professional dimensions. Hence, eigenvalues, verified according to criteria established by Kaiser (Field, 2009), establish the factors that provide greater explained variance capacity, the number of initial components, and total variance, as shown in Table 2.

Table 2

Total variance explained

Component	Initial eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% variance	% cumulative	Total	% de variance	% cumulative	Total	% de variance	% cumulative
1	2,050	29,282	29,282	2,050	29,282	29,282	1,583	22,614	22,614
2	1,084	15,482	44,764	1,084	15,482	44,764	1,551	22,150	44,764
3	,997	14,241	59,005						
4	,869	12,419	71,424						
5	,791	11,301	82,725						
6	,712	10,170	92,895						
7	,497	7,105	100,000						

Source: developed by authors.

Table 2 presents the initial eigenvalues after extraction and lastly after rotation. The columns corresponding to the initial eigenvalues always present the same number of items and factors, forming one factor for each item and detecting correlations between the items to extract factors with higher loadings of explained variance to eliminate part of the variance with smaller explanatory potential. Thus, the first factors (components) of the initial eigenvalues and the extraction of factors present a higher percentage of explained variance. Decreasing order of explained variance can be verified when the components and corresponding explained variance is analyzed (component 1 represents 29.282% of the explained variance in the initial eigenvalues and after extraction. Component 2, in turn, presents the second-highest percentage of explained variance in these two stages, and so on successively for the remaining components).

The extraction of the factors is based on the eigenvalue that should be higher than 1 (the eigenvalues of each value are exhibited in the column called "Total"). Therefore, the initial eigenvalues indicate two factors (eigenvalue of 2.050 corresponding to the first factor, and eigenvalue of 1.084 corresponding to the second factor), which have an accumulated variance of 44.764%. The remaining factors were extracted so that only these two factors remained, which are presented in "extraction sums of squared loadings" and, finally, "rotation sums of squared loadings" would present the new values corresponding to the two factors.

The items need to be weakly, moderately, or strongly correlated for the two factors to be identified (Field, 2009). According to the set of correlations formed by the items, the variance of each item's data is constituted of unique variance and variance shared with the remaining items. The shared variance of each of the items, also called commonalities, is presented in Table 3.

Table 3

Commonalities

Items	Initial	Extraction
FI	1,000	,483
FF	1,000	,427
ER	1,000	,608
ESF	1,000	,271
EDF	1,000	,493
ECEO	1,000	,513
EI	1,000	,339

Legend: IT– International Training; FT– Financial Training; ES – Experience in the Sector; EFS–Experience in the Financial Sector; ECFO– Experience as CFO; ECEO – Experience as CEO; andIE– International Experience.

Source: developed by the authors.

Table 3 presents the values of the variances: unique ("Initial" column) and shared ("Extraction" column). The values presented in the "Initial" column represent each item's unique variance, since, as shown in the "Initial eigenvalues" column of Table 2, principal component analysis is based on the creation of one item per factor; hence, seven factors for seven items. Therefore, item variance is not shared; so that, we have value "1" for unique variance, also called error or random variance to communality. The value presented in column "Extraction" represents shared variance, that is, commonalities, considering that seven items remained for the two factors after extraction and rotation of factors, showing that some items shared the factor's explained variance. Table 2 also shows that it is possible to interpret the cumulative explained variance better, so that it is possible to verify that 44.764% of the variance of the items that belong to factors "1" and "2" is shared, so there are enough correlations to place them in groups called factors.

After grouping the items into two factors and obtaining the percentage of the factors' individual explained variance: factor "1" (22.614%) and factor "2" (22.150%) and cumulative variance of 44.764%, as presented in Table 2, the percentages of explained variance were re-dimensioned to 100%. This procedure enables maximizing data interpretation regarding each factor and later regarding each of the items to differentiate the importance assigned to each of the factors and then construct the Financial Sophistication Index (ISF). Based on this reasoning, it is enough to weigh the explained variance of each factor by the cumulative rotated variance to find the percentage that is consistent with each factor. Equation 1 presents the calculation of the factors.

$$\%\,Factor = \frac{ExplainedVarianceFactor}{CumulativeRotatedVariance} \quad (1)$$

The results from equation "4" show that factor "1" represents 50.52% of the index and factor "2" represents the complementary part, i.e., 49,48%. Once each factor's value is identified, it is necessary to distribute this percentage according to the items that compose it. Hence, it is possible to identify the percentage that is consistent with each item. Based on this, the rotated component matrix, Table 4, presents the items that belong to the factors, the items loadings, and scales the order of importance assigned to the items within the factors.

Table 4

Rotated component matrix

Components	1	2
FI	,695	
FF	-,675	
ER	,516	
ESF	-,512	-,501
EDF		,701
ECEO		,566
EI		,513

Legend: IT–International Training: academic training (undergraduate and/or postgraduate studies) in international universities; FT–Financial Training: academic training (undergraduate and/or postgraduate studies) in the field of finances (Business Administration, Accounting, Economy of Finances); ES – Experience in the Sector: professional experience (in years) in the same sector as the company in which current works; EFS–Experience in the Financial Sector: professional experience in companies in the financial sector; ECFO–Experience as CFO: Experience as CFO; ECEO –Experience as CEO: Experience (in years) as CEO in the current company;andIE–International Experience: professional experience in international companies.

Source: developed by the authors.

The Varimax rotation orthogonal method was used for the rotated component matrix to maximize the dispersion of loadings within the factors and loads a small number of items in each factor. Table 4 presents the items' loadings according to each factor; the closer to "1", the more consistent the item within the factor. Note that all the items present loadings higher than 0.4,consistent and coherent with the recommended factor structure (Field, 2009). Comparison of the components that composed the two factors and the components that composed the two theoretical dimensions, as shown in Table 3, shows that the structure of factor "1" is close to the academic dimension, and the structure of factor "2" is coherent with the professional dimension.

The academic dimension is composed of the following items: "International Training" and "Financial Training", as shown in Table 1. The components that formed factor 1, according to Table 4, are "International Training", "Financial Training", "Experience in the Sector"and "Experience in the Financial Sector". The component "Experience in the Financial Sector" does not belong to the academic dimension, neither does "Experience in the Sector", but are correlated to the factor's remaining components, so they were grouped. However, the component "Experience in the Financial Sector" presented loadings directed to this item in both factors (factor 1: -0.512 andfactor 2: -0.501),which are considered low (Table 4). Hence, the logic according to the literature, and used in the construct "Financial Sophistication", the item "Experience in the Financial Sector" was eliminated from factor 1 and only kept in factor 2. Thus, factor 1 represents the index's more academic portion, composed of the items International Training" and "Financial Training", and "Experience in the Sector".

The professional dimension is composed of items: "Experience in the Sector", "Experience in the Financial Sector", "Experience as CFO", "Experience as CEO", and "International Experience", as shown in Table 1 and confirmed by KMO. The components of factor 2, according to Table 4, are: "Experience in the Financial Sector", "Experience as CFO", "Experience as CEO", and "International Experience". Note that this dimension lost only one item, which shows the more professional portion of the index.

The signs of the loadings of components in the factors result from the structure of existing correlations, with no implication in the importance assigned to the item concerning the dimension. Therefore, after distributing the components to each factor, obtaining their respective loadings (according to Table 4), and considering the results from equation 1, it was possible to calculate the components' percentage for the Financial Sophistication Index. Based on this line of reasoning, it is enough to weigh the item loading by the sum of the loadings of all the items that compose the factor (disregarding the value of the loading sign) and multiplying it by the percentage of the index that corresponds to the factor (result from equation 4). This calculation is repeated for all the items in the factor. Hence, the sum of the items' values resulting from this calculation should be equivalent to the percentage assigned to the corresponding factor. Equation 2 presents the calculation of the items.

$$\%\,Item = \left(\frac{Item loading}{\sum of the items' loadings corresponding to the factor}\right) * \%\,Factor \quad (2)$$

Equations "1" and "2" enabled to assign weights to the items. Thus, Table 5 presents the percentages of the factors and items concerning the Financial Sophistication Index.

Table 5
Importance of the dimensions and items for the ISF

	Dimension	Weight	Items	Peso
Financial Sophistication Index	Academic	50,52%	FI	18,62%
			FF	18,07%
			ER	13,83%
	Professional	49,48%	ESF	10,87%
			EDF	15,21%
			ECEO	12,27%
			EI	11,13%

Legend: ISF – Financial Sophistication Index; IT –International Training: academic training (undergraduate and/or postgraduate studies) in international universities; FT – Financial Training: academic training (undergraduate and/or postgraduate studies) in the field of finances (Business Administration, Accounting, Economy of Finances); ES – Experience in the Sector: professional experience (in years) in the same sector as the company in which current works; EFS – Experience in the Financial Sector: professional experience in companies in the financial sector; ECFO – Experience as CFO: professional experience as CFO; ECEO – Experience as CEO: Experience (in years) as CEO in the current company; and IE – International Experience: professional experience in international companies.

Source: developed by the authors.

The results presented in Table 5 show that the percentages that correspond to the factors remained relatively close. Therefore, what makes the weights of the items different is the number of items corresponding to each factor and the items' loadings, as shown in Table 4. Note that the academic dimension represents 50.52%,andthe professionaldimension corresponds to 49.48% of the Financial Sophistication Index.

Regarding the percentage of the index assigned to the items "Experience in the Sector" and "Experience as CEO", a differentiated treatment was necessary because these are continuous variables. Thus, the percentage of the items was distributed differently between the observations to respect the use of continuous variables and intensify the probability of its use. Experience in years (decades) was used as the parameter, as presented in Table 6.

Table 6

Parameterization of the items "ES" and "ECEO" for ISF

Experience in the Sector														
Decades	Observations						% of observations						% Explained variance	% Explained variance by decades
	2011	2012	2013	2014	2015	Total	2011	2012	2013	2014	2015	Total		
0	3	1	4	5	4	17	2,04%	0,63%	2,42%	2,96%	2,34%	2,10%	13,83%	0,00%
1 – 10	30	31	28	32	38	159	20,41%	19,62%	16,97%	18,93%	22,22%	19,63%		2,77%
11 -20	39	40	43	43	37	202	26,53%	25,32%	26,06%	25,44%	21,64%	24,94%		5,53%
21 – 30	30	35	44	41	41	191	20,41%	22,15%	26,67%	24,26%	23,98%	23,58%		8,30%
31 – 40	30	37	34	33	35	169	20,41%	23,42%	20,61%	19,53%	20,47%	20,86%		11,06%
41 ou +	15	14	12	15	16	72	10,20%	8,86%	7,27%	8,88%	9,36%	8,89%		13,83%
Total	**147**	**158**	**165**	**169**	**171**	**810**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**		
Experience as CEO														
Decades	Observations						% of observations						% Explained variance	% Explained variance by decades
	2011	2012	2013	2014	2015	Total	2011	2012	2013	2014	2015	Total		
0	9	13	22	16	21	81	6,12%	8,23%	13,33%	9,47%	12,28%	10,00%	12,27%	0,00%
1 – 10	97	108	106	116	119	546	65,99%	68,35%	64,24%	68,64%	69,59%	67,41%		4,09%
11 -20	20	21	24	26	22	113	13,61%	13,29%	14,55%	15,38%	12,87%	13,95%		8,18%
21 ou +	21	16	13	11	9	70	14,29%	10,13%	7,88%	6,51%	5,26%	8,64%		12,27%
Total	**147**	**158**	**165**	**169**	**171**	**810**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**		

Legend: ES – Experience in the Sector: professional experience (in years) in the same sector as the company in which current works; ECEO –Experience as CEO: Experience (in years) as CEO in the current company; and Financial Sophisticated Index. Table 6 shows that the item "Experience in the Sector" represents 13.83% of the Financial Sophistication Index. Thus, the parameterization of this item redistributed the percentage considering 5 segments. Item "Experience as CEO" represents 12.27% of the Financial Sophistication Index, considering 4 segments of decades. Equation "3" presents the calculation of the Financial Sophistication Index.

Source: developed by the authors.

$$ISF_{i,t} = \frac{\left[(PFI * VFI_{i,t}) + (PFF * VFF_{i,t}) + (PEDF * VEDF_{i,t}) + (PESF * VESF_{i,t}) + (PEI * VEI_{i,t}) + \left(\left(\frac{PER}{5D}\right) * DER_{i,t}\right) + \left(\left(\frac{PECEO}{3D}\right) * DECEO_{i,t}\right)\right]}{100} \quad (3)$$

Where:

- $ISF_{i,t}$ - Financial Sophistication of companyiin yeart;
- PFI - weight International Training;
- $VFI_{i,t}$ - Value of International training of companyiin yeart;
- PFF - weight Financial Training;
- $VFF_{i,t}$ - Value of Financial Training of companyiin yeart;
- $PEDF$ - weight Experience as CFO;
- $VEDF_{i,t}$ - Value of Experience as CFO of company i in yeart;
- $PESF$- weight Experience in the Financial Sector;
- $VESF_{i,t}$ - Value of Experience in the Financial Sector of company iin yeart;
- PEI - weight International Experience;
- $VEI_{i,t}$ - Value International Experienceof company i in year t;
- PER - weight Experience in the Sector;
- $5D5$ - Decades;
- $DER_{i,t}$ - Decades of Experience in the Sectorof company i in year t;
- $PECEO$ - weight Experience as CEO;
- $3D3$ - Decades;
- $DECEO_{i,t}$ - Decades of Experience as CEO of company i in year t.

Equation "3" shows the division of the sum of items by 100 to transform the result in an index between "0" and "1". This way, the Financial Sophistication Indexwas obtained.

4.1 Statistics of the Academic Financial Sophistication Index

TheAcademic Financial Sophistication Index is composed according to the factor 1 loadings (Table 4) and equation "2", considering 100% of the factor's percentage, so that the index presents values between "0" and "1". Regarding the percentage of the index assigned to the item "Experience in the Sector", the same criteria established in Table 6 should be considered. Equation "4" presents the calculation of the Academic Financial Sophistication Index:

$$ISFA_{it} = \frac{\left[\left(PFI * VFI_{it}\right) + \left(PFF * VFF_{it}\right) + \left(\left(\frac{PER}{5D}\right) * DER_{i,t}\right)\right]}{100} \quad (4)$$

Where:

- Academic Financial Sophistication Index of company *i*in year*t*;

4.2 Statistics of the Professional Financial Sophistication Index

The Professional Financial Sophistication Index is composed according to the factor 2 loadings (Table 4) and equation "2", considering 100% of the factor percentage, so that the index presents values between "0" and "1". Regarding the percentage of the index attributed to the item "Experience as CEO", the same criteria established in Table 6 should be considered. Equation "5" presents the calculation of the ProfessionalFinancial Sophistication Index:

$$ISFP_{it} = \frac{\left[\left(PESF * VESF_{i,t}\right) + \left(PEDF * VEDF_{it}\right) + \left(\left(\frac{PECEO}{3D}\right) * DECEO_{i,t}\right) + \left(PEI * VEI_{it}\right)\right]}{100} \quad (5)$$

Where:

- Professional Financial Sophistication Indexof company i in year t;

5. Anticipatingquestions to be investigated

The scientific community in the fields of business administration, accounting, economy, finances, and psychology has increasingly addressed the effect of human capital on decision-making, and consequently, performance (Barzegar & Farjad, 2011; Godoy & D'Amelio, 2012; Grip & Sauermann, 2013; Batalla-Busquets & Martínez-Argüelles, 2014), especially human capital in terms of job positions, such as that of a CEO, who needs to make effective and rapid decisions (Barros, 2005; Faulconbridge*et al*., 2009; Davis *et al*., 2013; Dickel & Moura, 2016; Fran *et al*., 2016; Dauth*et al*., 2017; Gounopoulos & Pham, 2018a; Gounopoulos & Pham, 2018b; Curi & Lozano-Vivas, 2020; Duan et*al*., 2020). Therefore, advancements in the technological field do not replace individuals, as decision-making is a complex and essentially human process; it is a product of individuals' choices and assessments (Tronco, Lobler, Santos & Nishi, 2019). Additionally, a CEO should be able to interact with and influence other top-level directors for management strategies to work (Georgakakis, Heyden, Oehmichen & Ekanayake, 2019). Therefore, management knowledge and experience, especially concerning the areas and processes in business finances, can cause important changes in companies.

Academic knowledge and professional experience in the management field have been the focus of research. Curi and Lozano-Vivas (2020), for instance, analyzed how managerial skills affect risk-taking and also verified the extent to which the vulnerability of an intangible asset, such as managerial skills, is crucial during an economic crisis. Brazil experiences periods of economic turbulence accruing from internal problems, such as political instability, but, because it is an emergent country, crises in other industrialized countries, and mainly in developing with which it has important trade relations, reflect here as well.

This context raises many questions, which could be investigated considering the metric proposed of Financial Sophistication:

- After years of financial crises, both due to exogenous issues, which impact business activities, and endogenous issues concerning financial difficulties, are the replacement of CEOs marked by individuals with higher levels of Financial Sophistication?
- Is there a preference for market analysts recommending the purchase of shares of companies with more financially sophisticated CEOs during and after crises? Given an expectation that s/he re-establish, or even, create an advantage compared to competitors in the sector?
- In timesof economic turbulence reflecting in the stock market, is it possible to perceive stability or even optimism in the stock prices of companies that have a CEO with greater Financial Sophistication?

A CEO's management and international expertise originated from both the academic and professional spheres is also the object of recent studies. However, research is still incipient to use variables that involve CEOs' characteristics and consider them individually. Some examples involve decisions regarding IPO, preparation of the initial disclosing of financial statements, exposure to longevity/perpetuity expectations, and earnings manipulation (Gounopoulos & Pham, 2018a; Duan *et al.*, 2020; Gounopoulos & Pham, 2018b; Kao & Chen, 2020; Jiang, Zhu & Huang, 2013). These issues are especially interesting to consider how they apply in emergent countries according to CEOs' freedom to make decisions, considering that corporate governance may be considerably weaker than in developed countries (Kao & Chen, 2020).

Approximately 36% of IPOs fail within five years (Gounopoulos & Pham, 2018a). Authors state that companies managed by expert CEOs are less likely to fail and are more likely to survive, while managerial skills have important implications on performance after an IPO. In turn, Duan et*al.*(2020) investigated the impact of international knowledge on the decision regarding the place where to launch an IPO. They found that CEOs with international experience are more likely to launch IPOs abroad. Additionally, they suggest that the option to launch stock on the market abroad occurs in countries with more advanced legal standards and for high technological segments. Custódio and Metzger (2014), however, reveal a tendency of more financially sophisticated CEOs (these authors consider experts in the financial field) to be hired by more mature companies, and that previous financial experience contributes to decision-making regarding financial policies (investment and financing). The studies seem to agree that a CEO with financial experience can mitigate information asymmetry when disclosing financial statements (Gounopoulos & Pham, 2018b), which is vital for companies seeking to enter and consolidate themselves in the capital market.

Kao and Chen (2020) report that the intention of launching an IPO is more likely to lead to earnings management, and consequently, decrease R&D expenses to raise profits immediately after the launch. In this sense, Jiang et*al.* (2013), draw attention to the possibility of CEOs with financial experience to have more condition to perform real earnings management (which affect cash flow, discretionary expenses, and production costs), which is more difficult to detect using accounting criteria, that is, accruals. However, the results show that CEOs with financial experience are consistent with the prudence concept and are consistent over time. Gounopoulos and Pham (2018b) also note that CEOs with financial expertise are less likely to manage earnings by accruals or real in the IPO year than those without such expertise. Therefore, they seem to understand the importance of disclosing financial statements and are aware of their role in reducing information asymmetry between companies and investors.

Many corporations in Brazil experience very early delisting. It is not very difficult to find studies in the fields of administration, accounting, and finance using restricted samples because they consider a slightly longer time series. The difficulty of companies to remain active is a gap that deserves greater attention from the scientific community, and the metric proposed here provides an opportunity to understand this context:

- Are companies that go public and are led by a highly Financially Sophisticated CEO more likely to succeed (active and in good financial shape)?
- Does a company, new to the stock market and managed by a Financially Sophisticated CEO, tend to have more investors interested when launching an IPO? And if so, are they able to raise the trading price? The reason would be that investors understand that the CEO's skills and abilities facilitate circumventing newcomers' difficulties and generate better results.
- Can a CEO's Financial Sophistication be a requirement to establish greater confidence in the "agent" and "principal" relationship, establishing legitimacy in the face of the market? The reason would be that the literature reports evidence of fewer earnings management and higher quality statements.

6. Final considerations

This study contributes to the literature in finances because it theoretically grounds the construct "Financial Sophistication", proposing three metrics, and shares recent studies' propositions. Financial Sophistication comprises academic and professional expertise in the finances field, namely: International Training and Financial Training (academic dimension); and Experience in the Sector, Experience in the Financial Sector, Experience as CFO, International Experience, and simultaneously having a top-level position in another company (professional dimension). The three metrics consider the characteristics of academic training and professional experience in the financial field, both separately and in combination, considering potential differences in its empirical application in future studies. By valuing an even greater contribution, this study collaborates to advancement in business administration and accounting by sharing some propositions of recent studies. The continuity of studies in the topic, which may use these propositions, tends to provide greater support to "principals", considering that a CEO's Financial Sophistication tends to impact his/her decisions and reflect on the staff, possibly producing secondary impacts.

Strategic decisions, consequently, business results are influenced by their managers' observable and cognitive characteristics (Hambrick & Mason, 1984; Pereira, Theiss, Lunkes, Schnorrenberger, Gasparetto, 2016). Therefore, investors are interested in understanding how managers' profile affects decision-making and consequently their interest in maximizing wealth. There is much to be addressed in this aspect, considering that the Brazilian stock market is relatively new. The following makes apparent the extent to which operation in the stock market is incipient in Brazil: the first Brazilian stock exchange (Bolsa de Valores do Rio de Janeiro) was created in 1845 (and ended its operations in 1864); there was virtually no capital market from 1930 until practically, the 1960s (especially for long-term operations); while the Securities and Exchange Commission (CVM) was created in 1976 (Galvêas, 2008). From this perspective, it is even more contemporary to consider the personal characteristics of a company's manager to understand the decision-making process and its reflexes. Therefore, the application of this metric, "Financial Sophistication" in the Brazilian context, is an aspect that can be considered and tend to provide meaningful contributions, both to the literature and for shareholders and stakeholders to guide their decisions and maximize their interests.

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