

Survival of e-commerce entrepreneurs: The importance of brick-and-click and internationalization strategies

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ABSTRACT

E-commerce is a fast-growing industry that attracts many entrepreneurs; however, the survival rate is lower than that of other industries. Entrepreneurs take many strategic decisions that have a significant bearing on the success of their e-commerce ventures. Two are particularly salient for our research: Is it better to start as a pure-click or open a physical store? To what extent should e-commerce ventures internationalize? We also wonder if it is worth reviewing the first annual accounts available. Grounding on organizational ecology theory, we develop a model hypothesizing that (1) the brick-and-click strategy favours survival; (2) internationalization favours survival; (3) firm size and financial health matter; (4) earnings management mediates the relationship between financial health and survival; and (5) the brick-and-click and internationalization strategies mediate the relationship between size and survival. The empirical study is performed by analysing seven years of data on 632 new e-commerce ventures using non-parametric means tests, a Cox regression, and a generalized structural equation model. The study tests the strategies followed by e-commerce entrepreneurs and firm characteristics that influence survival. We find that the risk of bankruptcy is 1.437 times greater for pure-click than for brick-and-click retailers, 2.778 times greater for local players than for internationalized firms, and 1.787 times greater for unprofitable firms than for profitable firms. Hence, it is worth analysing the financial statements provided by entrepreneurs; however, signs of earnings management should be checked. All these factors affect the probability of early bankruptcy as well as explain survival several years later.

1. Introduction

The e-commerce industry has experienced sustained growth since its earliest days. E-commerce retail sales as a percentage of total sales rose from 1% in 2000 to 4.6% in 2010 and 11.4% in 2019 (U.S. Census Bureau, 2020). The e-commerce ecosystem is characterized by large dominant companies, but with niches that small business entrepreneurs can exploit. An illustrative fact is that the FT-1000 list of Europe's Fastest-Growing Companies 2020 includes 45 e-commerce companies, ranking e-commerce as the sixth industry of the forty analysed (Kelly, 2020). The e-commerce industry is among the favourites of entrepreneurs; however, many of them go bankrupt. This not only happened during the Internet bubble of the 2000s when about half of dot-com businesses went bust by 2004 (Laseter and Rabinovich, 2016; Yoo and Jang, 2019); e-commerce continues to be risky in today's climate (Mittra et al., 2015). Small business entrepreneurs take many strategic decisions that have a significant bearing on the success of their e-commerce

ventures. Two are particularly salient for our research: Is it better to start as a pure-click or open a physical store? To what extent should e-commerce ventures internationalize? Investors also ask about the usefulness of reviewing the first annual accounts available and the financial variables that should be analysed, an issue we additionally address in this study.

Although critical success factors for e-commerce have been extensively studied (Choshin and Ghaffari, 2017; Wang, 2008) from the perspective of the widely tested models of Davis (1989), DeLone and McLean (2003), Rogers (1995), and Parasuraman et al. (1988), our study is based on a different theoretical framework, namely, organizational ecology theory (Hannan and Freeman, 1977, 1984), which is not widely used in e-commerce. Our model borrows fundamental aspects of this theory and applies them to the area of information systems. According to this theory, the market facilitates the disappearance of weak companies through natural selection. Although Penrose (1952) warns of the danger of making biological analogies to explain business

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¹ https://scholar.google.es/citations?user=NAW_YAMAAAAJ&hl=es.

phenomena, it is expected that companies that are strong at birth, develop a good strategy, and obtain profits during the first years of life will be survivors. However, little work had been carried out to investigate a firm's survival and performance empirically (Delmar et al., 2013; Gimeno et al., 1997). Gimeno et al. (1997) find that survival is enhanced by economic performance, but not uniquely explained by it. Thus, it is pertinent to quantify the relationship between performance and survival accurately and find other explanatory factors relevant in the case of e-commerce.

Success factors for e-commerce include online trust (Moody et al., 2014), word-of-mouth (Cai et al., 2014), price (Kaushik et al., 2020), promotion (Lim and Lee, 2015), website characteristics (Feindt et al., 2002), inventory ownership (Randall et al., 2006), logistics (Colla and Lapoule, 2012), procurement strategies (Xu et al., 2019), order of entry (Nikolaeva et al., 2009), firm size and financial performance (Banerjee et al., 2007), and environmental factors (Doern and Fey, 2006). Following the 'survival of the fitter' principle, our model includes firm size (Banerjee et al., 2007) and financial health (Falk and Hagsten, 2015). Furthermore, the model considers the strategies followed by e-commerce companies that may influence survival. The decision between opting for a dot-com and a brick-and-click (B&C) business model is firstly investigated. While the comparison between pure-click and B&C retailers has received academic attention (Difrancesco and Huchzermeier, 2020; Kim and Lee, 2020; Toufaily et al., 2013), the results for the impact on survival are inconclusive. We also consider the internationalization of the company. E-commerce favours international trade (Falk and Hagsten, 2015; Tolstoy et al., 2016), but whether e-commerce entrepreneurs that choose to carry out internationalization activities increase their chances of survival is understudied.

Our research thus aims to help entrepreneurs and investors in their decisions by identifying the factors that increase the survival rate. Most studies examine e-commerce success, whereas few deal with survival (Banerjee et al., 2007; Bose and Pal, 2006; Janda and Moreira, 2017; Kauffman and Wang, 2008; Nikolaeva, 2007; Sung, 2006). Some of the determining factors that explain short-term survival may not serve to ensure long-term survival; in this sense, a goal of short-term profitability can be drawn from the investments required to ensure future growth (Kogut and Zander, 1992). We analyse survival several years after inception. To the best of our knowledge, the survival predictors of entrepreneurs starting e-commerce companies have not yet been empirically outlined based on their first financial statements. Another novel contribution is that while Banerjee et al. (2007) and Kauffman and Wang (2008) focus on large and public companies, we focus on small entrepreneurs starting e-commerce companies. Similarly, Sung's (2006) study is carried out through interviews with e-commerce firms' managers and not using financial information. Nikolaeva (2007) includes elements of competitive strategy, industry structure, firm and product characteristics, and the macro environment, but does not use financial ratios. Bose and Pal (2006) use financial ratios to predict the survival or failure of click-and-mortar corporations, but theirs is a data mining study, which uses neural networks and other techniques to compare their predictive power.

The present study also investigates the extent to which it is worth analysing the financial statements provided by newly created companies. The usefulness of a firm's accounting information in its first years compared with other non-financial information has been questioned (Miloud et al., 2012). Indeed, banks request financial statements from only half of borrowers (Minnis and Sutherland, 2017). As many of these companies wish to convey a position of good health to obtain financing, signs of earnings management can appear in the

financial statements. Earnings management is one of the most prolific lines of research in the accounting area. However, outside the accounting field, these variables are rarely explicitly assessed in empirical studies and few survival models incorporate them (Serrano-Cinca et al., 2019). Our study includes indicators designed to detect the presence of earnings management practices (Fields et al., 2018; Wongsunwai,

2013).

Methodologically, while e-commerce research has widely adopted survival analysis (Banerjee et al., 2007) and structural equations models (Marinao-Artigas and Barajas-Portas, 2020), no relevant information systems study has thus far used structural equation models with survival outcomes, even though many e-commerce situations require time-to-event data (Kauffman et al., 2012). We use a generalized structural equation model (GSEM) to solve this problem, which combines structural equations with survival analysis.

2. Literature review

First, we conducted a scientometric analysis of e-commerce research by performing a keyword co-occurrence analysis and a citation network analysis to create knowledge maps. We complemented this analysis by reading the literature reviews of Choshin and Ghaffari (2017), Colla and Lapoule (2012), Feindt et al. (2002), and Nikolaeva (2007).

2.1. Scientometric analysis

We adopted Vosviewer software (van Eck and Waltman, 2017), which uses network data to map papers, authors, and journals into clusters. Vosviewer applies standard data reduction techniques (e.g. multidimensional scaling and cluster analysis) to bibliographic data to provide an overview of hundreds of manuscripts. From a roadmap, it is easy to obtain a distance chart with a ruler. The multidimensional scaling algorithm does the opposite: it creates a map from a distance chart. In this way, two cities whose distance is small appear close on the map. In the case of bibliographic data, two manuscripts are close if their bibliographies are similar, if they receive citations from the same papers, or if they use the same keywords. Hence, the knowledge maps of a discipline are constructed by clustering the diverse topics of a research area and showing the most relevant authors and papers. They are becoming commonplace in literature reviews (Veloutsou and Mafe, 2020). We performed the following search in Web of Science to identify, firstly, the most influential journals:

TS = ((e-commerce OR etailer OR B2C OR B2B OR e-business OR e-market OR "Internet commerce" OR e-shopping OR "digital commerce" OR "P2P lending"))

This search retrieved 32,226 papers. Fig. 1 shows the most influential journals grouped into three clusters. The number of citations received determines the size of the circle, serving as a proxy of the journal's importance, while the distance between two journals in the map indicates their relatedness in terms of co-citation links (van Eck and Waltman, 2017). The centrality of the map corresponds to the core of information systems journals, noted in red. The cluster of business and marketing publications is located on the right side, in green. The cluster of operational research publications is located on the right side, in blue. These clusters form independent e-commerce literature bodies because they have specific interests and cite each other; in other words, they are bibliographically coupled.

In the next analysis, we identified only the papers that deal with e-commerce survival. We made the following search in Web of Science:

TS = ((bankruptcy OR survival OR resilience) AND (e-commerce OR etailer OR B2C OR B2B OR "e-business" OR "e-market" OR "Internet commerce" OR "e-shopping" OR "digital commerce" OR "P2P lending"))

This search retrieved 244 papers, but we discarded 123 because they addressed the topic of study tangentially. A paper may be relevant for e-commerce survival research, but it may not include the chosen keywords; therefore, we followed a backward procedure, reviewing the references of the remaining 121 papers. In this way, we can identify papers that do not deal with e-commerce, but serve as a mandatory reference for investigating e-commerce survival. Fig. 2 shows the

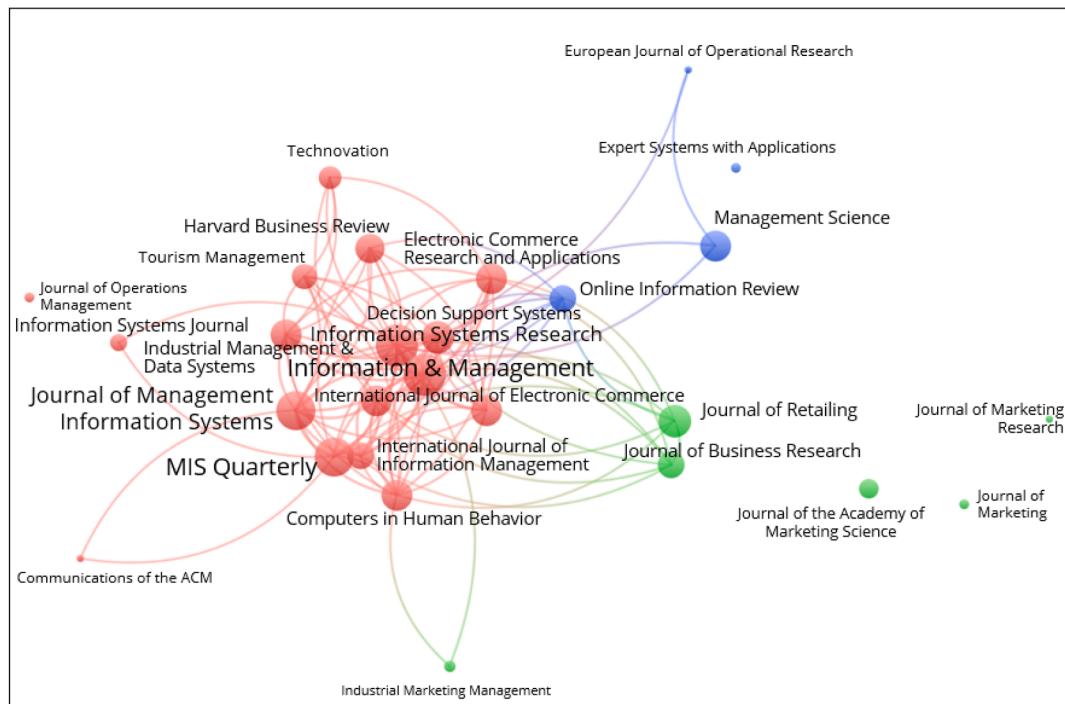


Fig. 1. Knowledge map showing the most influential journals in e-commerce research.

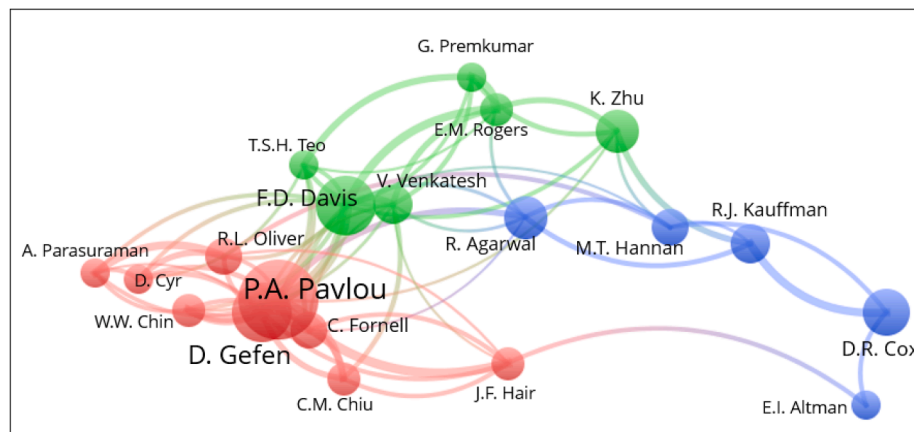


Fig. 2. Knowledge map showing 20 key authors for research on e-commerce survival.

knowledge map obtained, selecting the 20 most relevant authors. The area of the circle is proportional to the citations received.

The red cluster includes academic authorities on e-commerce success factors. [Pavlou \(2003\)](#) and [Chiu et al. \(2009\)](#) deal with consumers' acceptance of e-commerce, modelling the role of trust; [Chiu et al. \(2014\)](#) study customer loyalty; and [Gefen \(2000\)](#) analyses the importance of familiarity. [Cyr \(2008\)](#) considers the effect of such website characteristics as information design, navigation, and visual design on trust and satisfaction, which are clearly inspired by the dimensions of service quality ([Fornell et al., 1996](#); [Parasuraman et al., 1988](#)), as well as on customer satisfaction ([Oliver, 2014](#)). These studies usually use structural equations ([Chin, 2010](#)) and other multivariate data analysis techniques ([Hair et al., 1998](#)).

The green cluster includes authors who investigate the key success factors for e-commerce retailers by applying information technology adoption models ([Bhattacharjee and Premkumar, 2004](#); [Premkumar and Roberts, 1999](#)), the technology diffusion perspective ([Zhu et al., 2006](#)), and the adoption of e-commerce ([Teo and Ranganathan, 2004](#)). They

usually apply the technology acceptance model of [Davis \(1989\)](#) and diffusion of innovation theory of [Rogers \(1995\)](#), which model how users accept and use technology. The technology acceptance model emphasizes factors such as perceived usefulness and perceived ease of use. [Venkatesh et al. \(2003\)](#) propose a unified theory of the acceptance and use of technology.

The blue cluster brings together the academics who research firm survival, such as [Agarwal et al. \(2004\)](#). Organizational ecology theory usually supports survival ([Hannan and Freeman, 1977, 1984](#)). [Kauffman et al. \(2012\)](#) propose the use of event history in e-commerce research. These studies statistically analyse survival data ([Cox, 1972](#)) and usually employ financial ratios following studies that have predicted firm bankruptcy (e.g. [Altman, 2013](#)).

Finally, once the top journals and key authors were identified, we analysed the keywords from each of 32,226 papers to find out which topics arouse the greatest interest. The size of the label and circle of a keyword are determined by the weight of the keyword, measured by the number of occurrences. The clusters are distinguished by different

colours, and the lines between the items represent links. Link strength is represented by a positive numerical value. The higher this value, the higher is the number of co-occurrences (i.e. the number of publications in which two keywords occur together). Fig. 3 shows the knowledge map of e-commerce.

Four relevant clusters can be observed. The central word is *model*, indicating that most e-commerce studies develop explanatory models. Keywords such as *trust*, *satisfaction*, *service quality*, and *loyalty* stand out in the larger central cluster, which reveals the hegemony of these explanatory factors for the success of e-commerce, following DeLone and McLean (2004). Keywords such as *technology acceptance*, *perceived ease*, and *perceived usefulness* are found in the upper cluster, following the model of Davis (1989). Keywords such as *performance*, *competitive advantage*, *impact*, *markets*, and *management* can be found in the cluster on the right, which identifies studies that focus on the characteristics of e-commerce companies rather than customers. Our study would belong to this cluster.

2.2. Research motivation

The review of the literature on e-commerce revealed the frequency with which the models of DeLone and McLean (2003), Davis (1989), Rogers (1995), and Parasuraman et al. (1988) explain the success of e-commerce. Our research starts from organizational ecology theory developed by Hannan and Freeman (1977). Larsen and Eargle (2015) identify the 107 theories most used in information systems, but do not include organizational ecology theory, even though it is one of the most widely accepted theories to explain business survival (Coad, 2009; Habersang et al., 2018). The study of Javalgi et al. (2005) is one of the few that has adapted a model of organizational ecology to the global e-commerce environment. They forecast that e-commerce survivors will comprise low-cost producers focusing on satisfying the needs of the consumer. The emergence of the ecological perspective stimulated a debate on the comparative importance of selection and adaptation in explaining survival, as synthesized by Grandinetti (2018). The evolutionary theory of the firm argues that individual organizations can adapt to changes in the competitive environment (Nelson and Winter, 1973). However, according to organizational ecology theory, companies are conditioned to structural inertial forces and rarely succeed in making substantial modifications to their strategy and structure (Hannan and

Freeman, 1977). Levinthal (1991) and Grandinetti (2018) take the best of both worlds by using both natural selection and adaptation.

Table 1 groups the determinants of e-commerce survival into five categories: firm size, technical aspects, competitive strategy, financial aspects, and environmental factors. The literature review also revealed that the roles of B&C and internationalization in the survival of an e-commerce entrepreneur have rarely been studied. The importance of having a successful omni-channel retailing strategy is clear if traditional retailers hope to survive (Rigby, 2011); however, our study focuses on entrepreneurs starting e-commerce companies as opposed to consolidated companies. Although several authors have studied the importance of choosing suitable distribution channels (Colla and Lapoule, 2012; Nikolaeva et al., 2009; Wagner et al., 2020; Wallace et al., 2004), whether it is better to adopt a B&C strategy or choose to be a pure-click dot-com retailer is unclear. Few studies provide empirical evidence on the role of internationalization (Deng and Wang, 2016; Deng et al., 2017; Falk and Hagsten, 2015; Sapienza et al., 2006; Tolstoy et al., 2016). Indeed, Sapienza et al. (2006) highlight the need for studies that track the survival rates of internationalizing young firms.

Wiklund et al. (2010) analyse initial accounting information, but their study is not of e-commerce entrepreneurs. Several works have studied financial aspects (Feindt et al., 2002; Falk and Hagsten, 2015), but only whether adopting e-commerce improves the profitability of the company. To the best of our knowledge, none of these studies have investigated the existence of earnings management practices that could distort the true image of financial statements, although accounting manipulation was studied during the dot-com bubble (Bowen et al., 2002).

3. Model and hypotheses

Fig. 4 shows the model developed in this study. We argue that e-commerce entrepreneurs opting for B&C and internationalization strategies survive more than pure-clicks do. Being financially healthy shortly after inception matters; however, earnings management mediates the relationship between financial health and survival. Firm size matters, but a B&C strategy and an internationalization strategy mediate the relationship between size and survival.

The first hypothesis states that companies that are strong at birth largely survive. The following concepts drawn from organizational

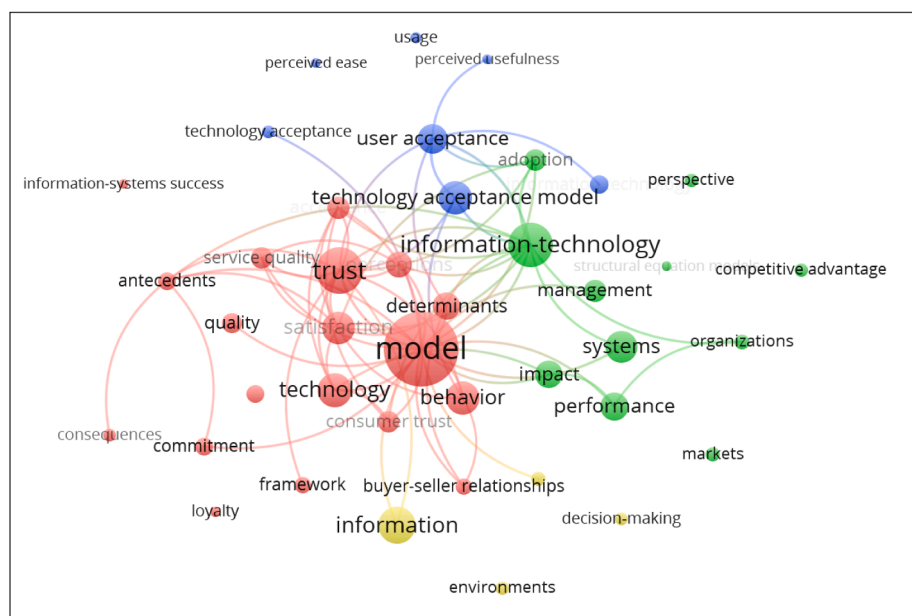


Fig. 3. Knowledge map showing the most used keywords in e-commerce research.

Table 1
Studies on factors of e-commerce success and survival.

| Determinant | Study | Work carried out |
|--|--------------------------------|---|
| <i>Firm size</i> | | |
| Number of employees | Banerjee et al. (2007) | This study found a positive relationship between firm size and survival, as predicted by product lifecycle theory, conducting an empirical study with data from 115 publicly traded Internet firms. |
| Number of products for sale | Wang et al. (2013) | Based on the theory of social capital and employing data from 5772 online stores from a Chinese marketplace, the study found evidence that the greater the number of products, the greater is the survival of online stores. |
| <i>Technical aspects</i> | | |
| Website design | Feindt et al. (2002) | This study found that usability, content presentation, and customer interaction through the company website are critical success factors to compete in the e-commerce space, using data from 150 e-commerce ventures worldwide. |
| Search engine optimization | Serrano-Cinca et al. (2010) | Using a sample of 138 US Internet businesses and web metrics variables (search engine optimization, popularity, reputation), this empirical study found a positive and significant relationship between web metrics and e-tailers' performance. |
| Purchase facilitation | Song and Zahedi (2005) | Relying on the theory of planned behaviour, the authors conducted an experiment developing 32 websites, finding that purchase facilitation variables (product description, large picture, payment options) are important factors in explaining purchase intention. |
| System quality | Lee and Kozar (2006) | Based on the model of information systems success (DeLone and McLean, 2004), the authors conducted a field study with 156 online customers and 34 e-commerce business managers, finding that navigability and security lead to the highest business performance. |
| <i>Competitive strategy</i> | | |
| Order of entry | Nikolaeva (2007) | This study found that market entry timing had a modest impact on survival rates by conducting an empirical study using data from 460 e-tailers. Some early entrants enjoy initial advantages, but many others suffer from pioneer burnout. |
| Price | Kaushik et al. (2020) | Using a multicriteria decision-making methodology, the authors found several determinants in the success and growth of online fashion retail in India: webstore image, price, online shop recognition, and reputation of stores. |
| Internationalization | Falk and Hagsten (2015) | This study was conducted using data from a group of 1146 firms from 14 European countries. The authors found that international experience may affect the degree to which firms engage in e-commerce: exporting firms are more active in online sales than non-exporting firms. |
| Privacy and responsiveness | Chiu et al. (2009) | This study investigated the repeat purchase intention of experienced online buyers based on the technology acceptance model, finding that online trust is critical for survival and is built through order fulfillment, privacy, responsiveness, and contact. The data were collected from 360 PCHome online shopping customers. |
| Inventory ownership | Randall et al. (2006) | This study hypothesized the factors that persuade firms to integrate inventory as well as the success of this decision based on the contingency theory of organizations. Analysing data from 50 Internet retailers found no evidence of an association between firm sales and the decision to integrate inventory. |
| E-fulfilment strategies | Lee and Whang (2001) | This study described innovative ways to apply e-fulfilment strategies to win the last mile by examining what happened to a sample of companies. Success factors included logistics postponement, dematerialization, resource exchange, leveraged shipments, and the B&C model. |
| Logistics and transportation service providers | Esper et al. (2003) | The authors conducted two experimental studies analysing the effects of carrier information and related website delivery strategies on consumers' delivery perceptions, evaluations, and willingness to purchase a product from the website. They found that offering consumers a choice of carriers can have a positive impact on their willingness to purchase from the merchant. |
| Multichannel | Wallace et al. (2004) | Applying the theory of buyer behaviour, the authors conducted an empirical study from 151 mail surveys, finding that multichannel strategies enhance customer satisfaction and ultimately customer retailer loyalty. |
| Distribution channel | Nikolaeva et al. (2009) | With data from 418 e-tailers in 14 product categories, the study found that pure-click dot-com e-tailers have a lower probability of survival than multichannel e-tailers. |
| Differentiation vs cost leadership strategy | Karagozoglu and Lindell (2004) | This study explored the transformation of bricks-and-mortar small and medium-sized enterprises into e-commerce by analysing the responses of a survey of 71 managers. They found that cost leadership does not contribute to profitability, while a strategy based on differentiation improves financial performance. |
| Trust and commitment | Mukherjee and Nath (2007) | This study adapted commitment/trust theory to the online retailing context. It found that both trust and commitment have a significant influence on customers' behavioural intentions using a survey answered by 651 professionals and university students. |
| Word-of-mouth | Kim and Son (2009) | Drawing on social exchange theory, the authors modelled post-adoption behaviours in the context of online services. The model was tested using data from 510 users of online portals. Behavioural outcomes related to survival include word-of-mouth, willingness to pay, and inattentiveness to alternatives. |
| Reputation | Cai et al. (2014) | Based on classical theories of reputation, the study showed that reputable sellers can expand their market faster than non-reputable sellers. A good reputation is also reflected in repeat business, trade expansion, and market survival. |
| Customer loyalty | Pavlou (2003) | Following the theory of reasoned action, the study provided evidence of a positive relationship between consumer intentions to transact online and trust in e-commerce, using a sample of 155 online consumers. |
| Loyalty card | Colla and Lapoule (2012) | Using interviews with French grocery retailers and consumers, the study found key success factors in the click and drive sector (a multichannel information and communication system, merging loyalty card databases, emphasis on customers). |
| Perceived risk | Kim et al. (2008) | Using a web survey and drawing on the technology acceptance model, theory of reasoned action, and theory of planned behaviour, the empirical results suggested that a consumer's trust has a strong positive effect on purchase intention as well as a strong negative effect on a consumer's perceived risk. |
| Utilitarian value and hedonic value | Chiu et al. (2014) | Based on means-end chain theory and prospect theory, the study showed that both utilitarian value and hedonic value are positively associated with buyers' repeat purchase intention. The data were collected from 782 Yahoo! Kimo customers. |
| Reward programmes | Lim and Lee (2015) | This study proposed a game-theoretical model to explain under which conditions a reward programme can be successful. The likelihood of success for reward programmes was found to be higher in online markets (because the cost of misfit is low) than in offline markets. |
| <i>Financial aspects</i> | | |
| Labour productivity | Falk and Hagsten (2015) | This study investigated the patterns of e-commerce activities and their impact on firm performance in several European countries, finding that the changes in e-sales activities and labour productivity growth are positively related. |

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Table 1 (continued)

| Determinant | Study | Work carried out |
|---|------------------------|---|
| Financial capital | Banerjee et al. (2007) | With data from 115 publicly traded Internet firms, the study evidenced the relevance of financial capital at different stages in their lifetime to survival. The results were consistent with product lifecycle theory. |
| Environmental factors External factors | Doern and Fey (2006) | The study drew on the theory of transaction costs and theory of social presence to highlight the impact of external factors (poor Internet connections, limited financial resources, high distribution costs, and cash payments on delivery) on the success of e-commerce in Russia. Successful e-commerce companies are those with environmentally friendly business models. |
| Environmental uncertainties | Huang (2006) | Based on strategic behaviour theory, this study proposed an optimal e-commerce strategic alliance model that overcomes three environmental uncertainties: changes in consumer habits, supplier resources, and information technology. |

ecology theory are relevant: the ‘survival of the fitter’ principle (Alchian, 1950), structural inertia (Hannan and Freeman, 1984), the liability of newness (Freeman et al., 1983), resilience (Holling, 1973), and imprinting (Stinchcombe, 1965). The ‘survival of the fitter’ principle applies to many practical contexts (Solomon et al., 2013; Zingales, 1998). For example, farmers expect the larger piglets in a litter of too many piglets to be more likely to survive (Quiniou et al., 2002). While the principle is widely accepted by many empirical studies, the theoretical explanations of its determinants are still a matter of discussion. It is often argued that the imprint left by the entrepreneur affects firm survival (Stinchcombe, 1965). Mathias et al. (2015) find several sources of imprinting, including family, partners and friends, education, work experience, work-related knowledge, skills, technology, and the environment. The liability of newness explains the low survival rate of new companies (Freeman et al., 1983); for example, they have not developed the routines, relationships, and statuses necessary to engage in the social and economic exchanges critical to their survival (Sapienza et al., 2006). However, other factors must be considered such as structural inertia, which limits the ability of companies to reshape their core structures in response to environmental changes, lowering their likelihood of survival. Structural inertia is low in young companies (Zhu et al., 2006) of small size (Aldrich and Auster, 1986) from dynamic sectors (Colombo and Delmastro, 2002), which could lead to results that contradict the predictions of the liability of newness (Sapienza et al., 2006).

Resilience, first introduced in ecological studies (Holling, 1973), is gaining interest in organizational studies (Annarelli and Nonino, 2016; Herbane, 2019). Organizational resilience is usually defined as the measurable combination of the characteristics, abilities, capacities, or capabilities that allows an organization to withstand known and unknown disturbances and still survive (Ruiz-Martin et al., 2018). It can be considered to be another explanatory factor for the ‘survival of the fitter’ principle. Resilience acts in the opposite way to structural inertia (Buliga et al., 2016).

Resilience is a polysemous concept that can take several forms. Resilience in e-commerce may be related to (i) the degree to which the company has the flexibility to adjust its processes to customer preferences (Phillips and Wright, 2009), (ii) a redundant and flexible logistics

service that can overcome any supply chain disruption (Hazen and Byrd, 2012), or (iii) information technologies that avoid service interruptions due to network problems (Gran et al., 2014) or can rapidly respond to a cyber-attack (Alostad, 2019). We rather propose a financial approach because resilience can also have a triple financial component for new companies: it can be strongly capitalized, make profits early, and have sufficient liquidity. A new company that is well capitalized can cope with adverse situations better than an undercapitalized firm. As young companies have not had the time to dispose of sufficient accumulated reserves (from the profit generated), they are less resilient than those that have been able to accumulate reserves (Akerlof and Shiller, 2010). If the company does not make a profit, it will become undercapitalized. Positive profits can thus be seen as the natural selection criterion: companies that earn money are selected by the environment, while others are excluded and disappear (Penrose, 1952). In the 2000s, financial performance was identified as one of the success factors of early e-commerce companies (Feindt et al., 2002). Finally, the cause of bankruptcy can be the lack of liquidity to deal with an unforeseen event. All three factors measure a firm’s financial health and hence the distance to bankruptcy (Altman, 2013).

A good business strategy can lead to positive results— even in the short term; however, empirical evidence suggests that the determinants of economic performance and survival may differ (Gimeno et al., 1997). Organizational ecology theory assumes that given natural selection, profit-maximizing firms will survive and dominate, but some nuances should be considered (van Witteloostuijn et al., 2003). For example, many e-commerce companies earn no profits in their first years of life. Hence, financial health is an omnipresent factor in most models of survival and bankruptcy for all types of companies (Altman, 2013; Delmar et al., 2013), and the same can be expected in the e-commerce industry. Financially healthy e-commerce companies can hire and retain talented employees and secure other resources (Chang, 2004). Hence, the following hypothesis is proposed:

Hypothesis 1: The probability of default of an e-commerce entrepreneur is negatively associated with the company’s financial health.

Although the relationship between financial health and survival is established, one may wonder about the extent to which accounting reflects a faithful image. Some companies may manipulate their profits or sales. Earnings management happens when managers use discretion in accounting standards to modify accounting reports (Healy and Wahlen, 1999). The theoretical framework that usually explains earnings management is positive accounting theory, which studies the relationships between the agents involved in the accounting process (Watts and Zimmerman, 1978). Earnings management is then explained as an accounting choice case in which managers exercise their discretion when selecting one accounting method over another according to their own interests. Organizational ecology theory emphasizes the role of environmental determinism over strategic choice. Thus, it can be argued that the environment exerts pressure and that managers try to maintain the image of their firms in the market. It is possible to find parallelisms with biological processes, since some species use deception and mimicry to survive. Entrepreneurs also struggle to survive, and some may stretch accounting legislation to the fullest or even cheat to do so.

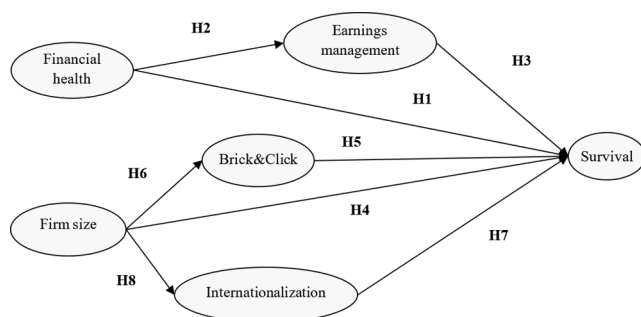


Fig. 4. A model for survival of new e-commerce firms. Estimated coefficients for generalized structural equation model (GSEM).

The relationship between earnings management and financial health is complex. The sign of the relation depends on the objective to be achieved, industry, situation of the company, and managers' incentives (Russell, 2017). Sometimes, managers want to inflate earnings to influence the stock price, while others want to deflate earnings to pay less tax or for income-smoothing purposes. Small entrepreneurs starting an e-commerce venture normally seek to inflate earnings to appear healthy and thereby obtain funds from crowdfunding, banks, or venture capitalists. To this end, a possible practice in e-commerce companies is the capitalization of internally generated intangibles, delaying the recognition of expenses to appear more profitable (Dinh et al., 2016; Lev, 2000; Wongsunwai, 2013). A company can capitalize intangible assets, but several criteria must be met (IASB, 1998). Companies are allowed to capitalize the costs associated with patents, trademarks, designer and programmer compensation, and software testing. If these criteria are not met, the company must recognize the expense; however, managers have some discretion in how to do this. Burgstahler and Dichev (1997) find that 30–44% of firms with slightly negative pre-managed profits exercise discretion when reporting a profit increase. Serrano-Cinca et al. (2019) find that companies that carry out earnings management activities have a higher probability of default.

Financial health increases survival, but the presence of inflated earnings should reduce survival. Failing companies capitalize intangible assets more aggressively than successful enterprises do (Jones, 2011). Jones (2011) finds that the voluntary capitalization of intangibles has strong predictive power in a firm failure model, even after controlling for several other factors. Accordingly, we expect earnings management to mediate the relationship between profitability and survival, and the following hypotheses can be stated:

Hypothesis 2: The low financial health of e-commerce entrepreneurs leads management to inflate earnings.

Hypothesis 3: The probability of default of an e-commerce entrepreneur is positively related to the suspicion of management inflating earnings.

The next hypothesis concerns the relation between size and survival. Organizational ecology theory hypothesizes a positive relationship between firm size and survival because size may provide organizations with sufficient resources to safeguard themselves from challenging environments; hence, small businesses suffer from the liability of smallness (Aldrich and Auster, 1986). Bercovitz and Mitchell (2007) note that larger companies tend to survive longer than smaller companies. O'Regan et al. (2006) find that e-commerce companies tend to be larger than those that have not become actively involved. Using data from 115 publicly traded Internet firms, Banerjee et al. (2007) find a positive relation between firm size and survival based on product lifecycle theory. Accordingly, the following hypothesis can be stated:

Hypothesis 4: The probability of default of an e-commerce entrepreneur is negatively related to the firm's size.

E-commerce retailers adopt various strategies. The simplest is a single channel strategy in which an e-commerce firm only sells online (i.e. a pure-click dot-com). Entrepreneurs who choose a dual channel sell online as well as open a physical store (i.e. a basic B&C e-commerce business). A further step involves implementing multichannel strategies in which sales are made through several channels simultaneously (physical stores, websites, marketplaces, phone sales, third-party distributors), but they are not connected to each other (Difrancesco and Huchzermeier, 2020). When integration occurs, we refer to omni-channel strategies, which can even be cross-channel if customers can jump from one channel to another to complete their purchase process (Kim and Lee, 2020).

Hannan and Freeman (1977) suggest that specialist organizations perform well in stable environments, while generalists perform well in unstable environments, a hypothesis from organizational ecology theory corroborated in a later empirical study (Freeman and Hannan, 1983). Today, e-commerce operates in an unstable environment, so a generalist strategy may be the least risky and most adequate in terms of survival. A B&C business can be less hazardous than a pure-click dot-com because it

is diversified. This is not a question of diversifying for reasons related to portfolio theory in finance; it must be grounded in strategic management theories (Lubatkin and Chatterjee, 1994). Lubatkin and Chatterjee (1994) agree that in a stock portfolio, the eggs should be put in different baskets; however, in the case of corporate diversification, they prove that success is achieved neither by putting the eggs in different baskets nor by putting the eggs in the same basket; rather, the successful strategy is putting the eggs in similar baskets. Managers should thus focus on building competitive advantage by adopting a B&C strategy, which takes advantage of the synergies between the two channels.

An important issue for the success of e-commerce is trust (Mukherjee and Nath, 2007; Pavlou, 2003; Stewart, 2003). Offline customers' trust affects their online confidence, as they are buying from the same company through another channel. Therefore, when retailers promote their websites, they should emphasize the integrity of their offline presence (Kuan and Bock, 2007). Toufaily et al. (2013) find that offline trust has a positive impact on online trust, a conclusion that agrees with previous studies (Kuan and Bock, 2007; Stewart, 2003), because of the advantageous role that an offline presence plays for a B&C. Having a physical presence is an advantage in that the interaction with a retail salesperson in stores contributes to building trust. Accordingly, Toufaily et al. (2013) recommend that pure-clicks ought to increase their social presence to compensate for the absence of a physical establishment.

Ofek et al. (2011) explore the effects on profits of adopting the multichannel format, developing a model based on the theory of industrial organization (Tirole, 1988). They highlight that companies can decrease their profits when they open an online channel if the competition between companies is intense. However, retailers fall into a kind of prisoner's dilemma in which if a competitor opens an online channel, it is better to open one as well. Luo and Sun (2016) develop a game-theoretical model to determine the optimal distribution channel. They conclude that product design is a relevant factor, especially in products such as jewellery where an online store is relatively less attractive to the consumer. Difrancesco and Huchzermeier (2020) analyse the competition between two retailers that must decide how to structure their sales channels. They link the implementation of omni-channel strategies to the survival of the company, finding that the equilibrium structure is determined by the values of the return rate, refund rate, and online channel attraction.

Ease of use and perceived usefulness—the components of the technology acceptance model presented by Davis (1989)—are explanatory factors for consumers' attitudes and satisfaction with e-commerce channels (Devaraj et al., 2002). B&C has potential advantages over a single-channel strategy when customers appreciate touching and feeling products (Huang and Jin, 2020; Ofek et al., 2011). B&C strategies enhance customer satisfaction and ultimately retailer loyalty (Wallace et al., 2004). Some consumers consider the standard of the return service when making purchase decisions. An important service offered by the omni-channel strategy is the possibility for customers to buy online and return in store, which enhances ease of use for customers and can partially minimize the risk of online shopping because it reduces return costs. Channel integration adds value to consumers by increasing their satisfaction and perceived usefulness. All this helps customers who normally buy from physical stores access online shopping. Furthermore, conversion increases because omni-channel consumers buy more than those who only buy through one channel (Kim and Lee, 2020). In an empirical study conducted with 418 online retailers, Nikolaeva et al. (2009) find that pure-click dot-com businesses have higher hazard rates than multichannel e-tailers. They argue that multichannel e-tailers can benefit from economies of scale in purchasing, discounted advertising costs, and the established brand value in physical stores. However, channel integration is a challenge, and such firms incur high implementation expenses, costly product returns, and an increased likelihood of sales cannibalization (Huang and Jin, 2020; Ofek et al., 2011). For these reasons, a B&C strategy may not always benefit retailers (Kumar and Ruan, 2006).

The resource-based view of the firm (Barney, 1991) supports the importance of firm size in a successful B&C strategy. More resources such as an expensive storefront, costly human help, utilities, licensing and permitting fees, renovations, and fixtures are needed to implement a B&C strategy than a pure-click dot-com strategy. In addition, channel integration implies having complex information systems that demand resources and knowledge, and firm size influences the capacity to innovate by allowing access to the knowledge needed to innovate. There is a positive relationship between firm size and diversification (Sabherwal and Sabherwal, 2005) as well as between firm size and strategic commitment to e-commerce (Kowtha and Choon, 2001); therefore, a larger firm is more likely to implement a B&C strategy than a smaller firm. Consequently, we expect the B&C strategy to mediate the relationship between size and survival, and the following hypotheses can be stated:

Hypothesis 5: The probability of default of an e-commerce entrepreneur is negatively related to the firm's B&C strategy.

Hypothesis 6: Large e-commerce companies favour a B&C strategy.

Many entrepreneurs wonder whether to start their e-commerce as already internationalized. The Internet offers opportunities to carry out import and export activities (Falk and Hagsten, 2015; Tolstoy et al., 2016), and cross-border e-commerce is growing in a way that is consolidating as a new form of international trade (Han and Kim, 2019). However, an internationalization strategy is neither simple nor cheap because it requires knowledge of foreign markets, and companies operating outside their home country may incur additional costs; that is, they may suffer from the liability of foreignness (Zaheer, 1995). Exporting is difficult for small e-commerce businesses because of the logistical challenges of international operations, bureaucracy, and punctilious legal requirements; moreover, they need a sophisticated business plan. Importing also involves paperwork, frequent contracts with foreign suppliers, and attendance at trade fairs and events.

The research provides inconclusive findings on the effects of exporting by new companies (Deng and Wang, 2016; Deng et al., 2017; Sapienza et al., 2006). Three main theories attempt to explain the success of internationalization strategies: the regionalization hypothesis, internationalization process theory, and international entrepreneurship theory. The regionalization hypothesis states that rapid internationalization is possible, but only if income derives from the region of the origin of the company in order to decrease the liability of foreignness (Rugman and Verbeke, 2004). Advocates of internationalization process theory (Johanson and Vahlne, 1977) posit that internationalization should be incremental and experience-based because companies acquire the necessary knowledge with age. However, a young firm can more easily adapt its processes and structure to the international environment, enjoying the learning advantages of newness (Sui and Baum, 2014). The formation of companies that are international from their foundation is an issue that has aroused significant interest since the seminal study of Oviatt and McDougall (1994). They establish international entrepreneurship theory, which argues that flexibility and adaptability enable small companies to exploit foreign location advantages.

Empirical studies report inconclusive results. Sui and Baum (2014) analyse three internationalization strategies (born-global, born-regional internationalization, and gradual internationalization), finding no significant differences between them as to their effect on survival, which is not surprising because the different theories yield conflicting predictions. Salomon and Shaver (2005) find that exporters increase product innovations, finding evidence of learning by exporting, although probably not uniformly across industries. Hagen et al. (2012) find a positive relationship between an accelerated international strategy and performance. Schwens et al. (2018) perform a meta-analysis of 41 empirical articles, confirming the positive relationship between the degree and scope of internationalization and performance. However, they do not analyse the effect of internationalization on firm survival, as only a small number of primary studies include this variable. They

strongly encourage more longitudinal studies that address firm survival and entrepreneurial internationalization.

The literature review does not clarify the role of internationalization in the survival of an e-commerce entrepreneur. Falk and Hagsten (2015) argue that e-commerce is a facilitator of international trade, and Tolstoy et al. (2016) also find a positive effect of adopting an online sales channel on international sales, but they do not research the relationship between internationalization and survival. Deng and Wang (2016) study companies that export through B2B portals, finding an inverted U-shaped relationship between sales and the number of months of a firm on the e-commerce portal. Deng et al. (2017) find that rapid entry into the export market generally does not help young ventures sustain their overseas business, which is justified by the triple liability of rapidness, newness, and foreignness. Schu et al. (2016) analyse the factors influencing the internationalization speed of online retailers, finding that the most favourable are the low imitability of an online shop and low distance to newly entered countries. Sapienza et al. (2006) investigate the consequences of early internationalization on the survival of companies. They argue that the earlier a firm internationalizes, the more firmly established it is. Their study emphasizes the difficulties of young companies that face the dual task of developing new routines and building key social relationships in a foreign market.

Organizational ecology theory provides additional justifications. Ecological diversification has its economic equivalent in organizational niche specification, as discussed in depth by Hannan and Freeman (1977). In an environment characterized by increasing competition, many e-commerce companies have found a niche by exporting local products to distant markets or importing products from abroad. The concept of resilience, as a precursor of survival, provides a new argument. Redundant technological infrastructure improves resilience (Gran et al., 2014). Having several logistics providers also increases resilience and the probability of survival (Hazen and Byrd, 2012). Similarly, an internationalization strategy increases resilience because if the internal market fails (e.g. due to a recession in the domestic market), some foreign markets can provide sufficient revenue for the company. Exporting allows for the diversification of e-commerce, which can reduce some of the risks. This does not mean that diversification should be hasty or that the more foreign markets covered, the better. Tolstoy et al. (2016) find that e-commerce retailers focusing on relatively few foreign markets achieve higher sales than those operating in relatively more foreign markets.

Internationalization requires resources, support, and strategic coordination. Size matters, and internationalization should involve a level of resources appropriate to the size of the firm to minimize risk (Johanson and Vahlne, 1977). The probability of being an exporter increases with firm size (Bonaccorsi, 1992). Firm size is also positively associated with the internationalization speed of e-commerce companies (Luo et al., 2005). Chung et al. (2007) find that the size of the company when it was founded has a positive relationship with the company's propensity to expand geographically, although small firms can develop unique products or services to overcome the liability of smallness (Oviatt and McDougall, 1994). Large firms with more resources are better able to seek out internationalization opportunities, and they do so with greater frequency than do small and medium-sized firms (Calof, 1993). Hence, we expect the internationalization strategy to mediate the relationship between size and survival, and the following hypotheses are proposed:

Hypothesis 7: The probability of default of an e-commerce entrepreneur is negatively related to the firm's internationalization strategy.

Hypothesis 8: Large e-commerce companies favour an internationalization strategy.

4. Empirical study

4.1. Sample and data

We performed an empirical study to examine the model and

hypotheses. The data came from the Spanish database SABI, distributed worldwide by Moody's, which takes accounting information from the national commercial register (Spanish Companies House) and non-financial information from other official sources. We selected code number 4791 of the Statistical Classification of Economic Activities, which corresponds to 'retail sales via the Internet'. All the companies in this sector created between 2000 and 2011 were filtered, and from each of these, a maximum of seven years of annual statements were selected. As not all e-commerce companies choose code number 4791 to identify their activity, we had to use the textual search offered by the SABI database to identify other e-commerce companies in the 'company description' field, using keywords such as 'electronic commerce', 'online shop', and synonyms. Bias may arise when the data come from a single year, making it common to design a pooled sample that mixes the data for several years (Barth et al., 1998; Beaver et al., 2005). The data from all the companies and years were pooled into a single sample to ensure robust conclusions were reached.

The SABI database also provides a company's administrative status; a company is considered to have failed if it has entered statutory bankruptcy proceedings (both voluntary and involuntary liquidations). Accounting information was taken from the second set of accounts rather than the first for two reasons. First, a company can be founded in December; then, it will only have a month of activity and its financial statements will reveal little. Second, companies without commercial activities publish annual accounts because firms acquire a legal personality when they enter the national commercial register. Considering that companies are founded uniformly throughout the year, the average age of the companies in the sample was 18 months from first presenting their annual accounts. However, two details must be taken into account. First, 28 companies presented annual accounts for the first year, but then went bankrupt without submitting annual accounts for the second year; these were not considered in our study. Second, some companies went bankrupt before closing their first fiscal year in December; in these cases, no accounting information was available in the databases used. The final sample of companies for which complete information was available for the analysis comprised 632 e-commerce companies.

The Spanish business environment consists mostly of micro, small, and medium-sized enterprises. The average asset size of the companies in the sample was €51,831, and most were microenterprises founded with just two employees. Of the sample companies, 91.1% had fewer than 10 employees and only 1.6% exceeded 50 million euros in sales. The largest company had 246 employees. Table 2 shows the percentage of bankruptcy and survival among the firms in the e-commerce industry by year. On average, 9.9% went bankrupt each year; that is, 40.6% of them survived over the seven years analysed. Table 2 also compares the bankruptcy rates of the e-commerce sector with those of 10 other sectors

between 2000 and 2011. We classified firms into failed or solvent according to their status and pooled the sample. The data show that the e-commerce sector is the second-riskiest sector of those analysed, only behind the construction industry.

Table 3 shows the variables used to test the hypotheses and their definitions. Survival time (SURV) is a dependent variable that computes the amount of time for which the companies survived. SURV could reach a maximum of 2555 days if companies survived the seven years analysed. FAILED is a dependent variable that indicates if the company went bankrupt. Many variables can serve as proxies for company size. We selected total assets (TA), sales (SALES), and the number of employees (EMP). We also calculated a dummy variable that distinguishes whether

Table 3

Variables employed for the hypotheses' testing and their definition.

| Variable | Definition |
|-----------------------------|--|
| <i>Dependent variable</i> | |
| SURV | Survival time. A continuous variable that computes the amount of time for which companies have survived, expressed in days |
| FAILED | A dummy variable equal to 1 if the company went bankrupt |
| <i>Firm size</i> | |
| TA | Total assets |
| SALES | Total sales |
| EMP | Number of employees |
| MICRO | A dummy variable equal to 1 if the company is a microenterprise (i.e. has fewer than 10 employees) |
| SIZE | A construct of three variables (TA, SALES, and EMP) that captures firm size |
| <i>Financial health</i> | |
| ROA | Return on assets (profitability ratio): Earnings before interest and taxes/total assets |
| PROFIT | Dummy variable equal to 1 if ROA is positive |
| TE/TA | Retained earnings strength (solvency ratio): Total equity/total assets |
| WC/TA | Working capital ratio (liquidity ratio): (Current assets - current liabilities)/total assets |
| HEALTH | A construct of three variables (ROA, TE/TA, and WC/TA) that captures financial health |
| <i>Earnings management</i> | |
| INTANG/TA | Intangible assets ratio: Intangible assets/total assets |
| D&A/TA | Depreciation and amortization rate: Depreciation and amortization/total assets |
| <i>Brick and click</i> | |
| B&C | A dummy variable equal to 1 if the firm integrates both offline and online presences |
| <i>Internationalization</i> | |
| INTER | A dummy variable equal to 1 if the firm performs import or export activities |

Table 2

Panel A): Percentage of bankruptcies for 10 industries for each year. Panel B): Detailed data for the e-commerce sector sample used in the study.

| A) Percentage of bankruptcies | 2nd year | 3rd year | 4th year | 5th year | 6th year | 7th year | Average |
|---|----------|----------|----------|----------|----------|----------|---------|
| Building | 9.86 | 9.93 | 10.48 | 11.17 | 11.89 | 13.47 | 11.13 |
| e-Commerce | 8.54 | 10.21 | 9.25 | 11.04 | 9.55 | 10.86 | 9.91 |
| Retail trade | 7.78 | 8.13 | 8.37 | 8.69 | 10.99 | 13.70 | 9.61 |
| Wholesale business | 7.26 | 7.23 | 7.55 | 7.80 | 10.22 | 13.51 | 8.93 |
| Extractive industries | 6.85 | 8.47 | 9.42 | 7.89 | 9.05 | 10.91 | 8.77 |
| Information and communications technology | 6.65 | 6.87 | 7.20 | 7.80 | 9.76 | 13.85 | 8.69 |
| Manufacturing industry | 6.68 | 6.98 | 7.20 | 7.34 | 9.36 | 12.23 | 8.30 |
| Transport | 6.21 | 6.59 | 6.81 | 7.24 | 9.51 | 13.13 | 8.25 |
| Agriculture, livestock and fishing | 4.66 | 4.46 | 4.90 | 4.99 | 8.02 | 10.18 | 6.20 |
| Utilities (water, gas, electricity) | 5.60 | 3.56 | 4.09 | 5.08 | 4.83 | 6.61 | 4.96 |
| B) E-commerce industry | 2nd year | 3rd year | 4th year | 5th year | 6th year | 7th year | |
| Total | 632 | 578 | 519 | 471 | 419 | 396 | |
| Failed | 54 | 59 | 48 | 52 | 40 | 43 | |
| Non-failed | 578 | 519 | 471 | 419 | 379 | 353 | |
| Bankruptcy (%) | 8.54% | 10.21% | 9.25% | 11.04% | 9.55% | 10.86% | |
| Survival (% accumulated) | 91.46% | 81.25% | 72.00% | 60.96% | 51.41% | 40.55% | |

the company has fewer than 10 employees (MICRO).

Four variables that best reflect the financial resilience of e-commerce entrepreneurs were chosen to measure financial health. Return on assets (ROA) is the profitability measure. PROFIT is a dummy variable that indicates the presence of profits. A dummy variable permits different intercepts and slopes for loss and non-loss firm-years (Beaver et al., 2012, 2019). Capital strength was measured by the solvency ratio, calculated by dividing total equity by total assets (TE/TA). Liquidity was measured by dividing working capital by total assets (WC/TA). Working capital is the difference between resources readily convertible into cash and current liabilities.

Earnings management can be identified from indicators designed to measure the possible manipulation of annual accounts (Beneish et al., 2013). Some accounting items are susceptible to manipulation, such as depreciation figures, loan loss provisions, and inventory values. However, each industry has its specificities. For example, the oil industry may exaggerate the oil reserves found, as did Shell (Ortiz-Martinez and Crowther, 2008), while the technology industry may aggressively capitalize R&D expenditure, as did WorldCom (Unerman and O'Dwyer, 2004). In the case of e-commerce entrepreneurs, experienced financial analysts tend to be wary of the intangibles figure on the balance sheet because many companies record intangible expenses as assets to make it appear that their profits are higher than they are in actuality. If the expense disappears from the income statement, then it appears as an asset, which results in a high amortization figure (Lev, 2000). For this reason, it was measured using two indicators: the intangible assets to total assets ratio (INTANG/TA) and depreciation and amortization to total assets (D&A/TA).

The SABI database provides two variables, namely, a dummy variable that identifies if the company exclusively carries out activities in the national market or carries out export or import activities (INTER) and a continuous variable showing the export sales percentage. However, the export sales percentage was only available for half of the companies that claim to export. For this reason, we used the dummy variable instead of the preferred continuous variable.

The SABI database includes a website address but does not allow us to distinguish if the company is a pure-click or a B&C. Hence, all the companies' websites were reviewed. In the case of bankrupt companies, their oldest homepages were reviewed on Archive.org, a library of Internet sites with many years of web history accessible through the Wayback Machine. This approach allowed us to access the website when the e-commerce company was founded to identify whether it had a physical store or only sold online. B&C is a dummy variable that equals 1 if the firm integrates both an offline and an online presence. It should be replaced by the percentage of online sales, but those data were not available.

4.2. Exploratory analysis

Table 4 shows the results of the Pearson correlation analysis. We winsorized the data to avoid the pernicious influence of atypical values following Bharath and Shumway (2008). The highest Pearson correlation coefficients were found among the variables associated with financial health, ranging between 0.80 and 0.92. The Pearson correlation coefficient between the size variables is high and positive, ranging between 0.62 and 0.74. The Pearson correlation coefficient between both earnings management indicators is 0.492, which is positive and statistically significant. The Pearson correlation coefficient between ROA and intangibles is -0.352 and that between ROA and depreciation -0.316 ; both values are negative and statistically significant.

Table 5 displays the results of the exploratory analysis and a comparison of means test, namely, a Mann–Whitney test for the continuous variables and a Chi-squared test for the dichotomous variables. The data show significant differences one year before failure in some variables. Internationalized companies have a higher probability of survival in the short term than those that do not export or import, and the differences are statistically significant. Surviving companies have larger sales and total assets than those that went bankrupt, but the differences in the number of employees are not statistically significant. Surviving companies are healthier financially than those that went bankrupt. Companies that failed present signs of earnings management, showing higher values than surviving companies in the two selected indicators. There are no statistically significant differences between B&C companies and dot-coms in terms of bankruptcy risk for short-term survival.

4.3. Survival analysis

We performed a Cox regression to analyse long-term survival. The same independent variables were used, except that the dependent variable was survival time (SURV). Table 6 shows the survival analysis results, including the beta coefficients, significance levels, and Exp(B) values; the latter is the ratio of hazard rates. A negative beta coefficient indicates that as the variable increases, the probability of survival increases. The risk of bankruptcy is 1.788 (1/0.559) times higher for e-commerce companies that are unprofitable after one year of life than for profitable firms; in other words, the probability of bankruptcy for unprofitable e-commerce companies is 44.1% higher than that for profitable firms. The risk is 1.783 times higher for microenterprises than for non-microenterprises. The risk is 2.778 times higher for local players than for internationalized firms. The risk of bankruptcy is 1.437 times higher for pure-clicks than for B&C firms. This last variable is not significant in explaining early bankruptcy, but is significant in explaining long-term survival. For the continuous variables, Exp(B) represents the predicted change in the bankruptcy hazard for a one-unit increase in the predictor. We found that an e-commerce business's probability of default is negatively related to all the firm size and financial health

Table 4
Pearson correlation coefficients between the variables.

| | TA | EMP | SALES | ROA | WC/TA | TE/TA | INTANG/TA | D&A/TA | B&C | INTER | PROFIT |
|-----------|----------|----------|----------|----------|----------|----------|-----------|----------|---------|---------|--------|
| TA | 1 | | | | | | | | | | |
| EMP | 0.629** | 1 | | | | | | | | | |
| SALES | 0.742** | 0.617** | 1 | | | | | | | | |
| ROA | 0.248** | 0.079 | 0.282** | 1 | | | | | | | |
| WC/TA | 0.229** | -0.022 | 0.097* | 0.798** | 1 | | | | | | |
| TE/TA | 0.229** | 0.042 | 0.105* | 0.831** | 0.917** | 1 | | | | | |
| INTANG/TA | -0.134* | -0.091 | -0.143** | -0.352** | -0.018 | 0.037 | 1 | | | | |
| D&A/TA | -0.272** | -0.131* | -0.288** | -0.316** | -0.226** | -0.170** | 0.492** | 1 | | | |
| B&C | 0.190** | 0.055 | 0.200** | 0.107** | 0.021 | 0.018 | -0.320** | -0.083 | 1 | | |
| INTER | 0.242** | 0.151** | 0.239** | 0.075 | 0.045 | 0.030 | -0.062 | -0.157** | 0.077 | 1 | |
| PROFIT | 0.221** | 0.032 | 0.360** | 0.857** | 0.312** | 0.288** | -0.286** | -0.262** | 0.119** | 0.057 | 1 |
| MICRO | -0.382** | -0.723** | -0.384** | -0.069 | -0.003 | -0.013 | 0.027 | 0.079 | -0.061 | -0.085* | -0.030 |

** p-value < 0.001.

* p-value < 0.05.

Table 5
Exploratory analysis and means test.

| A) Continuous predictors | All (N = 632) | | | Failed (N = 54) | | | Non-failed (N = 578) | | | MW test (Z and sig.) |
|---------------------------------------|-----------------|---------|------------|-----------------|--------|---------|----------------------|---------|---------|-------------------------|
| | Median | Mean | St dev | Median | Mean | St dev | Median | Mean | St dev | |
| Total assets, TA | 51.831 | 176.509 | 386.982 | 26.005 | 74.280 | 110.837 | 57.009 | 187.484 | 404.131 | -2.537** |
| Total employees, EMP | 2.00 | 5.013 | 15.088 | 0.87 | 3.60 | 4.78 | 2.00 | 5.111 | 15.529 | -0.654 |
| Total sales, SALES | 85.689 | 352.12 | 872.93 | 29.92 | 99.089 | 173.656 | 100.598 | 379.635 | 919.285 | -3.883*** |
| Return on assets, ROA | -0.014 | -0.229 | 1.707 | -0.306 | -0.809 | 2.618 | -0.001 | -0.167 | 1.570 | -4.203*** |
| Retained earnings strength, TE/TA | 0.077 | -0.072 | 1.002 | -0.189 | -0.604 | 1.407 | 0.094 | -0.015 | 0.932 | -3.916*** |
| Working capital ratio, WC/TA | 0.027 | -0.133 | 0.937 | -0.188 | -0.768 | 1.502 | 0.041 | -0.066 | 0.830 | -3.200*** |
| Intangibles asset ratio, INTANG/TA | 0.063 | 0.131 | 0.178 | 0.236 | 0.291 | 0.270 | 0.052 | 0.116 | 0.159 | -3.232*** |
| Depreciation and amortization, D&A/TA | 0.023 | 0.043 | 0.052 | 0.038 | 0.054 | 0.056 | 0.023 | 0.041 | 0.052 | -1.766* |
| B) Dummy predictors | Frequencies (%) | | | Failed (N=54) | | | Non-failed (N=578) | | | Chi test (Chi and sig.) |
| | All | Failed | Non-failed | Median | Mean | St dev | Median | Mean | St dev | |
| Internationalization, INTER | 18.8% | 1.9% | 20.4% | 0.00 | 0.02 | 0.14 | 0.00 | 0.20 | 0.40 | 11.135*** |
| Brick & Click, B&C | 39.2% | 35.2% | 39.6% | 0.00 | 0.35 | 0.48 | 0.00 | 0.40 | 0.49 | 0.407 |
| Profitable, PROFIT | 42.8% | 20.4% | 45.2% | 0.00 | 0.204 | 0.407 | 0.00 | 0.452 | 0.498 | 12.275*** |
| Microenterprise, MICRO | 91.1% | 96.2% | 90.8% | 1.00 | 0.961 | 0.194 | 1.00 | 0.907 | 0.289 | 1.309 |

Panel A) was made using the continuous variables and shows a Mann – Whitney *U* test.

Panel B) was made using the dummy variables and shows the results of a Pearson's chi-squared test.

*** significant at 1% level;

** significant at 5% level;

* significant at 10% level.

Table 6
Survival analysis results. Estimated coefficients and hazard ratios for the Cox proportional hazard model.

| Predictors | Univariate models | | | Multivariate model (full) | | | Multivariate model (reduced) | | |
|-----------------------------|-------------------|--------|----------------|---------------------------|--------|----------------|------------------------------|--------|----------------|
| | Coef. | Exp(B) | 95% CI | Coef. | Exp(B) | 95% CI | Coef. | Exp(B) | 95% CI |
| Total assets, ln(TA) | -0.248*** | 0.780 | [-0.32, -0.17] | -0.166*** | 0.846 | [-0.26, -0.02] | -0.174*** | 0.839 | [-0.22, -0.02] |
| Total employees, ln(EMP) | -0.267*** | 0.765 | [-0.45, -0.08] | 0.032 | 1.03 | [-0.15;0.25] | | | |
| Total sales, ln(SALES) | -0.221*** | 0.802 | [-0.38, -0.07] | -0.016 | 0.984 | [-0.15;0.03] | | | |
| INTER = yes | -1.021*** | 0.360 | [-1.39, -0.64] | -0.910*** | 0.402 | [-1.29, -0.48] | -0.838*** | 0.432 | [-1.24, -0.45] |
| B&C = yes | -0.363*** | 0.696 | [-0.59, -0.13] | -0.288** | 0.749 | [-0.50, -0.01] | -0.269** | 0.763 | [-0.52, -0.02] |
| Profitability ratio, ROA | -0.238*** | 0.788 | [-0.32, -0.15] | -0.099** | 0.905 | [-0.15, -0.02] | -0.120** | 0.886 | [-0.22, -0.02] |
| Solvency ratio, TE/TA | -0.186*** | 0.830 | [-0.28, -0.09] | -0.034 | 0.966 | [-0.29,0.26] | | | |
| Liquidity ratio, WC/TA | -0.229*** | 0.795 | [-0.33, -0.12] | -0.089 | 0.914 | [-0.42,0.21] | | | |
| Intangible ratio, INTANG/TA | 0.144*** | 1.155 | [0.06,0.23] | 0.154*** | 1.166 | [0.03,0.18] | 0.122*** | 1.130 | [0.04,0.19] |
| Depreciation rate, D&A/TA | 0.413*** | 1.511 | [0.12,0.70] | -0.002 | 0.997 | [-0.03,0.03] | | | |
| PROFIT = yes | -0.581*** | 0.559 | [-0.82, -0.34] | | | | | | |
| MICRO = yes | 0.578** | 1.783 | [0.05;1.11] | | | | | | |
| Log-likelihood | | | | -1513.1 | | | -1623.79 | | |

*** significant at 1% level;

** significant at 5% level.

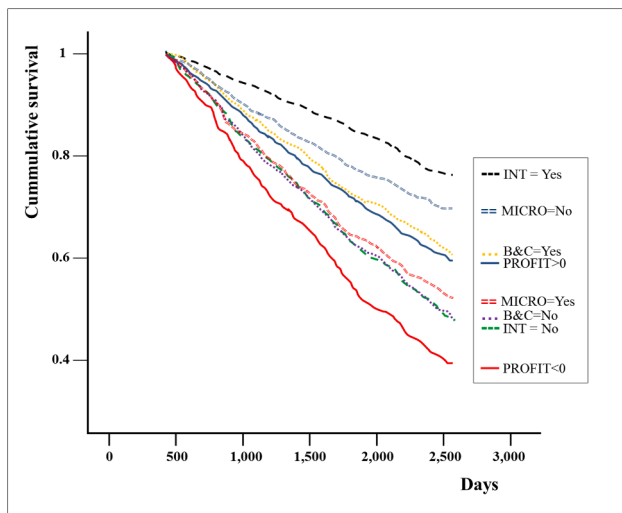


Fig. 5. Relationship between survival functions for the Cox model.

variables and positively related to the earnings management variables. Table 6 also shows the results of applying the Cox multivariate regression, including one model with all the variables and another obtained after applying the model selection procedures. Several approaches have been proposed for selecting models in Cox regression, such as stepwise procedures, information criteria methods (e.g. the Akaike information criterion and Bayesian information criterion), and methods based on shrinkage and dimension reduction (e.g. LASSO). All of these automate the selection of the relevant variables, but this process must be guided by expert judgement. For this analysis, some redundant variables were thus eliminated, leaving the reduced model with five significant variables: ln (TA), INTER, B&C, ROA, and INTANG/TA. The discarded variables were no longer significant in the full model.

Fig. 5 displays the survival functions for the Cox model. An absence of profits is the factor most related to the bankruptcy of the company because fewer than 40% of companies with losses survive seven years later. Internationalization enhances the survival of an e-commerce company because almost 80% of exporting companies survive seven years later.

4.4. Generalized structural equation model

Having a time-to-event dependent variable, we performed

generalized structural equation modelling (Hayes, 2009; MacKinnon et al., 2004). We used the *gsem* procedure in Stata 14. The three financial health variables are sufficiently correlated to reflect one construct, called HEALTH. This construct meets the requirements of unidimensionality, reliability, and convergent validity. The first eigenvalue is 2.65, explaining 88.37% of the variance. Reliability was examined using Cronbach's alpha (0.94) and composite reliability (0.95), revealing excellent internal consistency. The average variance extracted (AVE) is 0.88. The three size variables may also reflect one construct (SIZE). The first eigenvalue is 2.03, explaining 67.79% of the variance. The Cronbach's alpha coefficient is 0.81, composite reliability is 0.86, and AVE is 0.67, all above the conventional thresholds. It made little sense to calculate a construct with the two variables that reveal signs of earnings management. Therefore, we tested two structural equation models, that is, one with each earnings management variable (model 1 with INTANG/TA and model 2 with D&A/TA).

4.5. Results of the generalized structural equation model

Table 7 presents the results of the structural equation estimations. All the estimated coefficients are statistically significant and the two models present a good fit. A negative beta coefficient indicates that when the variable increases, the hazard decreases. The root mean square error of approximation (RMSEA) is 0.062 and 0.075, respectively. The comparative fit index (CFI) is 0.95 and 0.91 and the standardized root mean square residual (SRMR) is 0.038 and 0.05.

We estimated the direct, indirect, and total effects for the full model. Table 7 shows the estimated coefficients, ratio of hazard rates (Exp(B)), 95% confidence intervals by variable, and likelihood ratio test of the restricted model (direct effects) against the full or unrestricted model. The confidence intervals were obtained using bias-corrected non-parametric bootstrapping (Efron and Tibshirani, 1994) to adjust to the non-normal distribution of the indirect effect. All the variables significantly affect survival. We found statistically significant direct effects of SIZE,

HEALTH, INTER, B&C, INTANG/TA, and D&A/TA on survival. Exp(B) fluctuates between 0.40 for INTER and 0.87 for HEALTH. Holding all the other variables constant, internationalized companies are 60% more likely than domestic companies to survive seven years after foundation. B&C companies are 21% more likely than pure-click companies to survive seven years after foundation. A one-unit increase in HEALTH decreases the risk of failure by 13%. A one-unit increase in SIZE decreases the risk of failure by 28%. A one-unit increase in INTANG/TA increases the risk of failure by a factor of 1.18 (model 1). A one-unit increase in D&A/TA increases the risk of failure by a factor of 1.16 (model 2).

We applied the formal steps proposed by Baron and Kenny (1986) to examine the mediating effects of earnings management in the relationship between financial health and survival as well as the mediating effects of firm strategies in the relationship between size and survival. Our results achieved the steps necessary for mediation. The mediating effects are partial because when the intervening variables were included in the model, the effect of firm size or financial health on survival remained statistically significant. The parameter estimates show that HEALTH has a positive effect on survival; INTANG/TA and D&A/TA have a significant direct effect on survival; and HEALTH has a negative effect on INTANG/TA and D&A/TA (coef. of -0.063^{**} and -0.068^{**} , respectively). The beta coefficients of the regression show that the indirect effects of HEALTH through INTANG/TA and D&A/TA on survival are significant (coef. of -0.011^{**} and -0.010^{**} , respectively). Financial health increases survival, but the suspicion of earnings management practices reduces the likelihood of survival, simply because financial statements are not true and fair.

The results obtained also confirm the partial mediating role of B&C and internationalization strategies in the relationship between firm size and survival. SIZE has a positive effect on survival, INTER and B&C have a significant direct effect on survival, and SIZE has a positive effect on INTER (coef. of 0.097^{**}) and B&C (coef. of 0.086^{**}). The indirect effects of SIZE through INTER and B&C on survival are statistically significant (-0.08^{***} and -0.02^{***} , respectively). Table 7 also shows the total effect

Table 7

Direct and indirect effects. Indirect effects were calculated based on multiplication of direct generalized structural equation model (GSEM) effects along each path. 95% confidence intervals in brackets obtained using bias-adjusted nonparametric bootstrapping. Num. obs: 632.

| | | Model 1 | | | Model 2 | | |
|----------------------|--------------------------------|----------------------|--------|------------------|----------------------|--------|------------------|
| | | Coef. | Exp(B) | 95% CI | Coef. | Exp(B) | 95% CI |
| Direct effect (1) | SIZE | -0.329^{***} | 0.719 | $[-0.47, -0.18]$ | -0.336^{***} | 0.714 | $[-0.48, -0.19]$ |
| | INTER | -0.916^{***} | 0.400 | $[-1.31, -0.52]$ | -0.889^{***} | 0.411 | $[-1.28, -0.49]$ |
| | B&C | -0.237^{**} | 0.788 | $[-0.48, -0.02]$ | -0.263^{**} | 0.769 | $[-0.51, -0.01]$ |
| | HEALTH | -0.135^{***} | 0.873 | $[-0.24, -0.04]$ | -0.131^{***} | 0.876 | $[-0.23, -0.03]$ |
| | INTANG/TA | 0.169^{***} | 1.184 | $[0.09, 0.25]$ | | | |
| | D&A/TA | | | | 0.147^{*} | 1.158 | $[-0.13, -0.04]$ |
| Indirect effect (2) | SIZE by INTER | -0.088^{***} | 0.916 | $[-0.14, -0.04]$ | -0.086^{***} | 0.589 | $[-0.13, -0.04]$ |
| | SIZE by B&C | -0.020^{**} | 0.980 | $[-0.04, -0.01]$ | -0.022^{*} | 0.909 | $[-0.04, 0.01]$ |
| | HEALTH by INTANG/TA | -0.011^{**} | 0.989 | $[-0.03, -0.01]$ | | | |
| | HEALTH by D&A/TA | | | | -0.010^{*} | 0.921 | $[-0.03, -0.01]$ |
| Total effect (1 + 2) | SIZE by INTER and B&C | -0.438^{***} | 0.645 | $[-0.58, -0.29]$ | -0.445^{***} | 0.382 | $[-0.59, -0.29]$ |
| | HEALTH by INTANG/TA | -0.146^{***} | 0.864 | $[-0.24, -0.04]$ | | | |
| | HEALTH by D&A/TA | | | | -0.141^{***} | 0.869 | $[-0.24, -0.04]$ |
| | SIZE \rightarrow INTER | 0.097^{***} | | $[0.05, 0.12]$ | 0.097^{***} | | $[0.05, 0.12]$ |
| | SIZE \rightarrow B&C | 0.086^{***} | | $[0.07, 0.12]$ | 0.086^{***} | | $[0.07, 0.12]$ |
| | HEALTH \rightarrow INTANG/TA | -0.063^{**} | | $[-0.16, -0.03]$ | | | |
| | HEALTH \rightarrow D&A/TA | | | | -0.068^{***} | | $[-0.10, -0.04]$ |
| | Log pseudo-likelihood | -4499.96 | | | -3827.71 | | |
| | LR chi2(4) | 51.20 ^{***} | | | 66.93 ^{***} | | |
| | Model Chi-Square(6) | 20.52 | | | 33.80 | | |
| | RMSEA | 0.062 | | | 0.075 | | |
| | CFI | 0.951 | | | 0.910 | | |
| | SRMR | 0.038 | | | 0.050 | | |
| | Log pseudo-likelihood | -4499.96 | | | -3827.71 | | |
| | LR chi2(4) | 51.20 ^{***} | | | 66.93 ^{***} | | |

* p-value < 0.1.

** p-value < 0.05.

*** p-value 0.001.

of firm size and financial health on survival by combining the direct and indirect effects. The total effects are $\text{Exp}(B) = 0.65$ for firm size and $\text{Exp}(B) = 0.86$ for financial health. The last row of the table reports the likelihood ratio test of the restricted model (direct effects) against the full or unrestricted model. Finally, the likelihood ratio Chi-squared values are 51.20 and 66.93, exceeding the 5% critical value; hence, we rejected the restricted model in favour of the full model.

This study shows that all the hypotheses are supported by the data. The robustness of the study was ensured by analysing both short-term survival (within a year of being created) and long-term survival (after seven years). Furthermore, three techniques were performed: non-parametric tests for the difference between two means, Cox regression for survival analysis, and a generalized structural equation model. The results are consistent with each other and with the hypothesized relationships.

5. Discussion and conclusions

5.1. Findings

Many entrepreneurs wonder whether it is better to opt for a 100% online presence or have a physical store, a question that is under-researched in the literature (Difrancesco and Huchzermeier, 2020; Huang and Jin, 2020; Kuan and Bock, 2007; Stewart, 2003; Toufaily et al., 2013). We found that having a physical store increases resilience and decreases risk: the bankruptcy risk is 1.437 times greater for pure-clicks than for B&C retailers. Several authors point to the need for studies that track the survival rates of young companies that internationalize (Sapienza et al., 2006; Schwens et al., 2018). We found that opting for internationalized e-commerce projects increases the probability of survival: the bankruptcy risk is 2.778 times greater for local players than for internationalized firms that carry out export and import e-commerce activities. Further, the risk of failure is 1.787 times greater for e-commerce companies that are unprofitable after one year of life than for profitable firms. The larger the venture, the higher is the probability of survival: 47.64% of microenterprises (with fewer than 10 employees) survive seven years later compared with 67.65% for larger enterprises. This result is consistent with other studies that assess the firm size–survival relation (Banerjee et al., 2007).

5.2. Contributions

Our study shows that organizational ecology theory can be applied to explain the dynamics of e-commerce, a research area of growing interest (Wang et al., 2017). The ‘survival of the fitter’ principle is usually explained by factors such as imprinting (Stinchcombe, 1965) and the liability of newness (Freeman et al., 1983); although, Sapienza et al. (2006) note that the low structural inertia of young companies is a contradictory element. We argue that financial resilience could provide an adequate explanation. Making early profits, having a comfortable liquidity position, and exhibiting capital strength to deal with future risks lead to organizational resilience. We hypothesized that a B&C business should be less risky than a pure-click dot-com because it is diversified and that those companies performing export or import operations are more likely to survive because this allows them access to more markets, which increases resilience. We found that following a B&C strategy and internationalizing the online store increase survival. Indeed, all these factors not only affect the probability of early bankruptcy, but also explain survival several years later.

Examining accounting information for the first few years has been questioned (Miloud et al., 2012), as other types of data are preferred. We found it worthwhile for analysts to examine the accounting statements provided by companies in their early years; however, they should also pay attention to the presence of earnings management, which is common for such companies interested in appearing to be financially healthy. Analysts should pay particular attention to values of intangible

assets and depreciation that deviate from the e-commerce industry average. We found that the worse financial health, the greater is the manipulation and the lower is survival.

Many studies of e-commerce develop explanatory models, with structural equation models being the most common. We formulated a structural equation model with survival outcomes (i.e. a generalized structural equation model) that can model many e-commerce situations since a large number of interesting research issues in e-commerce centre on events (Kauffman et al., 2012), such as customer churn prediction, the conversion of marketing campaigns, product recommendation systems, participation in online communities and social networks, consumer credit scoring, the subscription and cancellations of services, product adoption speed, clickstream analysis prediction, cross-selling opportunities identification, and product lifespan prediction. Therefore, new avenues are available for future research.

5.3. Practical implications

The results of the study are useful for entrepreneurs, business incubators, investors, and policymakers because they allow us to identify typologies of survival strategies for e-commerce entrepreneurs. Investors in e-commerce increase the probability of success by selecting projects with the highest probability of survival. E-commerce is on the agenda of policymakers worldwide; public funding programmes should be targeted to projects with the highest survival rates, favouring the internationalization of business projects. Although e-commerce has been considered as a panacea for small businesses and entrepreneurs (Piris et al., 2004), the presented results show that large companies at birth are more likely to survive.

5.4. Limitations and future research directions

The limitations of the study come from the use of a single database. Focusing on one industry and one country may affect the generalizability of the results. It would be worthwhile testing the model with data on companies in other countries. Likewise, a future line of research would be to study resilience in e-commerce using financial and non-financial variables, especially those related to logistical, technological, and organizational aspects as well as imprinting by the entrepreneur. Another future line of research might be to develop an earnings management construct that considers the specificities of e-commerce companies. It would be interesting to study the trajectories that lead to the success or failure of this industry to go beyond explanatory models by carrying out predictive models that—from a set of variables—would help the decision-making processes of analysts, venture capitalists, and public administrations that subsidize entrepreneurship.

5.5. Conclusions

This study proposes a model for the survival of e-commerce entrepreneurs, hypothesizing that firm size, financial health, a B&C strategy, and an internationalization strategy favour survival. We argue that earnings management mediates the relation between financial health and survival. A B&C strategy and an internationalization strategy mediate the link between size and survival. The empirical study analyses seven years of data from a sample of 632 newly created e-commerce companies using non-parametric means tests, a Cox regression, and a generalized structural equation model. Its results support the ‘survival of the fitter’ principle. Survival is enhanced by firm size and financial health, but not uniquely determined by them. B&C and internationalization strategies are thus explanatory factors for survival. In summary, it is worth analysing the financial statements provided by entrepreneurs, although it is necessary to check if there are signs of earnings management.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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