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The British Accounting Review

journal homepage: www.elsevier.com/locate/bar

Management control systems, business financial literacy and financial leverage in business-incubated start-ups[☆]

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ARTICLE INFO

JEL classification:

M41

M13

Keywords:

Business financial literacy

Business-incubated start-ups

Financial leverage

Management control systems

ABSTRACT

Entrepreneurs manage the capital structure of their start-ups to align the assumption of financial risk with their risk appetite. We focus on the ways in which management control systems (MCS), categorized as financial and non-financial MCS, serve as determinants of financial leverage in start-ups. Of particular interest is the influence of entrepreneurs' financial literacy on this relationship. We test these associations on a sample of business-incubated start-ups by combining survey and archival data. Our results show that financial MCS are negatively associated with financial leverage, unlike non-financial MCS, which are positively related. Entrepreneurs' financial literacy mitigates the impact of these associations. Overall, our aim is to shed light on how start-ups navigate the trade-off between taking risks and controlling their operations. In addition, we add to the growing literature on the adjustment of financial leverage and the role of MCS and financial literacy in managing such leverage.

[☆] We gratefully acknowledge helpful comments and suggestions from the editor (Jason Zezhong Xiao) and two anonymous reviewers. The first author is thankful for the valuable feedback received at the doctoral colloquium of the European Accounting Association Annual Congress (2022) from the faculty members: Alexandra Van den Abbeele, Matthias Mahlendorf and Sally Widener, and from the other participants in the track D–Management and accounting research. We are grateful for the suggestions from Guillermo Buenaventura, Beatriz Garcia Osma, Ana Gisbert, Uliana Gottlieb, Cristina Grande Herrera, Li Jiafan, Eva Labro, Sofia Lourenço, Teemu Malmi, Juan Manuel Ramon Jeronimo, Hanno Roberts, Berend van der Kolk, Antonio B. Vázquez, and other seminar participants at the 2nd EIASM conference on Management Accounting and Control in SMES (2021), the XVI International Accounting Research Symposium (2021), the PRICIT Doctoral Workshop (2021), VIII and IX Research Forum on Challenges in Management Accounting and Control (2021 and 2022), the Workshop on Accounting and Management Control “Memorial Raymond Konopka” (2022), and the XV Ibero-American Conference on Management Control – CIBEC (2021). We thank FUNCAS for the meaningful support in conducting the study. This publication is part of the project PID2019-104163RA-I00 funded by MICIU/AEI /10.13039/501100011033; and the projects PID2022-139974NB-I00 and PID2022-136983NB-I00 funded by MICIU/AEI/10.13039/501100011033 and by ERDF/EU. We also acknowledge the contribution from FCT –UIDB/04728/2020; Santander Financial Institute; PRICIT (CAM-UAM-Professorship Excellence Program); Fundación Ramón Areces; and the Catedra UAM-Audidores Madrid.

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<https://doi.org/10.1016/j.bar.2024.101427>

Received 3 November 2021; Received in revised form 4 June 2024; Accepted 15 June 2024

Available online 15 June 2024

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Please cite this article as: Roberto Graña-Alvarez et al., *The British Accounting Review*, <https://doi.org/10.1016/j.bar.2024.101427>

1. Introduction

How to obtain resources for a rapid scale-up while controlling financial risk exposure is one of the main dilemmas faced by start-ups (Akroyd, Kober, & Li, 2019). Scaling a business model is challenging because it requires funding to develop and acquire new resources, systems, processes, and structures (DeAngelo, 2022). In their early stages, start-ups may secure equity from non-traditional sources such as family and friends to become established (Colombo, Franzoni & Rossi-Lamastra, 2015). However, as start-ups begin to operate, entrepreneurs face a critical decision regarding financing options, weighing the use of financial leverage through debt to support operations and growth initiatives against the alternative of relying more heavily on equity financing (Huyghebaert, Van de Gucht & Van Hulle, 2007).¹ Variations in capital structure among entrepreneurs do not stem from its irrelevance, as posited by the Modigliani and Miller theorem, but rather emerge as a result of entrepreneurs using capital structure adjustments as an important mechanism to achieve their desired level of risk (Herranz, Krasa, & Villamil, 2015).

In this study, we examine the mechanisms influencing the choice of financial leverage level in start-ups, to show how entrepreneurs navigate the binomial between assuming a certain level of financial risk and their decision-making managerial capability. An emergent strand of literature suggests that entrepreneurs' managerial preferences can strongly influence start-ups' leverage decisions, particularly their risk tolerance levels (Basha, Bennasar, & Goaid, 2023; Vos, Yeh, Carter, & Tagg, 2007).² This is especially true for start-ups, where entrepreneurs' judgments are central to ventures' decisions due to the former's involvement across all operational domains (Hendricks, Howell, & Bingham, 2019). In this context, previous research has emphasized the significance of the information that entrepreneurs have at their disposal and their managerial competencies as leading drivers of the main decisions about their start-ups (Gomez-Conde, Lopez-Valeiras, Malagueño, & Gonzalez Castro, 2023). We argue that the entrepreneurs' propensity to set a certain level of financial risk is a function of these two pivotal factors: the availability of information and managerial capabilities. Hence, our research questions address the relationship between the information available to entrepreneurs through management control systems (MCS) and their managerial competencies to interpret that information, encompassed by business financial literacy (hereafter, financial literacy), which will better explain the level of financial leverage in start-ups.

MCS³ can be categorized as either financial or non-financial MCS based on the nature of the information they provide (Gomez-Conde et al., 2023). On the one hand, financial MCS provide critical insights into firm efficiency, cost analysis, and cash control, among others and, on the other hand, non-financial MCS offer a different perspective by helping entrepreneurs visualize market trends, sales forecasts, competitor activities, and identify potential new customers or emerging market segments (Hall, 2008; Sandino, 2007). MCS can change managers' risk preferences by influencing their cognitive frameworks through the information they receive (Bisbe & Malagueño, 2012).

We expect a different association between each type of MCS and financial leverage. The use of financial MCS fosters a "managerial mindset" among entrepreneurs that is characterized by a tendency to avoid risky positions and a commitment to aligning their objectives and actions with the maintenance of financial operational control and decision-making power (Davila, Foster, & Oyon, 2009). Consequently, we predict that entrepreneurs using financial MCS will exhibit heightened awareness of financial risks, leading them to prioritize risk-averse decisions and cautious adjustments in their capital structure, resulting in a lower level of financial leverage. On the other hand, we posit that non-financial MCS are associated with higher levels of financial leverage. The indicators and metrics concerning prospective opportunities may prompt managers to take greater risks, seeking additional resources to finance their actions with the aim of scaling their business (Chenhall & Moers, 2015). This approach is in accordance with the established concept of a "creative mindset," which revolves around entrepreneurs expanding their business by taking proactive steps toward securing essential resources, often without overly concerning themselves with their firms' exposure to risk (Davila, Foster, & Jia, 2010). To the best of our knowledge, despite the economic importance of this topic, prior research has not established a link between MCS and financial leverage in start-ups,⁴ so this is our first research question.

Our second research question focuses on the relationships among financial literacy, financial and non-financial MCS, and financial

¹ Debt financing is the most prevalent source of capital for new ventures, while capital markets tend to be less accessible to such firms (Ross & Shin, 2024). The design and management of financial leverage plays a paramount role in the development of start-ups (DeAngelo, Gonçalves & Stulz, 2022). Lower levels of financial leverage offer the advantages of reducing financial costs, serving as a safeguard against liquidity challenges, and lowering the likelihood of financial difficulties and defaults. However, such advantages may come at the expense of limiting the firm's ability to rapidly expand its business model. In contrast, higher levels of financial leverage provide additional resources for taking actions aimed at business expansion, but it comes with an inherent assumption of risk and an increased likelihood of financial distress (Caskey, Hughes & Liu, 2012). Therefore, manage financial leverage is fundamental for start-ups (Cathcart et al., 2020).

² While our understanding of the factors influencing the capital structure of small firms, particularly start-ups, is still evolving, prior studies have uncovered significant differences in their financing strategies compared to those of larger firms (D'Amato, 2020). In particular, the financial decisions of start-ups may deviate from traditional firm's value maximization, driven by entrepreneurs' preferences (Basha et al., 2023).

³ MCS are "recurring and formalized sets of institutionalized protocols and routines designed to [...] assist managers in information gathering and decision-making" (Davila et al., 2015, p. 207). Previous discussions have suggested that the simple organizational structures such as start-up ventures may be effectively managed through informal controls (Davila, Foster, & Oyon, 2009). However, recent evidence challenges this notion, highlighting that even the smallest and youngest firms adopt formal control tools.

⁴ The past two decades have witnessed significant advancements in the field of MCS in start-ups (Davila et al., 2009b; Davila et al., 2010; Davila, Foster & Jia, 2015; Davila, Foster & Li, 2009).

leverage within start-ups. For the purposes of this study, we define financial literacy as the understanding of fundamental financial and accounting concepts and the way in which they are applied in managerial decision-making (Krische, 2019; Rakow, 2019).⁵ The existing accounting and finance literature lacks clarity regarding the connections among financial literacy, MCS, and financial leverage (Graña-Alvarez, Lopez-Valeiras, González-Loureiro, & Coronado, 2024). Recent evidence shows that MCS are used by managers with varying levels of financial literacy within start-ups (Gomez-Conde et al., 2023). Furthermore, Basha et al. (2023) suggest that financial literacy acts as a mechanism for refining risk assessment and decisions, in turn shaping entrepreneurs' risk appetite. As a result, this leads to either an increase or decrease in the level of financial leverage, contingent on the specific circumstances.

Drawing upon the abovementioned literature, we argue that financial literacy serves as a mechanism for refining risk assessments influenced by the utilization of financial and non-financial MCS, aligning an entrepreneur's risk appetite with the financial leverage of their start-up. First, we expect financial literacy to alleviate the negative relationship between financial MCS and financial leverage. Financially literate entrepreneurs can accurately assess the pros and cons of financial decisions, as they possess a great deal of comprehensive knowledge and skills related to financial products and processes (Cole, Sampson, & Zia, 2011). This proficiency enables them to effectively manage the risks associated with heightened levels of financial leverage. Second, we argue that financial literacy mitigates the positive association between non-financial MCS and financial leverage. Financial literacy is associated with more prudent behaviors such as taking on extensive debt (Fernandes, Lynch & Netemeyer, 2014), which could, in turn, enhance entrepreneurs' ability to prioritize future-oriented goals while avoiding any influence from risk assumptions stemming from non-financial MCS.

Overall, we examine the association among MCS, financial literacy, and financial leverage in business-incubated start-ups. We focus on incubated start-ups because non-incubated start-ups often struggle to adopt and use MCS. Incubators actively support and encourage incubated start-ups in adopting MCS from birth (Gomez-Conde et al., 2023). To test our hypotheses, we use a combination of survey and archival data. We obtain survey data from entrepreneurs and match their responses with financial information from the Iberian Balance Sheet Analysis System (SABI, Bureau Van Dijk) database. We run our model with observations from 109 start-ups. Our findings are consistent with the predictions. We observe that financial (non-financial) MCS are negatively (positively) associated with financial leverage. Our results also suggest that financial literacy mitigates these associations.

While previous research into the management accounting literature has primarily focused on the effects of MCS on innovation and performance of start-ups (Davila et al., 2009b, 2010, 2015), our study takes a novel focus by investigating how MCS influence their financial leverage levels. We extend the current literature in this field by presenting empirical evidence on the financial implications of MCS adoption and usage in start-ups. In addition, we illustrate how the interaction between financial literacy and MCS shapes the dynamics of financial leverage. This contributes to the ongoing finance literature by building upon insights into how financial literacy influences managerial preferences for financial leverage in small firms (Basha et al., 2023). Therefore, our contribution links the worlds of management accounting and corporate finance, which often operate as distinct research silos, overlooking the prior relationships we depict (DeAngelo & Roll, 2015). This integration allows us to offer new insights into the mechanisms used by start-ups to acquire additional resources and manage risk.

2. Literature review and hypothesis development

2.1. Capital structure of start-ups

Research on the factors influencing a firm's capital structure has been conducted predominantly within the realm of corporate finance (Chen, Harford, & Kamara, 2019; Hackbarth, 2008; Hackbarth & Mauer, 2012; Morellec, 2004). Pecking order theory (Myers, 1984) and trade-off theory (Bradley, Jarrell & King, 1984) have been traditionally utilized to address financing decisions, providing different explanations and implications. Pecking order theory is concerned primarily with explaining how firms choose among financing options based on the availability of internal funds and their desire to avoid information asymmetry. According to this theory, firms prioritize internal financing (i.e., retained earnings) over debt and shareholder equity to fund their investments. Trade-off theory suggests that firms seek an optimal capital structure by balancing the tax advantages of debt against the costs of financial distress. Although some studies on start-up leverage resonate with these traditional capital structure theories, recent developments suggest that the determinants of the capital structure of start-ups differ from those of large firms, as the former often have limited options regarding choosing between internal and external financing or achieving an optimal balance between them (D'Amato, 2020).

Regarding the hierarchy of financing preferences, start-ups typically do not have available retained earnings in the early stages of their development because they are often not profitable during this phase. Moreover, start-ups often face challenges in accessing external financing, primarily because they typically have limited or no access to stock markets and face collateral constraints (Basha et al., 2023; Cathcart, Dufour, Rossi, & Varotto, 2020). Start-ups can encounter significant hurdles when seeking collateralized debt as securing it lies in the valuation of intangible assets, including intellectual property (Huang, Boateng, & Newman, 2016). Additionally, in terms of optimizing the balance between debt and equity, financial decisions in start-ups may deviate from those for traditional firm value maximization (Cassar & Holmes, 2003). Start-ups, which are often nurtured within business incubators, may exhibit diverse financial behaviors driven by a combination of their founders' personal motivations and preferences and the supportive ecosystem provided by the incubator (Albort-Morant & Oghazi, 2016).

In this context, where entrepreneurs hold considerable decision-making authority (Gomez-Conde et al., 2023), the discussion about

⁵ Among the researchers who study small firms, there is a consensus regarding the measurement of a firm's financial literacy, which is based primarily on the financial literacy of the owner-manager (Molina-García, Diéguez-Soto, Galache-Laza, & Campos-Valenzuela, 2023).

the drivers of financial choices becomes particularly pertinent. Ayyagari, Demircuc-Kunt, and Maksimovic (2017) suggested that managerial resources, such as the availability of information, and managerial competences may shape and alter entrepreneurs' risk preferences by influencing their perceptions of risks and opportunities. When entrepreneurs have access to comprehensive and accurate information, they are better equipped to assess potential risks and rewards, which lead to more informed and potentially adjusted risk preferences (Cheng, Humphreys, & Zhang, 2018). Furthermore, managerial competences can significantly modify entrepreneurs' risk preferences by equipping them with the capabilities they need to assess and navigate risks effectively (Basha et al., 2023). Entrepreneurs who possess strong financial skills can better understand the potential outcomes of various risk scenarios (Custódio & Metzger, 2014). Building upon the above discussion, we contend that the entrepreneurs' preferences regarding assuming higher or lower-level financial risk in start-ups hinge on two pivotal factors: exposure to different types of MCS information and financial literacy to effectively process and understand this information.

2.2. MCS and financial leverage in incubated start-ups

From their inception, incubated firms are actively encouraged to adopt⁶ both financial and non-financial MCS simultaneously (Gomez-Conde et al., 2023). In a seminal study, Sandino (2007) suggested that financial MCS are linked to strategic decisions involving lower risks, while non-financial MCS influence managers' risk preferences toward more uncertain positions. Further studies in this stream of research have concluded that the use of MCS may alter the risk preferences of managers by shaping their cognitive frameworks based on the information they receive (Bisbe & Malagueño, 2012). Considering the above discussion, we argue that financial and non-financial MCS have different associations with financial leverage due to their distinct roles in shaping entrepreneurs' risk preferences (Ho, Bai, Lu & Quin, 2021).

Flamholtz and Randle (2015) linked the use of MCS with the three main questions that entrepreneurs need to answer: (1) Do we have a market? (2) Do we offer a product or service that the market desires? (3) Can we generate cash and profits by providing our products or services to the market? The adoption of financial and non-financial MCS plays a crucial role in providing answers to these pivotal questions, facilitating informed decision-making and strategic planning in the dynamic landscape of start-up entrepreneurship.

Financial MCS provide entrepreneurs with the relevant information to address question (3). Cash flow management is particularly relevant for start-ups, which often lack a financial safety net. To tackle this issue, entrepreneurs must cultivate a "managerial mindset," which involves avoiding risky positions, aligning their goals and actions, and maintaining control of their financial operations (Davila et al., 2009b). Otley (1994) suggested that this type of MCS promotes a conservative approach and fosters a "playing it safe" managerial preference. For example, decision-makers who analyze financial targets such as burn rates, cash flow projections or runways⁷ from previous periods are more aware of financial risks, and tend to prioritize risk-averse actions and cautious adjustments over other types of alternatives.

Consequently, we expect financial MCS to be associated with lower levels of financial leverage.⁸ The use of financial MCS in start-ups enhances entrepreneurs' awareness of financial risks, which increases the focus on (risk-averse) decisions that might jeopardize the current financial health and stability of the company (Abernethy, Bouwens, & Van Lent, 2013). This aversion to potential losses encourages a cautious approach to financial risk management and may lead to a reduced appetite for actions that could endanger a start-up's financial well-being. Furthermore, entrepreneurs who are more aware of financial risks may also become more aware of their own limitations in managing these risks (Herranz et al., 2015). This lack of confidence in their ability to handle financial challenges can lead to risk aversion among entrepreneurs, as they prefer to avoid situations they perceive as being high risk. This hypothesis is formally stated as follows.

H1a. The use of financial MCS is negatively associated with financial leverage in incubated start-ups.

Non-financial MCS provide entrepreneurs with valuable insights into the cause-and-effect relationships among operations, strategy, and objectives, including various elements of the value chain (Chenhall, 2005). This information is crucial for addressing questions (1) and (2). Furthermore, understanding market dynamics through non-financial MCS helps managers identify emerging business opportunities and formulate strategies to capitalize on them, ultimately driving growth (Davila, et al., 2015). This approach

⁶ Disparities in MCS adoption emerge between start-ups that have been incubated within business support programs and those that have not (Amezcueta et al., 2013; Gomez-Conde et al., 2023). Incubated start-ups face analogous resource constraints as those faced by their non-incubated start-up counterparts. However, incubated start-ups benefit from the coaching and training provided by the business incubator, which assists them in overcoming traditional resource constraints that might otherwise hinder MCS adoption among non-incubated start-ups under certain circumstances (Chatterji, Delecourt, Hasan, & Koning, 2019). Thus, an "incubation effect" drives MCS adoption in these organizations. These findings contrast with those observed in non-incubated start-ups, which often prioritize financial practices like financial planning and, in subsequent stages, non-financial practices such as strategic planning (Davila & Foster, 2007).

⁷ The burn rate shows how fast a start-up spends its money. A high burn rate can be risky, as it may lead to cash shortages. Cash flow projections serve as a financial forecasting tool, allowing start-ups to anticipate cash needs and avoid surprises. Runway is highly correlated to the burn rate and shows the length of time in which a start-up can operate before running out of cash.

⁸ A potential counterargument could be that financial MCS may facilitate increased access to financial leverage and the acquisition of debt at more favorable rates (Strebulaev, 2007). Multiple factors, including the start-up's specific situation and broader economic conditions, come into play when determining the terms of debt financing. However, entrepreneurs may prioritize specific managerial preferences that go beyond mere financial efficiency (Basha et al., 2023). Drawing on Herranz et al. (2015), we contend that entrepreneurs actively adjust their capital structure to align with their risk tolerance. We would like to express our appreciation to the reviewer who highlighted this argumentation.

aligns with the conventional idea of a “*creative mindset*” among entrepreneurs, as they orient entrepreneur on expanding the business by taking actions that secure the necessary resources, often without giving undue consideration to their firms’ degrees of exposure to risk (Davila et al., 2010). For example, entrepreneurs can obtain insights from non-financial MCS that support them in visualizing paths and market trends that may signal future opportunities while reducing the fear of unexpected financial setbacks.

Therefore, we expect non-financial MCS to be positively related to higher levels of financial leverage. Entrepreneurs employ these systems to collect feedback, evaluate the results of scalable growth-oriented choices, and optimize resource allocation, thereby engaging in mechanisms of learning and adaptation within their start-ups (Gomez-Conde et al., 2023). By continuously learning from the outcomes of their actions, entrepreneurs are able to make more informed and data-driven decisions. This feedback-driven decision-making process leads to a more calculated approach to risk-taking, as entrepreneurs become more confident in their ability to adapt and learn from their experiences (Appuhami, 2023). In this regard, entrepreneurs who use these systems can adapt their strategies and reallocate resources, based on real-time feedback, reducing the uncertainty associated with high-risk decisions. We argue that entrepreneurs may become less risk-averse when considering growth-related decisions, as they perceive that non-financial MCS contribute to informed and responsible growth strategies. The emphasis on this type of information shapes the perception that growth initiatives are both financially more viable and less risky (Ittner, Larcker & Randall, 2003). The learning and adaptability associated with the use of non-financial MCS can make entrepreneurs more comfortable with taking calculated risks and using financial leverage as a means to support the growth-oriented strategies. This hypothesis is formally stated as follows.

H1b. *The use of non-financial MCS is positively associated with financial leverage in incubated start-ups.*

2.3. MCS, financial literacy and financial leverage in incubated start-ups

Financial literacy refers to managers’ expertise (knowledge and skills) regarding concepts such as cash flows, budgeting, planning, payables, and debt management (Custódio & Metzger, 2014). Prior work suggests that financial literacy acts as a mechanism for refining risk assessment and plays a role in shaping the preferences of managers regarding financing strategies (Koropp, Gricchnik, & Gygax, 2013). However, prior insights have not provided a clear direction for the association between financial literacy and financial leverage (Basha et al., 2023). On the one hand, the financing options available to start-ups are often less formal and entail elevated costs, including unfavorable interest rates and repayment terms, compared to those available to larger firms (Howell, 2017). Entrepreneurs who have high levels of financial literacy tend to evaluate the potential costs associated with financial distress, which might deter them from actively pursuing debt financing (Klapper, Lusardi & Panos, 2013). These findings imply a negative relationship between financial literacy and financial leverage. On the other hand, it has been noted that entrepreneurs with high levels of financial literacy have a better understanding of financial products and procedures, so they are more familiar with the technical terminologies related to debt financing (Cole et al., 2011). Additionally, these financially literate entrepreneurs exhibit greater confidence in their ability to effectively manage the implications of financial leverage, including managing liquidity and shortfall risks within their firms, compared to financially illiterate managers. This confidence may enable them to counterbalance the negative perceptions surrounding debt issuance (Basha et al., 2023; Custódio & Metzger, 2014).

The relationship between financial literacy and MCS has also been discussed in prior literature (Graña-Alvarez et al., 2024; Lavia & Hiebl, 2015). Managers with high levels of financial literacy can strengthen the impact of financial MCS on operational efficiency by producing more accurate financial information, owing to their deep understanding of financial concepts and procedures (Krische, 2019). Unlike in conventional (non-incubated) start-ups, the managers of incubated start-ups have to adopt MCS as a prerequisite set by the business incubator, allowing managers with varying degrees of financial literacy to use such systems.⁹ Thus, we posit that financial literacy, in this context plays an “adjusting” role in the relationship between MCS and financial leverage.

On the one hand, financial MCS gather data to monitor firm operations and evaluate cash flow dynamics (Gomez-Conde et al., 2023). Then, financial MCS typically guide managers to take fewer financial risks. Notably, financial literacy reduces the potential negative preconceptions that firms may harbor regarding their dependence on external financing (Koropp et al., 2013). Moreover, it has been suggested that financially literate entrepreneurs can better contextualize and interpret the financial information provided by MCS than financially illiterate entrepreneurs can (Hussain, Salia, & Karim, 2018). Financially literate managers make decisions after thoroughly assessing the risks associated with financial leverage, thus being more confident in their abilities to effectively use financial MCS to monitor and control financial risk, reducing the fear associated with financial leverage. Therefore, we expect the negative association between financial MCS and financial leverage to be attenuated when managers possess a high degree of financial literacy. This hypothesis is formally stated as follows.

H2a. *When financial literacy is high, the use of financial MCS is less negatively associated with financial leverage in incubated start-ups.*

On the other hand, non-financial MCS provide information that allows managers to understand the “*big picture*” through reports that include data such as sales forecasts, customer trends, or competitor activities (Davila et al., 2015; Gomez-Conde et al., 2023; Hall, 2008). This information helps in synthesizing the background and guides managers in adopting forward-looking approaches, thus supporting future actions that may lead to business growth (Sandino, 2007). However, a high level of financial literacy leads to a more analytical decision-making process, facilitating alignment with the forward-looking mindset fostered by the comprehensive context provided by non-financial MCS (Chu, Florou, & Pope, 2022). Financial literacy also leads managers to fully evaluate the downsides of

⁹ Although we acknowledge the potential presence of endogeneity in MCS adoption by financially literate managers, we argue that this adoption is driven primarily by the incubator. This incubator-driven adoption is, in fact, exogenous to the manager’s level of financial literacy.

the use of debt (Riepe, Rudeloff & Veer, 2022). By comprehensively assessing the risks and benefits of various alternatives, financially literate managers are more likely to make analytical decisions when considering avenues for business growth, thus leading to more prudent financial decisions. That is, financial literacy may help temper this *momentum* of potential overoptimism derived from the information provided by non-financial MCS. Based on the previous discussion, we predict that financial literacy offsets the association between non-financial MCS and financial leverage. This hypothesis is formally stated as follows.

H2b. *When financial literacy is high, the use of non-financial MCS is less positively associated with financial leverage in incubated start-ups.*

3. Methods

3.1. Sample

We test our hypotheses using start-ups incubated in institutions listed in the ranking of the Funcas Foundation¹⁰ for 2018 and 2019. Funcas is a Spanish nonprofit think tank renowned for its economic and social research initiatives. Since 2013, Funcas has been releasing rankings of business incubators that encompass approximately 30% of all business incubators in Spain. These rankings categorize incubators based on the quality of the resources and services they provide to start-ups. The main goal of the ranking is to encourage institutional actors to support entrepreneurship by signaling the most effective resources and services available to guide and support start-ups.

The business incubators featured in the Funcas ranking share similar structures, selection criteria, and services offered to start-ups, aligning them with the classification of third-generation business incubators (Bruneel, Ratinho, Clarysse, & Groen, 2012). These third-generation incubators typically provide support to start-ups for a duration of approximately five years, although occasionally, the incubation period may extend beyond this timeframe (Gomez-Conde et al., 2023). The incubator offers both tangible resources, such as shared facilities, and intangible support in the form of advice, training, and networking opportunities. Notably, third-generation business incubators place particular emphasis on MCS adoption,¹¹ and their training plans emphasize enhancing managers' financial literacy (Soetanto & Jack, 2018). Given this contextual background, business incubators offer a suitable environment for studying the association between MCS and start-up financial leverage, along with their potential dependence on entrepreneurs' levels of financial literacy. The uniformity of the resources and services provided to each start-up within this ranking enhances the internal validity of the research findings.

3.2. Data collection

We employed two primary data collection methods. First, we conducted a cross-sectional questionnaire (Table 1 summarizes the main characteristics of the respondents). Second, we gathered financial data on our dependent variable spanning four years (2019–2022) after the survey to mitigate any potential distortions that could have arisen from relying solely on a single year (Malagueño, Lopez-Valeiras & Gomez-Conde, 2018). Additionally, we included data from 2017 to 2018 in our analysis, as we used prior values of the explanatory variables gathered from archival sources.

To obtain the financial data, we collected information from the Iberian Balance Sheet Analysis System (SABI-Bureau Van Dijk) database. This database provided us with essential metrics, including National Classification of Economic Activities (NACE) codes, business age, earnings before interest and taxes (EBIT), non-current and current assets, long- and short-term liabilities, value added, sales, equity, and operating results. These data enabled us to estimate the dependent variable, financial leverage, and to include several control variables. For consistency, we structured the financial data in a wide (cross-sectional) format, with one observation for each start-up. To do this, we averaged the value for each firm in the period adjacent to the survey, 2019–2022, to calculate our dependent variable. By employing this procedure, we mitigated the measurement error. Additionally, for the explanatory variables from the financial data, we averaged the past values for the period 2017–2019, so that this past period could explain the following moments. This procedure also aids in mitigating the measurement error.

We matched survey responses with financial data to gather insights into financial literacy, the utilization of both financial and non-financial management control systems (MCS), and several other control variables. These additional variables included the internationalization stage, the number of training hours in business management, and whether the respondent was the CEO or a member of the founding team. Our method, which integrated “hard data”, obtained from archival records for the dependent variable with both archival and survey-based metrics for explanatory variables, helps alleviate any potential concerns related to common method variance, adhering to the best practices (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

To develop the survey, we obtained the contact information of business incubators from their respective websites. Subsequently, in September 2019, we distributed the questionnaire to a total of 2154 start-ups using a specialized online platform. In crafting the survey, we followed Dillman (2011) regarding the survey design—simplicity, brevity, and relevance in the selection of topics and items. We took several actions to avoid a low response rate. First, we proactively reached out to business incubator officers, requesting that they encourage those start-ups under their purview to participate. We supplemented this with a cover letter explaining the goals

¹⁰ <https://www.funcas.es/en>.

¹¹ As an illustration, gaining entry into a business incubator typically necessitates submitting a comprehensive business plan along with a detailed array of performance metrics.

Table 1
Survey respondent characteristics.

	%
<u>Gender</u>	
Male	73.3
Female	26.7
<u>Age (years)</u>	
18–29	3.6
30–39	31.1
40–49	39.9
50–69	25.4
<u>Time to their current position^a</u>	
Immediately	21.1
Less than a year	29.8
1–2 years	8.8
2–3 years	5.3
3–4 years	7.0
4–5 years	8.8
6 years	19.2
<u>Position^b</u>	
Founding team member	82.4
CEO	59.6
Market officer	37.8
Strategic officer	49.5
<u>Level of study</u>	
Primary	2.6
High school	11.9
Bachelor's	32.6
Master's	40.4
Ph.D.	12.5
<u>Education branches</u>	
Science	15.1
Health science	5.9
Economic and business	26.5
Other social sciences	10.0
Engineering	35.2
Architecture	3.7
Arts and humanities	3.6

^a Time elapsed since the respondent left their prior occupation until the beginning of their current occupation.

^b A respondent could be simultaneously a member of the founding team and/or CEO, a market officer and a strategic officer (some respondents occupied all four positions).

and relevance of our study, with the aim of incentivizing start-ups to respond, regardless of their level of familiarity with the topic and the terminology, thereby minimizing potential self-selection bias. Second, we ensured data confidentiality and sent three reminders before the deadline in December 2019.

We received a total of 297 responses, for a response rate of 14%, which aligns with prior studies on management accounting (Hiebl & Richter, 2018) and research involving start-ups (Son, Ha, & Lee, 2019). Next, we matched the survey responses with data from the SABI database. Our analysis revealed that only 115 out of the 297 start-ups that completed the questionnaire reported financial information for both the target and explanatory variables within the study period. However, the presence of random missing values for certain variables¹² reduced the number of useable observations to 111 individual start-ups. As we explained above, we employed averages of financial data variables to avoid abnormal data due to a single year and to mitigate measurement error.¹³ In addition, to prevent potential bias in our results caused by extreme values, we winsorized our dependent variable, by excluding financial leverage values exceeding 1, as such situation indicates that the sum of financial liabilities exceeds the total assets, suggesting that the firm is potentially in a default scenario. Consequently, such firms cannot adjust their financial leverage levels. After employing this procedure, we had a final sample of 109 observations.

Finally, we conducted a chi-squared test to assess whether there was a significant difference in the distribution of responses across the subsamples of early and late respondents, as well as those who completed all sections of the questionnaire compared to those who

¹² Primarily concerning non-current assets.

¹³ We opt for averages rather than pooled data, as this alternative helps mitigate potential issues related to serial correlation and allows for the isolation of firm-specific random effects. We extend our gratitude to the editor and one of the reviewers for pointing out this issue.

did not (confidence level of 95%, chi-square = 0.77 with 27 degrees of freedom).

3.3. Variable measurement

Use of MCS. Research on MCS has highlighted that different definitions of similar constructs lead to ambiguity and hinder both comparability and knowledge accumulation (Bedford, 2020; Bisbe, Batista-Foguet; Chenhall, 2007; Grabner & Moers, 2013).¹⁴ To address these potential constraints, we emphasize the importance of ensuring construct validity through precise theoretical specification. Therefore, we chose those MCS practices that are the most frequently used in start-ups, as suggested by empirical evidence (Davila et al., 2015). We also followed the conceptual background provided by Malmi and Brown (2008), who suggested that financial MCS have a more tactical focus, while non-financial MCS exhibit a more strategic focus. Accordingly, we categorized MCS into financial and non-financial MCS (Gomez-Conde et al., 2023). While we acknowledge other potential categories in which these practices can be grouped, our conceptualization is firmly grounded in theory, as emphasized by Bedford and Speklé (2018). Consequently, our measurement of financial MCS practices included four items: (i) financial planning (e.g., preparation of financial operating budgets), (ii) financial evaluation (e.g., analysis of actual performance compared with budgeted performance), (iii) cost accounting and (iv) cash flow controls. For non-financial MCS, we encompassed an additional set of four items: (i) strategic planning (e.g., the extent to which the firm defines strategic (non-financial) goals), (ii) new product/project development goals, (iii) forecasts and goals related to sales, and (iv) customer relationship management system. Respondents were asked to rate their use on a 1–5 Likert scale (with values ranging from “1 = not at all” to “5 = to a great extent”).

We adopted reflective measurement models for these constructs, following the procedures of the main research corpus in management and accounting practices (Bisbe et al., 2007). We then evaluated the measurement model by analyzing its convergent validity and dimensionality, discriminant validity, and reliability (Bedford & Speklé, 2018). Tables 2 and 3 present the results, which support the accuracy of our measures. Regarding convergent validity and dimensionality, Table 2 shows that the confirmatory factor analysis loadings are well above the 0.5 threshold, and the average variance extracted (AVE) of each construct is above 0.5, indicating that these measures correlate with the factor. Table 2 also provides the extent to which the measure of a construct differs from those of the other constructs. Given that the loadings of every item are above 0.5 within a single factor, the membership of each item in the relative construct is supported. Table 3 shows the Fornell-Larcker (1981) criterion, in which the square root of the AVE must be greater than all respective correlation values; our constructs successfully fulfill this criterion, supporting their discriminant validity. Table 2 contains the results of the reliability test for each construct measurement. The findings support the reliability of each measurement since the Cronbach’s alpha and the Jöreskog’s (1971) congeneric reliability values, exceeded the threshold of 0.7.

Financial leverage. We followed the approach of prior accounting studies to measure financial leverage using a rate that includes a firm’s total liabilities¹⁵ divided by total assets (Jermias, 2008; Sun, Ding, Guo, & Li, 2016; Zou & Xiao, 2006). As the reverse association of financial leverage as a potential driver of financial and non-financial MCS could be a potential counterargument, we argue that this is not a concern in this study. We acknowledge that MCS and financial leverage could have a potential cyclical relationship, influencing each other in a recursive manner. However, the adoption of financial and non-financial MCS is supported by the business incubator at the beginning of the process, and each type of MCS influences manager’s risk preferences (Gomez-Conde et al., 2023). Consequently, the core relationship underpinning this study centers on how MCS serve as determinants of financial leverage. We seek to elucidate on how start-ups navigate the trade-off between assuming risk and exerting control over their operations.

Financial literacy. This construct, following the definition by Bongomin, Ntayi, Munene, and Malinga (2017), assesses a manager’s financial literacy in the context of business management. The measure initially encompassed 14 items, which we streamlined to four items, each exhibiting factor loadings exceeding 0.5,¹⁶ following the recommendations of Edelen, Thissen, Teresi, and Katja (2006) for managing an initially extensive measure. This simplification process allows for adherence to the recommendations of Lusardi and Mitchell (2014) in terms of simplicity and relevance for any measure that aims to capture the level of financial literacy. The four retained items were (i) “I am aware of the costs and benefits of accessing credit”, (ii) “I can correctly calculate the interest rates on my loan payments”, (iii) “I have used my skills to ascertain the financial trends of the firm”, and (iv) “I have skills in terms of minimizing losses by reducing bad debts”. Managers were asked to rate these items on a 1–5 Likert scale (with values ranging from “1 = totally disagree” to “5 = totally agree”).

Control variables. In our models, we also included a set of control variables as follows¹⁷

¹⁴ We are grateful to one of the reviewers for pointing out this issue.

¹⁵ The sum of short- and long-term liabilities with financial institutions and long-term liabilities with the government and other public administrations.

¹⁶ As we did with financial and non-financial MCS, we followed Bedford and Speckle’s (2018) recommendations to evaluate the measurement of reflective constructs. Tables 2 and 3 show that our measure of financial literacy meets the criteria of convergent validity and dimensionality, discriminant validity, and reliability.

¹⁷ In addition to this set of control variables, and as a sensitivity check, we also run our models including the interaction term between Financial and Non-financial MCS in the regressions. Untabulated results for our hypotheses are largely unchanged, except in the case of Financial MCS, which retains its sign but is not significant. However, we should note that the inclusion of this interaction creates severe collinearity problems. Consequently, we did not include it in the main tests. We thank the editor for this suggestion.

Table 2
Principal component analysis (PCA) and confirmatory factor analysis (CFA).

	PCA			CFA*
	Component 1	Component 2	Component 3	
Financial MCS				
Financial planning	0.166	0.857	0.127	0.834
Financial evaluation	0.316	0.826	0.123	0.852
Cost accounting	0.475	0.593	0.066	0.792
Cash flow control	0.414	0.523	0.314	0.757
AVE		0.510		
Cronbach's alpha		0.800		
Congeneric reliability (ρ_c)		0.839		
Non-financial MCS				
Strategic planning	0.747	0.344	0.053	0.841
Establish goals for new product/project development	0.772	0.227	0.157	0.840
Forecasts and goals related to sales	0.821	0.310	0.127	0.895
Customer relationship management system	0.598	0.077	0.095	0.623
AVE	0.546			
Cronbach's alpha	0.826			
Congeneric reliability (ρ_c)	0.831			
Financial literacy				
Awareness of the cost and benefits of credit access	0.067	0.227	0.737	0.749
Capacity to calculate loan's interest rates	-0.149	0.296	0.739	0.757
Ability to ascertain financial trends	0.216	0.024	0.726	0.727
Skills to minimize losses by reducing bad debts	0.292	-0.072	0.711	0.715
AVE			0.530	
Cronbach's alpha			0.818	
Congeneric reliability (ρ_c)			0.771	

Rotation method of principal component analysis: Varimax with Kaiser normalization, with the rotation converging in 5 iterations.

Table 3
Fornell-Larcker criterion.

	[1]	[2]	[3]
[1] Financial MCS	0.714^a		
[2] Non-financial MCS	0.620 ^b	0.739^a	
[3] Financial literacy	0.379 ^b	0.314 ^b	0.728^a

^a Square root of the AVE.

^b Bivariate Pearson's correlations (two-tailed), which are all significant at p value < 0.001.

- (i) *Manager capabilities*: These variables were chosen because existing evidence suggests that the knowledge and skills acquired by managers/entrepreneurs influence their use of MCS and subsequent decision-making (Lavia & Hiebl, 2015). Therefore, we use two proxies of manager capabilities, obtained through the questionnaire: (a) training hours: number of training hours in accounting and finance during business incubation, and (b) CEO-founder: a dummy variable that takes a value of 1 if the respondent is the main decision-maker in the firm (meeting the conditions of being CEO and a member of the founding team)¹⁸ and 0 otherwise.
- (ii) *Firm size and age*. Prior work shows that larger and more established firms tend to use MCS to a greater extent than do their smaller and younger counterparts (Bisbe & Malagueño, 2015). Moreover, size and organizational age also shape the level of financial leverage (Cassar, 2009). Therefore, we included five proxies already used in the literature to capture the potential association of size and age with leverage dynamics (Janke, Mahlendorf & Weber, 2014). Organizational age: (a) Data on organizational age were collected through the archival information of establishment data and the data of each annual account (natural log transformed). The other proxies come from archival data: (b) EBIT value; (c) non-current assets value; (d) return of assets, measured as the ratio of operating profit to total assets; and (e) sales growth, measured as the average percentage of annual sales growth computed as the difference between current sales (t) and sales of the prior year ($t-1$), divided by the sales of the prior year.
- (iii) *Strategic orientation*. Several studies have noted the implications of a firm's strategic orientation for its decision-making processes (Bedford, Malmi, & Sandelin, 2016). Accordingly, we accounted for strategic orientation with proxies of the following:

¹⁸ Cases in which any condition is not met were classified as non-CEO-founder for this analysis. We combined these conditions because the two-sample t -test of the mean differences in the levels of financial leverage showed that when any such difference is considered alone, the test failed to reject it at any p-value ($t = 0.50$; p-value = 0.62 for CEO-dummy, and $t = 0.56$; p-value = 0.58 for founding team-dummy) but did not do so if we merged them ($t = 3.00$; p-value = 0.003).

- (a) internationalization stage (García Osma, Gomez-Conde, & Heras, 2018), a dummy variable taking a value of 1 if the start-up reported international plans and 0 otherwise; (b) value added to total sales, measured as the rate of value added to total sales, which is a proxy for competitive strategy, as firms following any differentiation tend to have a larger ratio than do those following cost leadership (Mawdsley & Somaya, 2018); and (c) the difference between the return on equity (ROE; the ratio of operating profit to total equity) and the return on assets (ROA), accounting for the balance between the financial and economic aspects encompassed by a firm's management.
- (iv) *Industry*. We controlled for potential industry differences by including a dummy that takes a value of 1 if the company belongs to a technology industry (NACE) and 0 otherwise.

3.4. Empirical models and statistical procedure

We built a cross-sectional data model to test our hypotheses on the relationships among the use of financial and non-financial MCS, financial literacy, and financial leverage. Financial leverage is the dependent variable. The use of financial and non-financial MCS as predictors enables the testing of H1a and H1b. Moreover, by including the interaction between the use of financial and non-financial MCS and financial literacy as predictor variables, we have the framework to test H2a and H2b. The model formulation is as follows:

$$\text{Financial leverage} = \beta_0 + \beta_1 * \text{financial MCS} + \beta_2 * \text{non-financial MCS} + \beta_3 * \text{financial literacy} + \beta_4 * \text{financial MCS} * \text{financial literacy} + \beta_5 * \text{non-financial MCS} * \text{financial literacy} + \Sigma (\gamma * \text{controls}) + \varepsilon$$

Our dependent variable takes continuous values between 0 and 1. In this context, fractional probit regression is often preferred over ordinary least squares (OLS) regression.¹⁹ We also examined potential heterogeneity within our sample. A joint Wald test did not reject the absence of heteroskedasticity attributed to the three independent variables under scrutiny (Financial Literacy, Financial-MCS, and Non-financial-MCS) at a significance level of p value < 0.05. Therefore, we employed a fractional heteroskedastic probit regression for our model. This correction helped us in adjust for the unequal variances in the error terms among different observations, ensuring more accurate and efficient model estimates (Gujarati & Porter, 2009). Furthermore, to address endogeneity concerns, we averaged our explanatory time-variant variables in a prior period (2017–2019) relative to our time-variant dependent variable (2019–2022), which enables controlling for abnormal data relative to a single year and avoid the issue of reverse causation when both explanatory and outcome variables are measured contemporaneously. Additionally, we tackled the potential problem of omitted variables by incorporating a comprehensive set of both financial and survey control variables. Even if these variables are found to be non-significant, they serve to account for unobservable factors and remove any portion of variability in the target variables attributable to such unobservable factors (Lu, Ding, Peng, & Chuang, 2018). Finally, we standardized all the variables (excluding the dummy variables) before conducting the estimations.

Table 4 includes the descriptive statistics and correlations before the standardization of the variables. All the correlations are below $r = 0.6$, except for the association between financial and non-financial MCS. This finding is consistent with prior empirical studies that evaluated a set of MCS classified into two distinct categories (García Osma et al., 2018; Gomez-Conde et al., 2023).

4. Results

4.1. Hypothesis testing

Table 5 shows our regression results. Multicollinearity is not a problem in our model since the maximum VIF is 4.26, which is well below the generally suggested threshold of 10. H1a predicts that the use of financial MCS is associated with lower levels of financial leverage. The results show that the coefficient is significantly negative (full model: $\beta = -0.366$; p value < 0.001). Hypothesis 1b predicts that the use of non-financial MCS is associated with higher levels of financial leverage. The results show that the coefficient of the use of non-financial MCS is significantly positive (full model: $\beta = 0.257$; p value < 0.05).

Interpreting odds ratios in probit regressions does not offer meaningful insights into the probability changes associated with predictor variables. Instead, we can determine whether a variable change results in a higher or lower probability of the desired outcome, though without quantifying the exact magnitude of that change (Cameron & Trivedi, 2013). To enhance interpretability, we computed the average marginal effects of the regression in Table 6. Financial MCS has a negative marginal effect on leverage ($\beta = -0.115$; p value < 0.05) and non-financial MCs has a positive marginal effect on leverage ($\beta = 0.084$; p value < 0.05). Taken together, results of Tables 5 and 6 provide support our expectations that the use of financial (non-financial) MCS is associated with lower (higher) financial leverage.

To test H2a and H2b, we focus again on Table 5. The coefficient of the interaction term between financial MCS and financial literacy is significantly negative (full model: $\beta = -0.274$; p value < 0.001). Additionally, regarding the role of financial literacy on the relationship between non-financial MCS and financial leverage, the coefficient is significantly positive (full model: $\beta = 0.273$; p value < 0.01). Table 6 presents complementary results for the marginal effects ($\beta = -0.145$; p value < 0.001 and $\beta = 0.139$; p value < 0.05, respectively).

¹⁹ Unlike OLS regression, fractional probit regression directly models the probability of the dependent variable reaching a certain threshold, assuming a cumulative standard normal distribution (Greene, 2017).

Table 4
Main descriptive statistics and correlations of the sample.

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Financial leverage	0.387	0.278														
(2) ROE-ROA	0.152	1.248	-0.10													
(3) Sales growth	1.610	7.372	0.18	0.17												
(4) Value added to sales	0.686	6.821	0.03	-0.11	0.34											
(5) ROA	0.049	0.289	-0.12	-0.32	-0.16	0.57										
(6) Ln. org. age	1.987	0.542	0.02	-0.02	-0.12	0.02	0.07									
(7) Technological (d)	0.367	0.484	-0.08	0.17	-0.09	-0.13	-0.16	-0.20								
(8) International (d)	0.670	0.472	-0.08	0.13	0.07	0.18	0.09	0.03	0.29							
(9) CEO-founder (d)	0.615	0.489	0.19	-0.12	-0.07	-0.06	-0.05	0.03	-0.06	-0.11						
(10) EBIT	36,443	157,421	-0.01	0.00	-0.03	0.01	0.24	0.11	0.00	-0.04	-0.01					
(11) Non-current assets	218.592	859.736	0.17	0.02	0.02	0.03	-0.01	0.12	-0.06	-0.06	0.08	0.54				
(12) Training hours	137.064	226.713	-0.03	-0.01	-0.02	-0.05	-0.03	0.06	0.12	-0.25	-0.09	0.09	-0.04			
(13) Financial literacy	3.851	0.699	-0.10	0.11	-0.04	0.05	0.07	-0.01	0.18	0.09	0.03	0.09	-0.04	0.29		
(14) Non-fin. MCS	3.268	1.095	-0.07	0.01	0.11	-0.01	-0.14	-0.07	0.17	0.04	0.07	-0.23	-0.16	0.13	0.31	
(15) Fin. MCS	3.305	1.102	-0.08	-0.10	-0.04	0.11	-0.05	-0.09	0.21	0.10	0.13	-0.31	-0.16	0.05	0.24	0.64

All correlations higher than |0.19| are significant at p value < 0.05; (d) dummy variable.

Table 5
Fractional heteroskedastic probit regression results.

Dependent variable	<i>Z financial leverage</i>			
	(1): Only control variables		(2): Full model	
	Coef.	S.E.	Coef.	S.E.
L1. Z ROE-ROA	-0.106	(0.050)**	-0.140	(0.079)*
L1. Z sales growth	0.122	(0.057)**	0.002	(0.041)
L1. Z Value added to sales	0.059	(0.148)	0.264	(0.114)**
L1. Z ROA	-0.100	(0.123)	-0.222	(0.109)**
Z Ln organizational age	0.017	(0.084)	0.028	(0.066)
Technological (d)	-0.020	(0.167)	0.214	(0.098)**
International (d)	-0.075	(0.173)	-0.106	(0.125)
CEO-founder (d)	0.240	(0.143)*	0.072	(0.121)
L1. Z EBIT	-0.967	(0.089)	0.011	(0.045)
L1. Z non-current assets	0.167	(0.081)**	0.057	(0.045)
Z training hours	-0.010	(0.071)	-0.057	(0.049)
Z financial MCS			-0.366	(0.102)****
Z non-financial MCS			0.257	(0.111)*
Z financial literacy			-0.287	(0.082)****
Financial MCS × financial literacy			-0.274	(0.069)****
Non-financial MCS × financial literacy			0.263	(0.093)**
Intercept	-0.373	(0.167)**	-0.510	(0.155)**
Firms	109		109	
Pseudo R-squared	0.033		0.047	
Wald Chi-squared (sign)	33.12****		61.51****	
Max VIF	3.98		4.26	

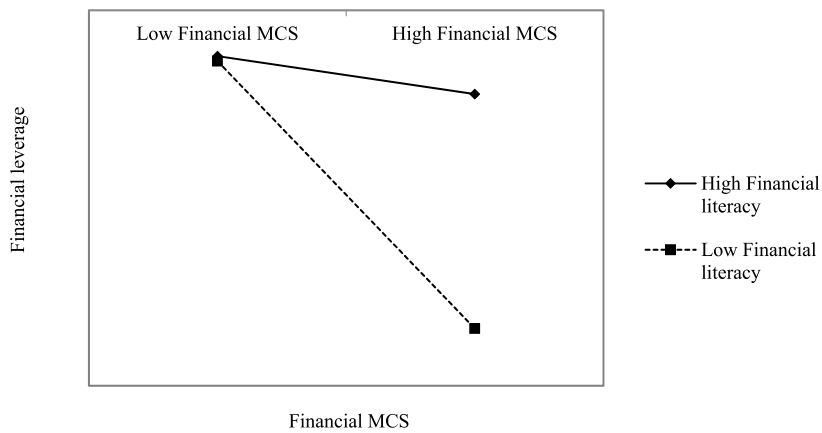
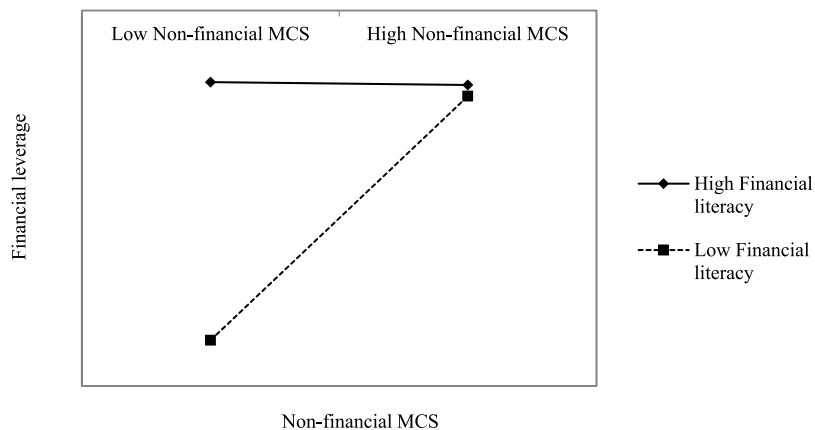
Standardized coefficients and robust standard errors (in parentheses) are presented, except for dummies and intercepts (unstandardized coefficients). ****p<0.001, ***p<0.010, **p<0.050, and *p<0.100. Z denotes a standardized variable, and (d) denotes a dummy variable. L1: These variables are lagged relative to the dependent variable to avoid potential problems of endogeneity and causality attributable to contemporaneous measures. All the other variables are measured at a single moment.

Table 6
Average marginal effects of the fractional heteroskedastic probit regression (full model). *Delta method.*

Dependent variable	<i>Z financial leverage</i>	
	Coef.	S.E.
L1. Z ROE-ROA	-0.074	(0.038)*
L1. Z sales growth	0.001	(0.021)
L1. Z Value added to sales	0.139	(0.070)**
L1. Z ROA	-0.117	(0.058)**
Z Ln organizational age	0.014	(0.032)
Technological (d)	0.109	(0.048)**
International (d)	-0.054	(0.053)
CEO-founder (d)	0.039	(0.062)
L1. Z EBIT	0.006	(0.023)
L1. Z non-current assets	0.030	(0.027)
Z training hours	-0.030	(0.023)
Z financial MCS	-0.115	(0.058)**
Z non-financial MCS	0.084	(0.051)**
Z financial literacy	-0.085	(0.064)*
Financial MCS × financial literacy	-0.145	(0.056)****
Non-financial MCS × financial literacy	0.139	(0.061)**
Firms	109	
Pseudo R-squared	0.047	
Wald Chi-squared (sign)	61.51****	
Max VIF	4.26	

Standardized coefficients and robust standard errors (in parentheses) are presented, except for dummies and intercepts (unstandardized coefficients). ****p<0.001, ***p<0.010, **p<0.050, and *p<0.100. Z denotes a standardized variable, and (d) denotes a dummy variable. L1: These variables are lagged relative to the dependent variable to avoid potential problems of endogeneity and causality attributable to contemporaneous measures. All the other variables are measured at a single moment.

To better interpret these findings, we also illustrate these interactions in Fig. 1. Panel A shows that the relationship between financial MCS and financial leverage is negative at lower financial literacy levels but that higher financial literacy levels mitigate this association. Furthermore, Panel B shows that non-financial MCS are positively associated with financial leverage at lower levels of

Panel A. Financial MCS and financial literacy**Panel B.** Non-financial MCS and financial literacy**Fig. 1.** Interactions between management control systems (MCS) and financial literacy and their associations with financial leverage**Panel A.** Financial MCS and financial literacy**Panel B.** Non-financial MCS and financial literacy

*Adjusted predictions with 95% confidence intervals. Low levels are calculated by reducing the mean of the variable by two standard deviations. High levels are calculated by adding up to the mean of the variable by two standard deviations.

financial literacy. However, as entrepreneurs' financial literacy levels increases, the positive association between non-financial MCS and financial leverage is attenuated.

In addition, to complete these insights, we conducted an (untabulated) analysis of the average marginal effects of the interactions by calculating the coefficients of financial (non-financial) MCS on financial leverage, based on the two categories (low/high) of financial literacy depicted in Fig. 1. We find that the association between financial MCS and financial leverage is significantly more negative for low values of financial literacy than for high values ($\beta = -0.193$; p value = 0.01). Moreover, the association between non-financial MCS and financial leverage is significantly positive for low values of financial literacy ($\beta = 0.138$, p value = 0.04).

Overall, we find support for our predictions about the potential interaction of financial literacy on the association between the use of both financial and non-financial MCS and financial leverage. Entrepreneur's financial literacy adjusts the preferences for financial leverage that the use of financial and non-financial MCS entails.

4.2. Robustness checks

To complement the prior results, we conducted a series of robustness checks (untabulated). First, we analyzed the item "capital investment procedure", which is recognized as one of the most commonly used MCS in start-ups (Davila et al., 2015). This control is challenging to categorize definitively as either a financial or non-financial MCS because it aggregates financial information with a

long-term and strategic focus (a theoretical assumption of the non-financial practices). In our analysis, we first added it to financial MCS and reran our regression. Then, we included it in the non-financial MCS category and re-estimated the model. The results do not change, further confirming that financial and non-financial MCS are reflective constructs.

Second, we checked the association suggested in the small-firm literature that financial literacy drives the use of financial MCS (Lavia & Hiebl, 2015). Although we did not reject the prior work that suggests this association, we argue that in the context of incubated start-ups, this relationship may differ because MCS are adopted with the assistance of an incubator (“the incubation effect”). To investigate this potential association within our sample, we modified the dependent variable in our model, considering financial MCS and we ran an OLS as it is not a ratio bounded between 0 and 1. The results indicated that financial literacy is not a significant ($\beta = 0.076$; p value = 0.37) antecedent of financial MCS in this particular setting. These findings align with our chosen methodological and theoretical approaches.

Third, we performed some additional robustness checks to address the potential concern that a high correlation between financial and non-financial MCS and their interactions with financial literacy might introduce bias into our estimations. To address this issue, we used the orthogonal transformation of the predictors (Gomez-Conde et al., 2023). This procedure effectively reduces the correlations between financial and non-financial MCS ($r = 0.020$) and between their interactions with financial literacy ($r = 0.021$), with all the correlations having values well below 0.6. We retained the transformation matrix and used it to back-transform the estimates to the original scale of the variables, facilitating the final interpretation of the size of the association. The estimations maintained the same sign and significance levels. This robustness check provides additional robustness in that any potential bias arising from multicollinearity has been effectively addressed in our analysis.

Finally, to ensure completeness and comparability with prior findings, we also checked the potential three-way interaction among financial MCS, non-financial MCS and financial literacy. The coefficient is significantly negative ($\beta = -0.143$; p value = 0.07), so the results seem to be driven by the effect of financial MCS, which usually have a greater weight, in startups as well (Lavia & Hiebl, 2015; Gomez-Conde et al., 2023). Notably, previous research has argued that the coexistence of both MCS within an organization does not necessarily imply equal utilization or adoption levels (Gomez-Conde et al., 2023). Despite the inclusion of the abovementioned three-way interaction, the coefficients of the single interactions among financial and non-financial MCS and financial literacy and the main associations of both MCS with financial leverage maintained the same sign.

5. Discussion and conclusions

We provide novel insights into how financial and non-financial MCS shape the dynamics of financial leverage. Furthermore, we explore the extent to which financial literacy plays an adjusting role in these relationships. Prior work has shed light on a critical dimension; specifically, in *non-incubated* start-ups, only financially literate entrepreneurs have the cognitive resources necessary to adopt MCS (Davila & Foster, 2007), which is why we developed this study in the “*incubation context*”, where business incubators assist start-ups in adopting MCS from their inception (Amezcuca, Grimes, Bradley, & Wiklund, 2013). Then, in such firms, managers with different levels of financial literacy are assisted in making informed decisions based on the information gathered from both financial and non-financial MCS.

Our evidence indicates that financial MCS are negatively associated with financial leverage, while non-financial MCS are positively related. Notably, to the best of our knowledge, we are the first to document these associations, thus providing fresh empirical evidence that illuminates entrepreneurs’ preferences for financial leverage (DeAngelo & Roll, 2015). In doing so, our results contribute to the accounting literature, which has hitherto focused on empirically substantiating the relevance of MCS in managing start-ups (e.g., Davila, Foster, & Li, 2009; Davila et al., 2015, 2010, 2015), by elucidating their association with financial leverage. Overall, we provide novel insights into the dilemmas faced by start-ups as they endeavor to scale their ventures while maintaining the firm control of their financial operations (Akroyd et al., 2019). Finally, and significantly, we also offer compelling evidence regarding how an entrepreneur’s level of financial literacy adjusts the associations of financial and non-financial MCS with financial leverage. Therefore, financially literate entrepreneurs tend to be less closely associated with extreme positions in terms of financial leverage, whether they use a larger number of financial or non-financial MCS, compared to financially illiterate entrepreneurs.

This study has significant practical implications, elucidating how business incubators can improve their coaching and training programs by considering the interplay between entrepreneurs’ financial literacy and the use of MCS on financial leverage. We propose that incubators proactively assess financial literacy *ex ante*, particularly during the early stages. For entrepreneurs with lower financial literacy levels, extending their firms’ incubation period and providing comprehensive financial education to managers are advisable steps. Notably, effective financial education often requires enough time to change behaviors (Rakow, 2019). This recommendation underscores the meaningful contributions of our study in guiding business incubation practices.

Like all empirical research, our study also has certain limitations that suggest promising avenues for future work. We are unable to empirically test the associations among financial MCS, financial literacy, and financial leverage with firm default. To explore this aspect, the development of a comprehensive, longitudinal dataset that captures data on the use of financial MCS and managers’ financial literacy levels over multiple occasions, alongside repeated measures of financial leverage and default levels, would be necessary. This is a relevant research avenue for both academics and practitioners (managers, incubators, and policy-makers). Furthermore, another possible research avenue lies in conducting comparative studies across different countries. Various contextual factors, including institutional dynamics, training plans for entrepreneurs, and the level of economic development, could shape both the use of MCS and entrepreneurs’ levels of financial literacy.

Although we have carefully tried to minimize endogeneity, readers should interpret our findings cautiously without overstating a causal effect between financial and non-financial MCS (and their interactions with financial literacy) on financial leverage. To mitigate

this concern, we have consistently framed our results in terms of associations throughout the manuscript. Importantly, the generalizability of our results is limited when applied to non-incubated start-ups. The use of MCS and entrepreneurs' financial literacy levels are likely to be more pronounced in incubated start-ups than in their traditional counterparts. This discrepancy arises from the fact that business incubators actively guide and facilitate MCS adoption from the beginning, providing substantial financial training in business management. In fact, business incubators often mandate the use of MCS and require entrepreneurs to undergo corresponding training if they want to have their projects incubated in the incubator facilities (Soetanto & Jack, 2018). Therefore, the findings on the interactions between financial and non-financial MCS and financial literacy should be cautiously generalized to non-incubated start-ups in future work.

Data availability

Data will be made available on request.

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