

**THE IMPACT OF EFFECTUATION, CAUSATION AND RESOURCES ON NEW VENTURE
PERFORMANCE: NOVICE VERSUS EXPERT ENTREPRENEURS**

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Abstract

Effectuation theory offers new ways of understanding entrepreneurial decisions and it is opposed to the traditional, rational, and so-called causal approach. A significant portion of the effectuation literature is rooted in the idea of entrepreneurial experience and expertise, with conclusions suggesting that novice and expert entrepreneurs apply effectual and causal logics differently when making decisions about their ventures. Further, resources are seen as critical to deployment of effectual vs. causal behaviors. The main goal of this paper is thus to evaluate whether the roles of effectuation and causation in performance differ for experts and novices, and how these logics interact with resource availability. Based on data from a sample composed of 178 New Technology-Based Firms (NTBFs), our analyses show that causation seems to be determinant of firm performance in experts' ventures only, whereas effectuation is relevant for both experts and novices. Moreover, the availability of resources seems to interact only with causation in their relationship to performance.

Keywords: Effectuation, Causation, Resources, Performance, Experience, New Technology-Based Firms

JEL Classification L25 · L26 · M13

1. Introduction

When starting a new venture, entrepreneurs must make decisions that affect their new firms' performance. Understanding how entrepreneurs process information, reason and make decisions, and how their decisions affect organizations have thus gained importance in the field of entrepreneurial processes (Read and Sarasvathy 2005; Dew et al. 2009; Engle 2017). Sarasvathy (2001, 2008) identifies two decision-making logics guiding entrepreneurial behaviors: causation and effectuation. Although effectuation has received growing attention over the past decade (e.g., Dew et al. 2009; Brettel et al. 2012; Deligianni et al. 2017; Alsos et al. 2019; McKelvie et al. 2019), research has focused mainly on understanding the drivers leading to the adoption of these two logics. More recently, focus has shifted towards the effects of effectual and causal decision-making processes on firm performance (Smolka et al. 2016; Laskovaia et al. 2017; An et al. 2019), but empirical studies are still scarce.

Effectuation theory is still in a nascent phase of development (Arend et al. 2015; Read et al. 2016; Alsos et al. 2019); nevertheless, it represents an extensive paradigm shift in understanding entrepreneurial behavior and decision-making in the initial stage of a new venture (Read et al. 2009b; Sarasvathy 2001; Laine and Galkina 2017; Alsos et al. 2019). Researchers have focused especially on the development of conceptual arguments, qualitative studies, and longitudinal studies (e.g., Reymen et al. 2015; Laskovaia et al. 2017; Engle et al. 2017; Hauser et al. 2019; McKelvie et al. 2019), mainly addressing the question of how effectual principles benefit firm performance. However, less attention has been paid to the impact of causation (Laskovaia et al. 2017; DeTienne et al. 2015). Therefore, it has been highlighted the role of pre-commitments and alliances in sharing risks (Read et al. 2009b) and in obtaining key resources to develop the firm (Chandler et al. 2011). It has been also argued the application of the flexibility principle in developing adaptation capabilities to confront environmental changes, and the determinant role of affordable loss reasoning when making decisions aimed at improving performance (Read et al. 2009b; Wiltbank et al. 2009). In addition, experimentation can be a key catalyst for the development of innovations. Empirically, some studies have demonstrated the positive impact of effectuation on firm performance (e.g., Wiltbank et al. 2009; Brettel et al. 2012; Smolka et al. 2016; Cai et al. 2017; Deligianni et al. 2017; An et al. 2019). Nevertheless, only a few studies show a positive relationship between causation as an explicit decision-making logic and performance (Brettel et al. 2012; Smolka et al. 2016; Laskovaia et al. 2017; An et al. 2019). Further, although the need for empirical papers analyzing the relationship between types of decision-making logic (effectual, causal) and expertise was noted some years ago (Nienhuis 2010; Politis 2008), the lack of empirical studies to advance knowledge of how these variables relate to each other and to performance continues to constitute a gap in the effectuation literature.

Moreover, the availability of relevant resources determines the way entrepreneurs make decisions and thus how these decisions impact performance. For instance, Read and Sarasvathy (2005) state that effectual strategies are more common in resource-poor situations, based on the mere lack or scarcity of required resources to implement plans, and therefore hinder causal behavior in favor of effectuation. This finding suggests that better results are more likely when entrepreneurs think and act effectually under conditions of low resource availability. The strategic literature shows two opposed views, however, on resource slack (Nohria and Gulati, 1997): high availability of resources can relax incentives to explore and innovate; but, conversely, slack permits the venture to experiment with new projects.

In addition, because effectuation was initially developed through experiments with expert entrepreneurs (Sarasvathy 2001, 2008; Welter et al. 2016), a significant portion of the effectuation literature is rooted in the idea of entrepreneurial expertise (e.g., Read and Sarasvathy 2005), where results highlight differences in the way expert and non-expert entrepreneurs apply decision-making logics (Sarasvathy 2001; Read and Sarasvathy 2005; Dew et al. 2009; Frese et al. 2019). According to previous research, expert entrepreneurs are more likely to apply an effectual logic in decision-making (Read et al. 2009a; Read and Sarasvathy 2005), relying more on a contingency than on a predictive approach due to their knowledge accumulated in performing entrepreneurial and managerial tasks (Nelson 2005). On the contrary, the lack of expertise of novice entrepreneurs makes them more prone to employ deterministic behavior guided by established plans and predefined goals (Read and Sarasvathy 2005). These differences in their tendency to use effectual and causal ways of thinking in entrepreneurial decision-making lead us to expect different impacts on performance of effectuation and causation for novices and experts. Moreover, experience can determine the ways in which entrepreneurs manage resources (Holcomb et al. 2009; Mannor et al. 2016), which, in interaction with decision-making logics applied, may also affect performance.

Given the importance of understanding how these logics can lead to better results and thus underpin the new venture's survival and success, and considering the potential differences in applying effectual and causal reasoning depending on the level of entrepreneurial expertise, the main goal of this paper is to determine whether the roles of effectuation and causation in performance differ between expert and novice entrepreneurs. Further, we consider how the availability of resources (financial, human, and technological) with which to carry out new projects may determine the relationship between types of decision-making logic and performance, in a comparison of experts and novices.

This paper aims to contribute to the entrepreneurship literature in three ways. First, we respond to the call by McKelvie et al. (2019) to advance effectuation research by showing how effectuation occurs and how it impacts performance, and in line with recent works (Smolka et al. 2016; Laskovaia et al. 2017; An et al. 2019). We contribute to this debate by providing empirical evidence of the effects of effectuation and causation on performance, and of how these effects may vary depending on several conditions. Second, we aim to contribute to the entrepreneurship literature (Read and Sarasvathy 2005; Alsos et al. 2019) by empirically analyzing the role of experience and resources on performance when entrepreneurs use effectual and causal approaches. We demonstrate that entrepreneurs' expertise may be a key for both researchers and practitioners in the identification of distinct elements (thinking logic, resources, and their interaction) that explain new firm performance. Finally, our study contributes to the empirical advancement of the effectuation approach by empirically proving the scale proposed by Chandler et al. (2011) in the specific context of New Technology-Based Firms (NTBFs).

This study is structured as follows. Following this introduction, we explain our theoretical framework, concluding with the study hypotheses. We then present the methods used to perform the empirical analysis, followed by the results obtained. Finally, we discuss our findings and the main conclusions drawn from them.

2. Theoretical framework and hypotheses

Effectuation theory constitutes a powerful approach to addressing processual aspects of entrepreneurial phenomena. In its original conception (Sarasvathy 2001), the theory posed two alternative approaches used by entrepreneurs in the process of new venture creation and development: causation and effectuation. Causation derives from the rational decision-making perspectives of classical microeconomics, while effectuation has its foundations in cognitive science (Chandler et al. 2011). Causation represents a rational, linear logic consistent with predictive planning, whereas effectuation processes are related to non-predictive strategies (Wiltbank et al. 2006). According to Sarasvathy (2001, p. 252), the logic underlying causation is “to the extent that we can predict the future, we can control it.” However, effectuation focuses on the controllable aspects of an unpredictable future (Sarasvathy 2001) with a different underlying logic based on control of means and exploitation of contingencies—that is, “to the extent that we can control the future, we do not need to predict it” (Sarasvathy 2001, p. 252). Effectuation thus seems to be a better approach for facing uncertainty (Sarasvathy and Kotha 2001).

Sarasvathy's seminal study (2001) also outlines the four main principles of effectuation. Instead of analyzing alternatives to choose the one with the maximum expected return, effectually-oriented individuals

choose among alternatives by applying a logic of loss affordability; exploiting unexpected environmental contingencies rather than pre-existing knowledge, capabilities, and resources; controlling an unpredictable future instead of predicting an uncertain one using statistical inferences to make decisions and delineate actions; and stressing strategic alliances and pre-commitments instead of competitive relationships.

In addition, effectuation asserts the importance of initial means owned by the entrepreneur rather than ends as the starting point of the entrepreneurial process. Causation takes effects as given and focuses on choosing among the means available to achieve the effect, whereas effectuation takes means as given and focuses on choosing among possible effects to be achieved with that set of means (Sarasvathy 2001). After an intensive effort to operationalize these ideas by creating a multi-item scale to measure causation and effectuation, Chandler et al. (2011) propose a tool that compiles the main principles and consists of various dimensions. The scale includes causation, as well as four dimensions for effectuation—affordable loss, experimentation, flexibility, and pre-commitments.

2.1 Effectuation, causation, and performance

The literature on entrepreneurship argues that the application of various effectual principles benefits firm performance. First, through a focus on pre-commitments and partnerships, effectual entrepreneurs establish alliances that enable them to share the risk of the venture (Read et al. 2009b) and their firm to exploit stakeholder/partner resources such as information, knowledge, and access to networks. Establishing pre-commitments may also help entrepreneurs to guarantee some outcomes for the first phase of the firm's development based on pre-sales agreements. Strategic alliances enable the firm to obtain valuable resources from potential customers, suppliers, and competitors prior to having fully developed products (Chandler et al. 2011). Second, in applying the affordable loss principle, entrepreneurs manage risk by considering the worst-case scenario and can thus measure upside opportunity potential carefully (Read et al. 2009b); keeping costs down and pushing revenues up can result in better opportunities for improved performance in the future. Third, decision-making based on principles of flexibility leads the firm to develop adaptation capabilities to react more quickly to environmental changes, potentially stimulating the formation of dynamic capabilities that support superior long-run firm performance (Teece 2007). Finally, the principle of experimentation can be a determining factor in the development of innovations, which provide the foundation for performance improvements, particularly in technological contexts such as the NTBF setting.

Empirically, previous studies have also provided arguments supporting the positive relationship between effectuation and new venture performance (e.g., Smolka et al. 2016; Cai et al. 2017; Deligianni et al. 2017; An et al. 2019). For instance, Urban and Heydenrych (2015) demonstrate that the effectual principles of pre-commitment, experimentation, and flexibility significantly affect performance; and Wiltbank et al. (2009) demonstrate that the use of effectual principles results in fewer investment failures, potentially enhancing performance. Similarly, in the context of R&D, Brettel et al. (2012) find that applying effectual principles increases performance in project development. Other studies have proven that the construct of effectuation as a whole has a positive impact on new venture performance (Cai et al. 2017; Smolka et al. 2016). Analyzing the impact of effectuation on new venture performance among 1453 student entrepreneurs, Smolka et al. (2016) find that using effectuation impacts new venture performance positively, with pre-commitments and flexibility as the principles with a greater impact.

Moreover, several authors (e.g., Deligianni et al. 2017) find evidence for effectuation as a moderating and mediating variable, demonstrating that effectuation processes exert a positive effect on the relationship between product diversification and new venture performance. Similarly, Mthanti and Urban (2014) show that effectuation moderates the relationship between entrepreneurial orientation and firm performance in high-technology firms. More recently, in examining how social identities influence the way an entrepreneur manages the firm and its consequences for business performance, Estrada et al. (2018) conclude that effectuation channels the effects of specific identities on business performance.

We therefore hypothesize the following:

Hypothesis 1: The use of effectual logic when making decisions is positively related to new venture performance.

The entrepreneurship literature has paid less attention to the relationship between causation and performance, despite the importance of this link (Laskovaia et al. 2017). Some studies in strategic and planning research that analyze causation as a rational decision-making logic support this relationship, however. DeTienne et al. (2015), for example, examine the role of causation in entrepreneurial exit strategies, Kristinsson et al. (2016) explain how causal logics shape the relationship between founding team diversity and innovation, and Brinckmann et al. (2010) perform a meta-analysis of the benefits of business planning for new venture performance. Other studies (Kristinsson et al. 2016; Laskovaia et al. 2017) show a positive effect of causation on performance when causation is seen as an explicit cognitive logic in entrepreneurial decision-making. For

example, Smolka et al. (2016) and Brettel et al. (2012) evaluate effectuation and causation jointly as they relate to performance in ventures and projects, respectively. More recently, researchers (Reymen et al. 2015; Frese et al. 2019) claim that causal processes and effectual logics help ventures differently. The latter help entrepreneurs to find opportunities to exploit when they appear, whereas the former enable them to establish what is predictable in some decisions, in order to make the most of these decisions. Similarly, for Laskovaia et al. (2017) both effectuation and causation have positive effects on new venture performance. These authors suggest that novice entrepreneurs implement both effectual and causal behavioral patterns during new venture creation but that the relationship with new venture performance is stronger for causation than for effectuation. Finally, in studying the combination of firms' decision-making logics and entrepreneurial resourcing behaviors to create value in a sample of Chinese ventures, An et al. (2019) connect the hybrid use of effectuation, causation, and bricolage to firm growth and survival.

We therefore hypothesize the following:

Hypothesis 2: *The use of causal logic when making decisions is positively related to new venture performance.*

2.2 Resources and performance: interactions with effectuation and causation

Resource mobilization is a key issue in every entrepreneurial initiative (Desa and Basu 2013). The strategic management literature provides a wealth of empirical findings on the importance of resources to enhance performance. Resources are critical for survival (Pfeffer and Salancik 2003), competitive advantage (Barney 1991), and growth (Penrose 1959). Resource scarcity, in contrast, reduces the likelihood of survival and impedes new venture growth (Musso and Schiavo 2008). Having sufficient resources improves the way new ventures confront drastic environmental changes by enabling more flexibility and room to manoeuvre when responding to competitors (George 2005). Such ability ultimately leads to better financial performance (Daniel et al. 2004).

Previous research on entrepreneurship shows that the resources of a new business, such as its human resources, are crucial to its growth (Chandler 1998; Brinckmann et al. 2011). In fact, since entrepreneurs usually have access to very limited resources when first beginning new firm creation (Hanlon and Saunders 2007), the fledgling new venture's performance depends on the entrepreneur's capacity to configure resources in a way that creates value (Barney 1991; Penrose 1995). Researchers observe a positive relationship between resources such as financial and technological resources or employees' know-how and firm performance and competitive advantage (e.g., Esteve-Pérez and Mañez-Castillejo 2008; Yang et al. 2017). For instance, financial resources

can serve as catalysts in the process of acquiring and configuring resources (Alsos et al. 2006), while human resources repay intensive development in new firms that are often constrained in access to other resources.

Technological resources play a very important role in value creation. For example, firms with a wide range of technological resources can experiment in new fields, increasing their flexibility to face market changes (Grant 1996; Zahra and George 2002). Further, researchers highlight the importance of technological resources to innovative performance (Grant 1996; Miller 2006), especially in technology-based firms, since the dominant resources behind growth and performance are technological in nature (Stuart 2000). Brinckmann et al. (2011) demonstrate that the growth of new technology-based firms generally depends on their resources, due to intensive R&D efforts, the need for highly skilled labor, and expensive production facilities.

In sum, each resource can help to improve a firm's performance individually, but all resources together also have synergetic values to produce unique opportunities (Hult and Ketchen 2001). Such a synergetic combination of resources can explain differences in firms' performances (Dutta et al. 1999; Teece et al. 1997).

We therefore hypothesize the following:

Hypothesis 3: The availability of resources is positively related to new venture performance.

Recent studies grounded in the resource-based view (RBV) have shifted the focus from the resource stock to the critical role of managers in generating value from resources (Mannor et al. 2016). If we translate this new focus into entrepreneurial new ventures, the choices and decisions entrepreneurs make about how to deploy the resources available gain new importance. In addition, the availability of relevant resources determines how entrepreneurs make decisions and the impact of these decisions on performance. Following our theoretical framework, we conceptualize the way in which entrepreneurs make choices and decisions as two cognitive logics: effectuation and causation. In new ventures, therefore, resource endowments can interact with effectual or causal rationales to guide the entrepreneur's decisions.

Various studies on entrepreneurship have made several efforts to understand the effectuation rationale in relation to resources. For example, Read and Sarasvathy (2005) find that effectual strategies are more likely to be used in resource-poor situations due to the sheer lack of resources required to implement plans. In addition, Hsu (2007) argues that entrepreneurs—who are usually short of resources, especially in the early stages of their ventures—actively engage in their community by establishing networks to access resource providers and exchange ideas. Such activity suggests the effectual principle of alliances and pre-commitments and supports the idea of effectual activation when resources are constrained. Yet the strategic literature on resource slack presents

two opposing views (Nohria and Gulati 1997): that a high availability of resources can relax incentives to explore and innovate (potentially related to lower use of experimentation and less search for pre-commitments); and, conversely, that slack enables the venture to experiment with new projects (potentially enhancing experimentation and forcing flexibility). More recently, Alsos et al. (2019) argue that resources connect with effectuation in three important ways. First, the likelihood that novice entrepreneurs have limited resources gives them few viable choices apart from effectuation or bricolage. Second, effectuation expects entrepreneurs to create partnerships with others when setting up a business in order to obtain more resources. Third, in the scenario of abundance of resources, since a novice is less likely to follow a co-creative process such as effectuation, such cases “may encourage an accelerated transition from effectuation to causation” (Alsos et al. 2019, p. 9).

Regarding the connection between entrepreneurs’ use of causation and resources, we may first argue that causation focuses on exploitation of pre-existing capabilities and resources to maximize expected returns (Chandler et al. 2011; McKelvie et al. 2013). In this sense, resource availability can be seen as a condition that fosters plan design and implementation. In other words, causal logics respond to resource combination and transformation in order to implement pre-defined plans. In another vein, although large resource endowments may enable the firm to set goals in advance and meet them more easily, this process could hinder entrepreneurial progress by reducing firms’ incentives to identify new business opportunities and establish new goals (Mosakowski 2002), leading to overestimation of firm possibilities and relaxing control over plan execution. However, several studies argue that the business plan is vital in the entrepreneurial process as a causal tool, since it encourages the efficient use of resources and increases decision speed (Laskovaia et al. 2017).

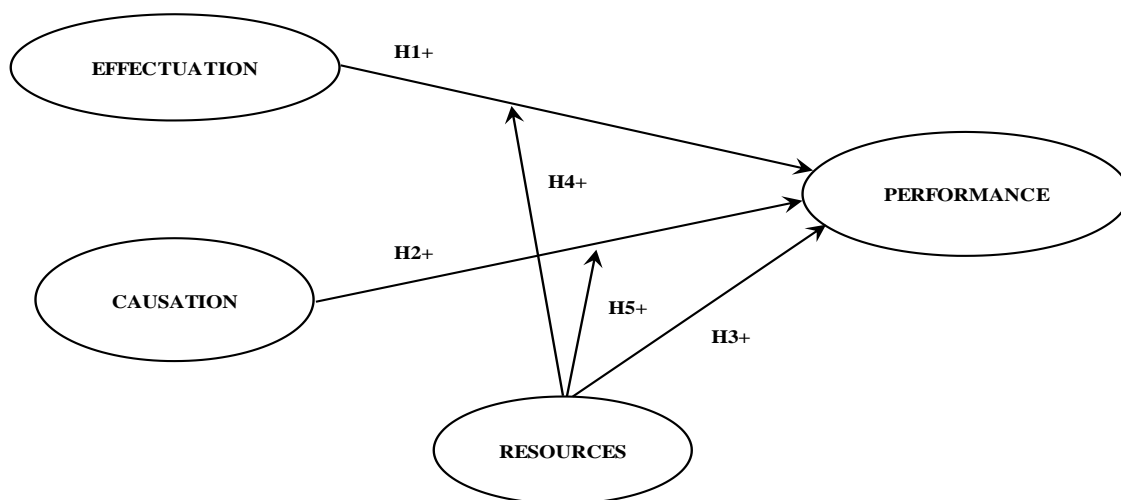
Based on the previous arguments, we hypothesize that:

Hypothesis 4: *The availability of resources positively moderates the relationship between effectuation and new venture performance, such that a higher level of resource availability strengthens this relationship.*

Hypothesis 5: *The availability of resources positively moderates the relationship between causation and new venture performance, such that a higher level of resource availability strengthens this relationship.*

Our theoretical model summarizing the relationships proposed can be seen in Figure 1:

Figure 1. Theoretical model



2.3 The role of entrepreneurial experience: differences between novice and expert entrepreneurs

In previous research we find strong arguments leading us to expect differences in the hypothesized relationships depending on the level of expertise of the entrepreneur. Specifically, the key distinction in prior studies is between novice and experts.

First, the effectuation literature highlights that expert entrepreneurs are more likely to apply effectual logic when making decisions (Read et al. 2009a; Dew et al. 2009; Read and Sarasvathy 2005). Knowledge accumulated through experience and the level of expertise acquired can lead entrepreneurs to rely more on a contingency approach than on a predictive, deterministic orientation with regard to decision-making and action. Indeed, entrepreneurial expertise contributes to configuration of the skill set necessary to launch a venture (Nelson 2005) and enable the individual to deal more efficiently with uncertain environments (Capelleras et al. 2018). For instance, having previous experience founding a firm probably implies knowledge and expertise in raising financial capital, recruiting employee talent, or developing top management practices (Hsu 2007), as well as in identifying opportunities in the environment (Baron 2006). If we connect these observations to effectuation theory, we can argue that effectual behaviors are more likely to emerge among expert entrepreneurs, as their set of skills to set up a new venture is more highly developed than in novices; in other words, having more skills to launch the business is equivalent to having more starting means. In contrast, it has been suggested that due to novices' generally lower level of expertise, they tend to rely more on established plans to meet predefined goals, instead of making decisions according to contingencies (Read and Sarasvathy 2005). Following these arguments, we can expect different impacts on performance of effectuation and causation depending on whether the

entrepreneur is expert or novice, based on their tendency to place greater emphasis on effectual or on causal thinking when making decisions for their new venture. We therefore posit the following hypotheses:

Hypothesis 6a: *The positive relationship between the use of effectual logic and new venture performance is stronger when the founder is an expert rather than a novice entrepreneur.*

Hypothesis 6b: *The positive relationship between the use of causal logic and new venture performance is stronger when the founder is a novice rather than an expert entrepreneur.*

Second, it has been argued that managers' previous experience contributes to a better use of resources (Peteraf and Barney 2003; Shamsie and Mannor 2013). Mannor et al. (2016) assert that learning gained from experience improves effective management of different types of resources. Specifically, "the ability of managers to generate value from the use of resources stems from the experience that they have accumulated in managing these over time" (Mannor et al. 2016, p. 1330). Repeated experience enables entrepreneurs to develop deeper knowledge of the nature, use, and potential of the resource, and so they have advance knowledge of the best way to deploy it (Shamsie and Mannor 2013). These ideas suggest there may be differences between experts and novices concerning the role played by resource availability on entrepreneurial performance. Accordingly, we formulate the following hypothesis:

Hypothesis 6c: *The positive relationship between availability of resources and new venture performance is stronger when the founder is an expert rather than a novice entrepreneur.*

Third, since entrepreneurial expertise can determine the way in which entrepreneurs manage resources, and given that resource management involves decision-making, the role of resource availability in the relationship between effectuation/causation and performance may differ between novices and experts. For example, Read and Sarasvathy (2005) state that novices' inexperience makes them less likely than experts to change their vision when the resources to implement it are available. Therefore, novices seem to be more reluctant to modify the configuration of resources even in the case of receiving unfavorable feedback. This argument suggests that the interaction between resource availability and effectuation may be weaker for novices than for expert entrepreneurs. In addition, due to the expectation of a more effective management of resources by experts (Mannor et al. 2016; Shamsie and Mannor 2013), we may expect a stronger positive contingency effect of resources on the impact of both types of logic (effectuation and causation) on their ventures' performance. On the one hand, experts' tend to rely more on effectual logic when making decisions (Read and Sarasvathy 2005;

Dew et al. 2009), which combined with a better management of resources may result in performance improvements. On the other hand, resource availability may act as a fostering condition for the development of causal strategies such as plan design and implementation, which in interaction with a more effective deployment and mobilization of resources facilitated by entrepreneurial experience may result in better overall performance.

Based on the foregoing arguments, we posit the following hypothesis:

Hypothesis 6d: *The positive moderating effect of resource availability on the relationship between effectuation/causation and new venture performance is stronger when the founder is an expert rather than a novice entrepreneur.*

3. Method

3.1 Sample

Our sample is composed of 178 Spanish NTBFs no older than 6 years, which is the selection criterion applied in previous research for consideration as new ventures (e.g., Robinson and McDougall 2001; Manev et al. 2015; Laskovaia et al. 2017). NTBFs operate in a technologically-intensive industry with a high degree of innovation and market uncertainty. As a consequence, it is usually a challenge for these types of firms to implement a feasible business plan in the first stage (Andries and Debackere 2007; Reymen et al. 2017), which makes non-predictive strategies highly relevant. Compared to causal logic, effectual reasoning is thus more appropriate when making decisions under uncertainty (Sarasvathy 2001; Sarasvathy and Kotha 2001). Therefore, the context of NTBFs is particularly suitable to develop empirical research on effectuation (e.g., Mthanti and Urban, 2013). In addition, resource availability is a key determinant in technology-intensive industries for the development of new strategic options, in alignment with the rapidly changing environment. For example, NTBFs usually need intensive resources to fully develop their product (Pinkwart and Proksch 2014). Finally, by focusing on a single industry we limit the unobserved heterogeneity among firms by reducing the variance in industry conditions (Paeleman and Vanacker 2015).

To identify these firms within the Spanish business population, we followed the definition of NTBFs proposed by the Spanish National Statistics Institute (INE), which classifies NTBFs as firms conducting their activity mainly in the pharmaceutical industry, aeronautical construction, sectors for communications production (including office equipment and computer materials), technology manufacturing industry, chemical industry, medical and odontology manufacturing, R&D activities, and telecommunications.

The contact data were taken from the SABI database (Iberian Balance Sheet Analysis System), which contains data from 2 million Spanish and 500,000 Portuguese firms. Within the database, we select only technology-based firms no older than 6 years, obtaining a total number of 1461 NTBFs. To obtain information on the study variables, we designed a structured questionnaire. The data were gathered from April to May 2015, through a CATI system via the questionnaire, which was addressed to the founder. We chose founders as respondents because they are important firm members who are very likely to have holistic knowledge of the company's situation.

Of the 1461 NTBFs contacted randomly, 189 responses were obtained, resulting a response rate of 12,93%. Eleven of the questionnaires returned were discarded because an unacceptable quantity of necessary data was missing. Thus, 178 usable questionnaires were finally obtained, and these form the basis of the current study. Regarding the age of the firms in the sample, 37.1% were 4-5 years old, 25.8% were 3-4 years old, 20.8% were under 3 years old, and 16.3% were 5-6 years old. Micro-firms, with fewer than 10 employees, accounted for 90% of the study sample. Of the remainder, 9% had 10-50 employees, and only 1% reported 50-250 employees. The firms' founders presented the following characteristics: 54% were 34-44 years old, 28% were 45-55 years old, 12% were 23-33 years old, and 6% were 56-64 years old. By gender, 81% were male. Finally, 70.5% of the participants had higher education, 27.5% had secondary qualifications and 2% had only primary education.

Various techniques were employed to control for common method bias (Podsakoff and Organ 1986; Podsakoff et al. 2003) and thus reduce the risk of measurement error. First, we performed a pre-test of the questionnaire to control for the problem of ambiguous items, since a clear understanding of the questions helps prevent idiosyncratic interpretation by the respondents. Second, the questionnaire instructions emphasized the anonymity and confidentiality of the data treatment process. It was also made clear that there were no correct or incorrect answers. These procedures help reduce evaluation apprehension and make respondents less likely to edit their responses in order to appear more socially desirable or to conform with what they believe the researcher wants them to respond. Third, we performed Harman's single-factor test to discount the possibility of obtaining a single factor that explained most of the variance. The results of the analysis indicate that questionnaire items load into eight factors that explain 68.01% of the variance. Since the first factor represents 12.57% of the variance, it is highly unlikely that common method variance is a problem in our data (Podsakoff and Organ 1986).

Finally, to test for non-response bias, we compared responses between early and late respondents. The latter were considered as surrogates of non-respondents (Armstrong and Overton 1977), for reasons such as lack of interest in the subject matter (Palazuelos et al. 2018), the prodding required or a lengthy response time. The results of the t-test for independent samples showed that the mean differences between early and late respondents were not statistically significant in relation to the number of employees in the firm ($t = 1.262$; $p = 0.102 > 0.05$) or the size of the founding team ($t = 2.99$; $p = 0.316 > 0.05$). We thus conclude that the study sample is not affected by non-response bias (Armstrong and Overton 1977).

3.2 Measures

To measure the variables we relied mostly on Likert-type scales validated in previous research. For the *dependent variable* (**Performance**), consistent with previous research, we used a subjective measure adapted from Zahra (1996). Subjective measures are particularly useful for evaluating the non-financial dimensions of organizations' performance (Stam and Elfring 2008) and have been proven to be highly consistent with performance reported by objective measures (Poon et al. 2006). Objective measures, in contrast, are difficult to compare among firms that do not use the same accounting practices (Ottum and Moore 1997). We therefore used self-reported measures to capture the multi-faceted nature of performance and asked the respondents to evaluate (ranging from 1 "very low" to 5 "very high") the firm's level of achievement since creation in the following aspects of organizational performance: return on investment, return on equity, customer growth, sales growth, and employment growth.

We measured the *independent variables* as follows. **Effectuation** was measured using the scale developed by Chandler et al. (2011), which compiles four dimensions—experimentation, affordable loss, flexibility, and pre-commitments. Following these authors, we treat effectuation as a multidimensional, formative second-order construct consisting of four reflective first-order sub-components (the above dimensions), all measured on a 5-point Likert-type scale (from 1 "strongly disagree" to 5 "strongly agree"). We measured **Causation** similarly, using the scale developed by Chandler et al. (2011), which includes items that reflect envisioning ends in advance, business planning behaviors, and competitive analyses oriented to predicting an uncertain future. All items were measured on a 5-point Likert-type scale (from 1 "strongly disagree" to 5 "strongly agree"). Finally, the variable for level of resource availability (**Resources**) was measured using a 3-item instrument built from previous related scales. Respondents were asked to assess their level of agreement

with three statements asking whether they had sufficient availability of financial resources, human resources, and technical support to undertake new projects, where 1 represented complete disagreement and 5 complete agreement.

We include a set of *control variables*, including both objective indicators derived from the SABI dataset and self-reported indicators. First, **firm age** was calculated by the number of years since the firm was founded, based on the SABI reports. We expect that older firms, which are more consolidated in the market, will have better performance. Furthermore, as resource accumulation is time-dependent (Paeleman and Vanacker 2015), it is pertinent the consideration of firm age in our model. Second, we considered **firm size**, according to the latest available figure (2015) of number of employees according to SABI. Firm size is expected to influence both performance and the ability to accumulate resources (George, 2005), and has been described in previous literature as an influential factor for success (e.g., Ensley et al. 2002; Song et al. 2007). Both of these control variables have been included in prior studies on effectuation and performance (Guo et al. 2018; Eyana et al. 2018; Mthanti and Urban 2014; Smolka et al. 2016; Deligianni et al. 2017; Laskovaia et al. 2017).

Besides these indicators based on secondary data, we also included two self-reported data items, namely the size of the **founding team** and the proportion of the firm's **equity** held by the founder. The size of the **founding team**, as a reflection of entrepreneurial team size (Deligianni et al. 2017), is expected to influence how resources are managed and accumulated, and therefore may impact on decision-making and hence firm performance. For example, larger teams may comprise more diverse competences and therefore be better equipped to perform tasks and to manage the work load (Pinkwart and Proksch 2013). Additionally, this control variable has been considered in previous effectuation research (e.g., Laskovaia et al. 2017).

The proportion of the firm's **equity** held by the founder reflects the level of involvement in the firm's management and decision-making processes. Previous research has suggested that the percentage held in venture equity may be a signal of the founder's incentives and power to enhance organizational performance (Ucbasaran et al. 2003), as ownership control influences the attribution of management roles in the firm (Nelson 2003). We may expect thus that founder's proportion in venture equity influences decision-making, and hence performance.

To test differences between **experts** and **novices** in the proposed model, we split the sample into two groups, according to previous start-up experience—that is, whether the individual had participated previously in founding a business (drawn from a question in the survey). As previous start-up founding experience involves considerable time commitment, extensive practice and total immersion in entrepreneurial tasks (Read and

Sarasvathy 2005; Dew et al. 2009), it is a good parallel for expertise in the entrepreneurship domain. Therefore, this measure constitutes a valid proxy for our study purposes. Moreover, previous studies have used this approach to distinguish between expert and novice entrepreneurs (e.g., Capelleras et al. 2018; Estrin et al. 2013), and specifically in effectuation research (e.g., Johansson and McKelvie 2012; Cai et al. 2017).

4. Analysis and results

Prior to testing our measurement and structural models, we performed exploratory factor analysis to guarantee the scales' dimensionality for our variables *Performance*, *Effectuation*, *Causation*, and *Resources* using the Varimax rotation method with Kaiser's Normalization. To ensure that the data were appropriate for this analysis, we first performed statistical tests, including Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measures to assess sampling adequacy. For Bartlett's test of sphericity, the level of significance obtained was 0.00 for each of the variables. The measure of sampling adequacy was also above the limit required (0.5) (Hair et al. 2006). The exploratory factor analyses revealed the unidimensionality of the scales for performance, causation, and resources, confirming that all the corresponding items explain a single construct (Hair et al. 2006). As expected, we observed the existence of four underlying factors in the effectuation scale, a finding consistent with other studies that have confirmed the multidimensionality of this construct (Chandler et al. 2011; Mthanti and Urban 2014).

We tested the proposed model by using the variance-based SEM technique and the partial least squares (PLS) estimation method with the statistical software package SmartPLS 3 (Ringle et al. 2015). PLS is highly appropriate for our research purposes due to the relatively small sample considered and the specification of the second-order constructs as formative, which prevents us from evaluating the model using the covariance-based SEM technique (Benítez-Amado et al. 2015; Wang et al. 2015). The model was analyzed and interpreted in two stages, first assessing the reliability and validity of the measurement model and then evaluating the structural model. This sequence ensured that the constructs' measures were valid and reliable before attempting to draw conclusions regarding relationships among constructs (Barclay et al. 1995).

4.1 Measurement model evaluation

Since our model contains both reflective and formative constructs, we had to treat them differently. Traditional assessments of validity and reliability (Cronbach's alpha, composite reliability [CR], and average variance extracted [AVE]) apply well to reflective constructs, but not to formative ones. For the formative constructs, we

assessed not only content validity (as in the reflective approaches) but also multi-collinearity, weights, and significance level, as well as loadings and their level of significance for our constructs (Petter et al. 2007). For effectuation, a formative second-order construct, we applied this procedure over the four dimensions. We performed a bootstrap analysis with 5000 subsamples to obtain the significance level of the indicator loadings, dimension weights and loadings, and beta coefficients, as recommended in Hair et al. (2014).

These analyses show that our reflective constructs (effectuation sub-dimensions, causation, resources, and performance) achieve satisfactory values (Hair et al. 2014), confirming the scales' reliability, convergent validity, and discriminant validity (see Tables 1a, 1d, 1e, and 1f). We assess indicator reliability by checking the outer loadings. Indicators with loadings below 0.40 should always be eliminated from reflective scales (Hair et al. 2014). Accordingly, five indicators were excluded (see Tables 1a and 1d), which additionally was considered to not undermine the content validity of the corresponding constructs. Some authors have found similar problems dealing with these scales (e.g., Smolka et al. 2016). For convergent validity, we examine the AVE, which are above the recommended value of 0.5 for every construct. Finally, discriminant validity is assessed by the Fornell-Larcker criterion (Fornell and Larcker 1981), according to which the square root of the AVE of each construct should be higher than its highest correlation with any other construct (see Tables 1b and 1g). To complete assessment of discriminant validity, when observing outer loadings the indicators exhibit a stronger association with their own constructs than with the other latent variables (Hair et al. 2014).

Validation of the formative construct (effectuation at the second-order level) shows that multi-collinearity, weights, and loadings all present good measurement properties (Table 1c). First, there is no problem of multi-collinearity, as the variance inflation factors (VIFs) of the dimensions are far below 10 (Petter et al. 2007). Second, all the weights and loadings are significant at 0.01 level or lower (Hair et al. 2014). Overall, the results of these analyses show that the proposed model has good measurement properties.

The descriptive statistics and correlations of the study variables reported in Table 2 show a significant positive correlation between effectuation and causation ($r=0.42$; $p<0.01$). This result is in line with previous literature pointing out that both decision-making logics are neither independent nor opposites (Smolka et al. 2016). Recent studies in this field argue that effectuation and causation are not exclusive logics, that is, both can be used at the same time, although the use of one or the other may vary over time (Reymen et al. 2015, 2017; Sarasvathy 2008; Dew et al. 2009). Moreover, optimal decisions may result from a combination of the two types of logic (Reymen et al. 2015; Brinckmann et al. 2010).

Table 1a. Measurement model evaluation at first-order level: Effectuation

Construct/indicator	Loading	p-value	Cronbach's Alpha	CR	AVE
EXPERIMENTATION			0.681	0.800	0.580
E1. We experimented with different products and/or business models.	0.706	0.000			
E2. The product/service that we now provide is essentially the same as originally conceptualized.	Dropped	Dropped			
E3. The product/service that we now provide is substantially different than we first imagined.	0.602	0.003			
E4. We tried a number of different approaches until we found a business model that worked.	0.938	0.000			
AFFORDABLE LOSS			0.627	0.802	0.576
AL1. We were careful not to commit more resources than we could afford to lose.	0.766	0.000			
AL2. We were careful not to risk more money than we were willing to lose with our initial idea.	0.849	0.000			
AL3. We were careful not to risk so much money that the company would be in real trouble financially if things didn't work out.	0.926	0.000			
FLEXIBILITY			0.829	0.885	0.722
F1. We allowed the business to evolve as opportunities emerged.	0.769	0.000			
F2. We adapted what we were doing to the resources we had.	Dropped	Dropped			
F3. We were flexible and took advantage of opportunities as they arose.	0.835	0.000			
F4. We avoided courses of action that restricted our flexibility and adaptability.	0.663	0.000			
PRE-COMMITMENTS			0.745	0.886	0.795
A1. We used a substantial number of agreements with customers, suppliers and other organizations and people to reduce the amount of uncertainty.	0.867	0.000			
A2. We used pre-commitments from customers and suppliers as often as possible.	0.916	0.000			

Table 1b. Discriminant validity for reflective dimensions of effectuation

	Affordable loss	Experimentation	Flexibility	Pre-Commitments
Affordable loss	0.849			
Experimentation	0.018	0.762		
Flexibility	0.210	0.097	0.759	
Pre-Commitments	0.150	0.303	0.246	0.892

Table 1c. Measurement model evaluation at second-order level: Effectuation (formative construct)

Construct/indicator	VIF	Outer Weights	p-value	Outer Loadings	p-value
EXPERIMENTATION	1.112	0.260	0.005	0.460	0.000
AFFORDABLE LOSS	1.042	0.377	0.000	0.525	0.000
FLEXIBILITY	1.106	0.496	0.000	0.715	0.000
PRE-COMMITMENTS	1.187	0.459	0.000	0.714	0.000

Table 1d. Measurement model evaluation: Causation (reflective construct)

Indicator	Outer Loadings	p-value	Cronbach's Alpha	CR	AVE
Causation			0.691	0.809	0.517
C1. We analyzed long run opportunities and selected what we thought would provide the best returns.	Dropped	Dropped			
C2. We developed a strategy to best take advantage of resources and capabilities.	0.789	0.000			
C3. We designed and planned business strategies.	0.773	0.000			
C4. We organized and implemented control processes to make sure we met objectives.	Dropped	Dropped			
C5. We researched and selected target markets and did meaningful competitive analysis.	Dropped	Dropped			
C6. We had a clear and consistent vision for where we wanted to end up.	0.634	0.000			
C7. We designed and planned production and marketing efforts.	0.667	0.000			

Table 1e. Measurement model evaluation: Resources (reflective construct)

Indicator	Outer Loadings	p-value	Cronbach's Alpha	CR	AVE
Resources			0.636	0.802	0.579
R1. We had sufficient financial resources to undertake new projects.	0.746	0.000			
R2. We had sufficient human resources to undertake new projects.	0.779	0.000			
R3. We had sufficient capacity in technological support/technical infrastructures to undertake new projects.	0.758	0.000			

Table 1f. Measurement model evaluation: Performance (reflective construct)

Indicator	Outer Loadings	p-value	Cronbach's Alpha	CR	AVE
Performance			0.791	0.856	0.549
Level of achievement in:					
Performance 1. Return on investment.	0.744	0.000			
Performance 2. Return on equity.	0.583	0.000			
Performance 3. Customer growth.	0.818	0.000			
Performance 4. Sales growth.	0.797	0.000			

Performance 5. Employment growth.	0.738	0.000
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Table 1g. Discriminant validity for reflective constructs (performance, resources and causation)

	Performance	Resources	Causation
Performance	0.740		
Resources	0.485	0.761	
Causation	0.355	0.288	0.719

Table 2. Descriptive statistics and correlation matrix

Variable	Mean	S.d.	1	2	3	4	5	6	7
1. Performance	3.38	0.81							
2. Firm age	3.94	0.95	-0.07						
3. Firm size	5.66	12.96	0.13	-0.01					
4. % equity	52.69	29.69	-0.07	0.06	-0.07				
5. Founding team	2.70	2.24	0.02	-0.01	-0.09	-0.48**			
6. Effectuation	3.73	0.58	0.35**	-0.04	0.13	-0.08	0.06		
7. Causation	4.03	0.68	0.30**	-0.02	0.09	-0.16*	0.08	0.42**	
8. Resources	3.54	0.88	0.47**	-0.01	0.03	-0.15*	0.06	0.28**	0.27**

* $p < 0.05$. ** $p < 0.01$. N=178

4.2 Test of hypotheses

As explained in the hypotheses development section, we find strong arguments to expect differences in the relationships of the proposed structural model, depending on whether or not the individual has previous entrepreneurial experience. We split the sample into two groups (novices and experts) and test the hypothesized relationships separately for the two subsamples, to best determine how entrepreneurial experience shapes the relationships of effectuation and causation with new venture performance, and their interactions with resource availability.

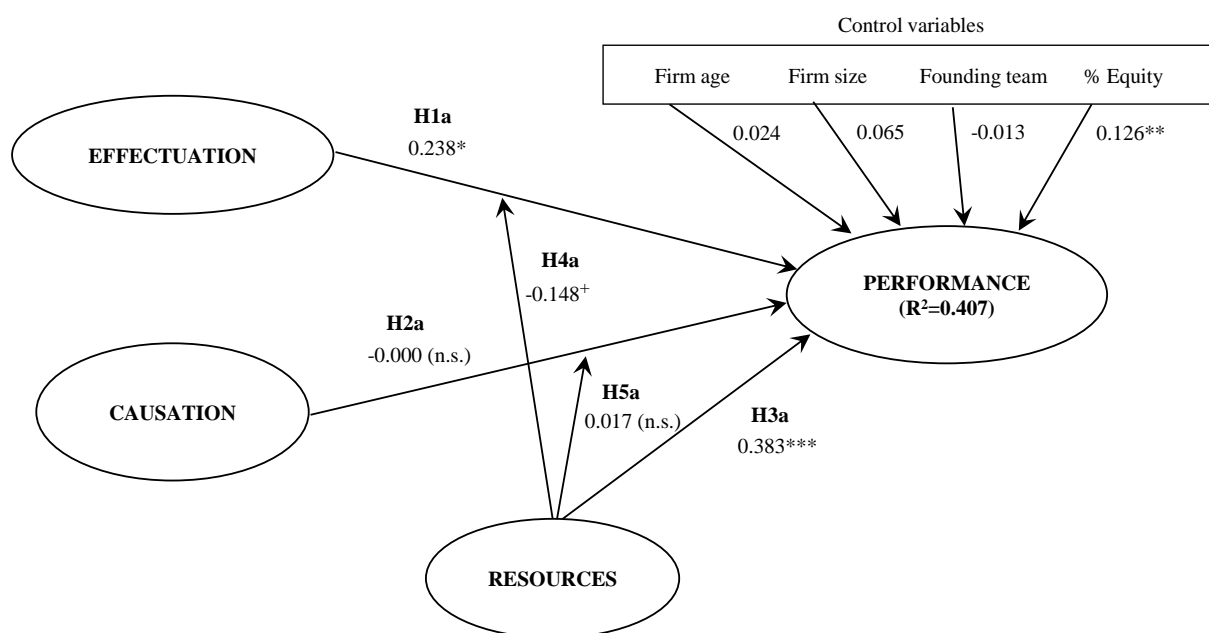
In Figures 2a and 2b we show the results of the hypothesis testing for novices ($n = 108$) and for experts ($n = 68$), respectively. For the purpose of results display, we distinguish between hypotheses H1a to H5a for novices and H1b to H5b for experts (see Figures 2a and 2b). Path coefficients, significance level and R^2 are displayed in the figures.

Based on the results we can confirm a positive and statistically significant influence of effectuation on the performance of NTBFs, both for novices ($\beta = 0.238$, $p < 0.05$) and for experts ($\beta = 0.268$, $p < 0.001$). We thus confirm H1 for both groups. We also find a positive relationship between causation and performance in businesses with expert founders only ($\beta = 0.245$, $p < 0.05$). This result leads us to accept H2 for experts and reject it for novices. We confirm H3 for novice founders only ($\beta = 0.383$, $p < 0.001$).

As for the moderating relationships hypothesized (H4 and H5), our results show that the interaction effect between causation and resource availability on performance is positive and significant in new ventures with expert founders ($\beta = 0.303, p < 0.01$). For novices, the interaction effect between effectuation and resources is close to significant ($\beta = -0.148, p < 0.1$). The results for the control variables indicate that only the founder's proportion of shareholder equity has a significant effect on performance in firms founded by novices ($\beta = 0.126, p < 0.01$), whereas only firm size appears to be significant in experts' new ventures ($\beta = 0.264, p < 0.01$).

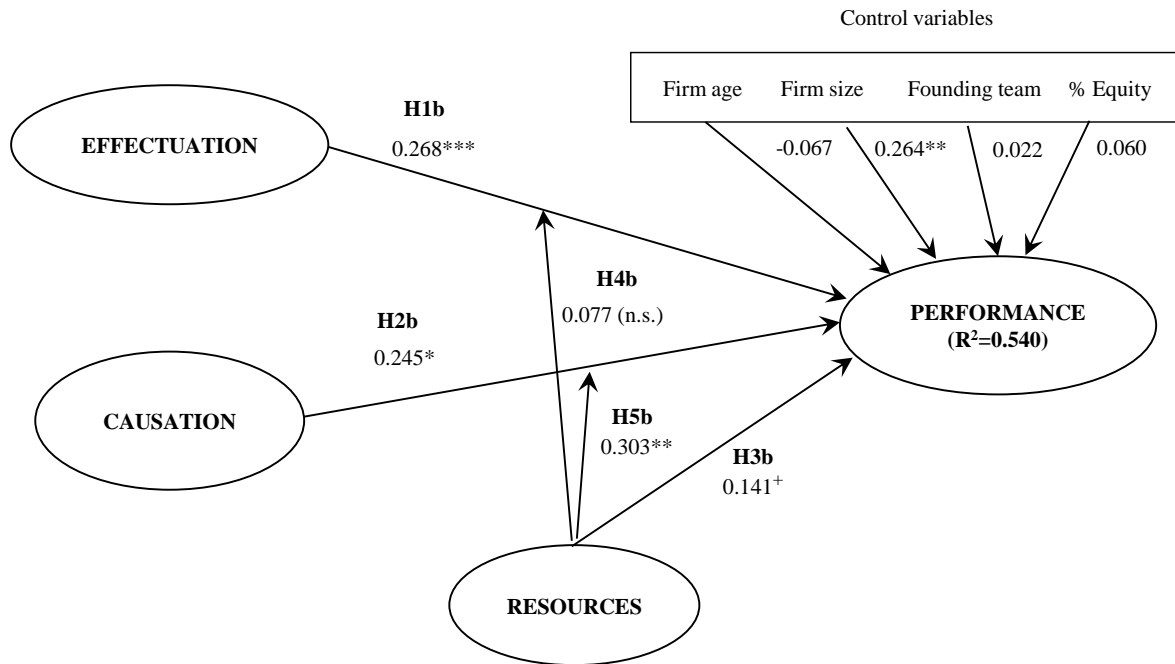
In assessing model fit through PLS analysis, the path coefficients, their level of significance, the R^2 values, and the effect size (f^2) measure the explanatory power and structural quality of the model appropriately (Chin 2010). Path coefficients of around 0.2 are considered economically significant (Benítez-Amado and Ray 2012). The R^2 value for performance is 0.407 in the model for novice founders and 0.540 in the model for expert founders, showing satisfactory explanatory power. The f^2 values, which provide the relative size of each incremental effect/link introduced in the model, are near the recommended limits for the key constructs (following Leal-Rodríguez et al. [2014], the limits for weak, medium, and large effect size are 0.02, 0.15, and 0.35, respectively). For novices, the f^2 values for effectuation, resources, and the interaction effect are 0.06, 0.19 and 0.03, respectively. For expert founders, the f^2 values for effectuation, causation, and the interaction between them are 0.11, 0.10, and 0.15, respectively. Joint interpretation of the foregoing goodness of fit indicators suggests that the proposed model has good overall explanatory power and satisfactory structural properties.

Figure 2a. Results for novice entrepreneurs (n=108)



⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2b. Results for expert entrepreneurs (n=68)



⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In addition, we tested for robustness in our inter-group comparison by conducting a *post hoc* multi-group analysis, in order to evaluate whether statistically significant differences exist between experts and novices for the effects in the proposed model (Table 3). This analysis allows us to test for significant differences in group-specific parameter estimates, mainly path coefficients. To do so, we perform Henseler's multi-group analysis (Henseler et al. 2009). This approach builds on bootstrap outputs generated by SmartPLS (Ringle et al. 2015), and so there is no symmetric distributional assumption (Sarstedt et al. 2011). This implies the necessity to apply a one-side test to reveal any significant difference in the group-specific path coefficients (Sarstedt et al. 2011). A result is considered significant at 5% if the p-value (p_{Henseler}) is smaller than 0.05 or larger than 0.95¹.

¹ Please see: <https://www.smartpls.com/documentation/algorithms-and-techniques/multigroup-analysis>

Table 3. Multi-group comparison test results

Relationship	Novices (N=108)	Experts (N=68)	<i>p</i> Henseler	Is the difference in path coefficients significant?
Effectuation → Performance	0.238*	0.268***	0,584	Not significant
Causation → Performance	-0.000	0.245*	0,971	Significant (p < 0.05)
Resources → Performance	0.383***	0.141 ⁺	0,046	Significant (p < 0.05)
Interaction effect between Resources and Effectuation on Performance	-0.148 ⁺	0.077	0,940	Not significant
Interaction effect between Resources and Causation on Performance	0.017	0.303**	0,980	Significant (p < 0.05)
R²	0.407	0.540		

⁺ $p < 0.10$. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

Based on the results of the *post hoc* multi-group analysis (Table 3), we find three statistically significant differences between the two groups. First, our results show that the relationship between causation and performance is significantly different for experts and novices, with an absence of effect in the latter, which is contrary to what we expected (H6b). This suggests that causal logic may be a more effective recipe for high performance in firms founded by expert rather than novice entrepreneurs. In contrast, the slight difference between groups of the significant impact of effectuation on performance is not statistically significant, and therefore H6a is not supported. This result reinforces the idea of the relevance of effectual strategies for performance improvements, irrespective of the level of entrepreneurial experience. Second, the difference between novices and experts regarding the impact of resource availability on performance is significant, such that higher level of resources seems to be a more relevant determinant for the performance of novices' new ventures in comparison with experts. This result leads us to reject H6c. The third significant difference concerns the moderating effect of resources on the relationship between causation and performance. Resource availability appears as a positive contingency for better performance when applying a causal logic in decision-making in the case of new ventures led by experts, in contrast with the absence of any such effect for novices. This result partially confirms H6d. However, we do not find any statistical support for the expected stronger moderating effect of resource availability on the relationship between effectuation and new venture performance for expert entrepreneurs.

It should be noted that the difference between groups regarding the interaction effect on performance of effectuation and resource availability is quasi significant (at the 10% level). However, the similarly low level of significance for this effect in novices ($\beta = -0.148$, $p < 0.1$) prevents us from drawing conclusions.

5. Discussion, limitations and future research

The entrepreneurship literature has analyzed the effect of causal and effectual logics on new venture performance (Smolka et al. 2016; Laskovaia et al. 2017; An et al. 2019) but most such studies have not examined these logics while differentiating between novice and expert entrepreneurs. Two exceptions are the studies by Read et al. (2009) and Dew et al. (2009), which analyze this phenomenon in a sample of MBA students and expert entrepreneurs to determine the drivers of the use of a specific logic. Our study contributes to this literature by analyzing the effect of causal and effectual logics on new venture performance based on the entrepreneur's previous experience in the context of European high-technology firms. Our findings contribute to prior literature on entrepreneurship and effectuation in several ways.

First, McKelvie et al. (2019) call for the need to investigate the impact of effectuation on the organization. We respond to this call by establishing conceptual and empirical relationships of effectuation and causation with respect to new venture performance. Our results confirm that effectuation has a positive and direct influence on performance in the context of NTBFs, both for expert and for novice founders. This result is consistent with prior studies that show the effectiveness of effectuation in new venture performance (e.g., Read et al. 2009; Cai et al. 2017; Smolka et al. 2016; Laskovaia et al. 2017; Deligianni et al. 2017; An et al. 2019). However, for causation we find a positive relationship with performance only for expert founders, and not for novices. This finding contrasts with previous arguments, suggesting there is a tendency for novices to follow more causal principles when starting a business, while experts seem to rely more on effectual strategies (Read and Sarasvathy 2005; Dew et al. 2009; Gabrielsson 2011). This implies that the tendency to use more one thinking logic or another is not directly related with their effect on firm performance, and that this effect may be conditioned by multiple factors. A plausible explanation for this result may be found in the industry context of this study. On the one hand, in dynamic environments such as high-technology sectors, experienced entrepreneurs may tend to rely on tools they know very well, such as business planning, to rapidly enhance venture legitimacy (Delmar and Shane 2004). Additionally, entrepreneurs' experience is the result of decisions made, as well as observed and understood outcomes (Nelson 2012); this underlines the importance of learning

from failures and successes (Minniti and Bygrave 2001). The experience gained from learning may lead expert entrepreneurs to develop action plans using causation to achieve better performance in rapidly changing environments.

On the other hand, this environmental dynamism may impel inexperienced, novice entrepreneurs toward effectual decision-making to make the most of rapid changes (for example, in terms of flexibility and experimentation) in order to identify and exploit constantly emerging opportunities. Another explanation could be that novice entrepreneurs are already in the process of developing a business (the current one), and therefore are rapidly becoming experts, particularly in a fast-changing sector that forces quick learning. Experience is continuously being built up through actions, choices exercised and results observed, as part of a learning process by being in business (Minniti and Bygrave 2001). Future research needs to find better measures to conceptualize levels of entrepreneurship experience to avoid the potential effects of confounding expertise acquired through a complete entrepreneurial experience in the past with the possible insights gained from expertise accumulated by creation and management of the new current business.

Our second contribution to the entrepreneurship literature is to highlight the importance of resources and their interaction with entrepreneurial experience when creating a business (Read and Sarasvathy 2005; Alsos et al. 2019). We examine both the direct role of resource availability as well as its contingent effect on the relationships of effectuation and causation to new venture performance, both for expert and for novice entrepreneurs. First, we find a direct and positive effect of resource availability on firm performance only when the founder has no previous entrepreneurial experience, as it seems to have no relevant effect for expert entrepreneurs. Since this result can be explained by the importance of resources for novices when the resource of accumulated knowledge is scarce, our results confirm that resource availability has more impact on performance in the case of novice entrepreneurs than in that of experts. However, different types of resources require different forms of management; moreover, experiential learning varies according to the nature of the resource (Mannor et al. 2016). This suggests new avenues for future research, pointing at the interest in considering the distinct role of different resources in order to be able to give more nuanced conclusions about the role of resource availability in explaining new venture performance, and its interaction with entrepreneurial experience.

In addition, our study provides evidence about how resource availability moderates the connections of effectuation and causation to performance. Our results indicate a moderating effect of resource availability on the relationship between causation and new venture performance in firms founded by experts, but not those founded by novices. This result is in line with previous studies in the strategic literature which argue that

incentives to innovate decrease in the presence of higher levels of resources (Nohria and Gulati 1997). As resource availability grows, experts tend to commit available resources more to established plans and objectives (causal rationale) than to experimentation and innovation (effectual rationale), perhaps as a way to exploit relevant resources rationally and thus achieve better results in a rapidly changing environment. Related to this, it has been previously argued that causal strategies such as business planning favor firm development, by ensuring an efficient use of available resources (Delmar and Shane 2003). In the light of this finding, it may be interesting for expert entrepreneurs to consider applying causal principles when making decisions, since this approach can promote the best use of available resources and enhance the firm's performance.

Our results also show that the interaction between effectuation and availability of resources is non-significant for expert entrepreneurs. This outcome is in line with the proposition of Read and Sarasvathy (2005) that resource availability does not affect the use of highly effectual action in the case of expert entrepreneurs. In the case of novices, contrary to our expectations, we find that the interaction between effectuation and resources is negative and slightly significant. A general explanation for this unexpected result is that the role of resource availability in performance differs depending on entrepreneurial expertise and the combination of this expertise with decision-making logic. Another potential explanation is that novices make worse use of the resources at their disposal when deploying them effectually than when they are applied according to a predetermined plan. In our case, the novice entrepreneurs' operation in an extremely uncertain context led them to attempt to exploit opportunities through innovation and experimentation. In seeking to benefit from opportunities before they disappeared, so as to obtain future financial rewards, these entrepreneurs may have been less worried about present performance. Future studies are required to shed light on this issue, possibly by exploring the effect of the four dimensions of effectuation separately in their interplay with resources.

Our research methodology has several limitations. First, since this study is based on cross-sectional data, the results should be analyzed prudently, as no firm conclusions can be drawn about the direction of causality among the variables studied. It would be interesting for future research to address this deficiency through longitudinal studies, examining these variables over different periods. Longitudinal studies could also detect variations in behavior over time. Some authors suggest that entrepreneurs use effectual approaches when starting a new venture but may rely on more causal approaches once the firm is established (Sarasvathy 2008; Alsos et al. 2016). Further studies could also explore the dynamic relationship between effectual and causal behaviors and firm performance over time. As the accumulation of resources is time dependent (Paeleman and Vanacker 2015), it would also be interesting to examine how changes in resource availability influence decision making,

and their interactions in explaining performance over time. Second, we recognize that using mainly primary data to undertake our analysis is a limitation. Future research should combine primary and secondary sources to obtain a more complete picture of this phenomenon. Third, our study is limited by the European context, our small sample size as well as the specificity of the sector considered. As key organizational differences (i.e., resources, organizational structure, number of employees, and total revenues) may exist between European and U.S./Asian technological firms, as well as between different industries within the same country, future research should explore whether our results can be extended, by means of comparisons between European and U.S./Asian data, or by exploring differences between different industries.

We hope that the present study opens avenues to advance future empirical research on effectuation and contributes to the application of effectuation as a valid logic for other strategic issues in entrepreneurship research beyond venture creation, such as the management of new firms' survival and growth.

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