



Board feminization and innovation through corporate venture capital investments: the moderating effects of independence and management skills

Ramzi Benkraiem, Sabri Boubaker, Souad Brinette, Sabrina Khemiri

► To cite this version:

Ramzi Benkraiem, Sabri Boubaker, Souad Brinette, Sabrina Khemiri. Board feminization and innovation through corporate venture capital investments: the moderating effects of independence and management skills. *Technological Forecasting and Social Change*, 2021, 163, pp.120467. 10.1016/j.techfore.2020.120467 . hal-03018707

HAL Id: hal-03018707

<https://hal.science/hal-03018707>

Submitted on 3 Feb 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

**Board Feminization and Innovation through Corporate Venture Capital Investments:
The Moderating Effects of Independence and Management Skills**

Ramzi BENKRAIEM, Ph.D.

Audencia Business School, France

Email: rbenkraiem@audencia.com

Sabri BOUBAKER, Ph.D.

EM Normandie Business School, Paris &

IRG, Université Paris Est Créteil, France

Email: sboubaker@em-normandie.fr

Souad BRINETTE, Ph.D.

OCRE, EDC Paris Business School, France

Email: souad.brinette@edcparis.edu

Sabrina KHEMIRI, Ph.D.

Paris-Saclay University, Evry Univ, IMT-BS, LITEM, 91025, Evry-Courcouronnes, France.

Email: sabrina.khemiri@imt-bs.eu

Author Biographies:

Ramzi BENKRAIEM is a Full Professor at Audencia Business School in France. He Holds a PhD from Toulouse Graduate School of Management and an HDR (State Habilitation for supervising Doctoral Research) from Western Brittany University. His research interests lie mainly within the Economics, Accounting and Finance areas. He published several papers in both French and international peer-reviewed journals.

Sabri BOUBAKER is a Full Professor of Finance at EM Normandie Business School, Paris and Research Fellow at the Institut de Recherche en Gestion (University of Paris Est). He holds a Ph.D. in Finance from University of Paris Est (2006) and a HDR degree (Habilitation for Supervising Doctoral Research) in 2010 from the same university. He has recently published many academic papers in international refereed journals. He is the co-founder of the Paris Financial Management Conference.

Souad BRINETTE is an Associate Professor at the OCRE, EDC Paris Business School, France. She holds a PhD in Finance in 2009 from the IAE of Aix-en-Provence, Aix-Marseille University. Her research interests include entrepreneurial finance, corporate finance, capital structure, corporate governance and intrapreneurship. She is an Associate Professor at the EDC Paris Business School since 2011, where she teaches and coordinates Finance and accounting courses.

Sabrina KHEMIRI is an Associate Professor at the Paris-Saclay University, IMT Business School, France. She holds her PhD in Business Administration in 2009 from the IAE of Aix-en-Provence, Aix-Marseille University. Her research interests include financing choice, private equity, corporate venture capital and governance. She is an Associate Professor at the Paris-Saclay University, IMT Business School since 2020 where she teaches financial strategies and finance courses.

Author statement:

Souad BRINETTE: Conceptualization, Methodology, Software. **Sabrina KHEMIRI:** Data curation, Software, Validation, Visualization, Investigation. **Ramzi BENKRAIEM:** Writing-Original draft preparation. **Sabri BOUBAKER:** Supervision, Writing- Reviewing and Editing.

Highlights:

- ✓ We investigate the relationship between board feminization and corporate venture capital (CVC) investments
- ✓ We stress the importance of the moderating effects of independence and management skills on this relationship
- ✓ Female independent directors impede CVC investments
- ✓ Female directors with management backgrounds enhance such investments
- ✓ The study findings enrich the debate on the usefulness of CVC investments as innovation vehicles

Board Feminization and Innovation through Corporate Venture Capital Investments: The Moderating Effects of Independence and Management Skills

Abstract: The purpose of this paper is to investigate the relationship between board feminization and innovation through corporate venture capital (CVC) investments, as well as the moderating effects on this relationship of independence and management skills. This study relies on a set of unique data to measure CVC activity for all French-listed companies that undertook a CVC strategy between 2000 and 2018. We found that the appointment of female independent directors impeded CVC investments, whereas the appointment of female directors with management backgrounds enhanced such investments. Our findings are robust to alternative measures of board feminization. Overall, our results enrich the debate on the usefulness of these innovation vehicles for the French economy.

Keywords: Board attributes; Feminization; Innovation; Financing; Corporate venture capital investments.

1. Introduction

Board feminization and its impact on outcomes have attracted increasing attention, both in the media and in the literature (Poletti-Hughes & Briano-Turrent, 2019; Ibarra, 2012; Merchant, 2011). The specificities of boards are essential. Board diversity regarding gender has become a government concern around the world. Indeed, many proposals for governance reform explicitly enforce quotas for women on corporate boards. In France, since its enactment in 2011, the law on the balanced representation of women and men on corporate and supervisory boards, known as the “Copé-Zimmermann Act”, has set a mandatory quota of 40% of the under-represented gender on corporate boards as of January 1, 2017, in listed companies and in companies with more than 500 permanent employees and a turnover of more than € 50 million. The sanctions imposed in the event of non-compliance with the law involve, on the one hand, the nullification of appointments that do not comply with the objective of parity, and, on the other, the suspension of the payment of directors’ attendance fees. The “Copé-Zimmermann Act” has created a dynamic of the feminization of corporate and supervisory boards. An increase of women on corporate boards of more than 50% has been observed between 2013 and 2016. On average, the boards of SBF 120 companies now include five women each, corresponding to a rate of feminization of about 38% in 2016.¹ Hence, in academic research, the feminization of boards has recently received much attention. Studies focusing on board feminization have examined whether women’s presence on corporate boards has an impact on a firm’s corporate governance (Adams & Ferreira, 2009), performance (Mahadeo et al., 2012; Campbell & Minguez-Vera, 2008; Carter et al., 2003; Dang & Nguyen, 2016; Ahern & Dittmar, 2012; Apesteguia et al., 2012; Adams & Ferreira, 2009), strategic behavior such as mergers and acquisitions (Chen et al., 2016), and innovative investments (Galia & Zenou, 2013; Balsmeier et al., 2014).

¹ Special Company Newspaper. Saturday, September 17, 2016. Number 70.

However, despite the large number of academic works on board feminization, to the best of our knowledge, no study has yet attempted to examine the impact of the gender diversity on corporate venture capital (CVC) investments. CVC is one form of corporate entrepreneurship, conducted outside the corporates, which consists of creating funds to invest in innovative start-ups. CVC is used by large corporations as a tool for corporate development (Reichardt & Weber, 2006). Generally, CVC is defined as firms taking risks and being proactive and innovative, as shown by their investments in start-ups (Noyes et al., 2014; Covin & Miles, 2007). The importance of innovation has been widely recognized in the literature since the pioneering studies of Schumpeter. Innovation allows firms to achieve and extend a competitive advantage (Hitt et al., 1997; Ferreira, 2010), expand market share, and increase their performance (Franko, 1989; Miller & Triana, 2009; Torchia et al., 2011). Increased global competition and rapid technological change have made the permanent renewal of sources of competitive advantages necessary, forcing businesses to innovate (Hamouti et al., 2014; Del Giudice et al. 2019). In such a context, partnerships, strategic alliances, and cooperation agreements allow firms to have access to new technologies and hence acquire new competitive advantages (Narula, 2002; Oxley & Sampson, 2004; Bahri Korbi & Said, 2016; Ferraris et al., 2019). Lerner (2012) has revealed that CVC is the best way to motivate innovation, since it is a “hybrid” model program that combines features of corporate research laboratories and venture-backed start-ups “within a powerful system that consistently and efficiently produces new ideas”. Besides, Chemmanur et al. (2014) has highlighted that conventional vehicles for joint ventures are less innovative than the hybrid model.

In recent years, CVC commitments have grown substantially around the world and in France in particular. According to the French Association of Investors for Growth, funds raised from industrial companies witnessed a sharp rise from 32 million euros in 2008 to 289 million euros in 2013, with 89% of this amount originating from French companies. French industrialists have shown genuine enthusiasm for investment funds in start-ups. Notably, 2015 marked a year of clear

acceleration of commitments in venture capital by large groups. In 2016, investment in CVC reached 2.7 billion euros in comparison to 1.5 billion euros in 2015.² In response to the ongoing growth in the popularity of CVC, research on this topic is gaining more attention. Several studies have investigated the determinants of this strategy. This broad array of research has shown that CVC strategies are influenced by the strength of corporate-specific resources, performance, the availability of resources, and low levels of indebtedness (Brinette & Khemiri, 2019), as well as by the corporate network through interlocking boards (Noyes et al., 2014) and industry conditions (Basu et al., 2011; Dushnitsky & Shaver, 2009). Despite the role of female directors in decision-making (Elstad & Ladegard, 2012; Pathan & Faff, 2013; Chen et al., 2016), the link between board feminization and CVC investments has not been studied, as investing in CVC is time-consuming, expensive, and risky (Zahra and Covin, 1995). We believe that the decision to engage in CVC activity is not an easy one to make. Hence, we argue that the presence of women on boards will have an impact on CVC strategy.

Addressing this gap, the purpose of this paper is to extend knowledge of financing innovation by examining whether women's presence on corporate boards impacts CVC investments in France. More specifically, we investigated the moderating effects of independence and management skills on this relationship. We believe that the association between board feminization and CVC is influenced by these attributes because the composition or characteristics of a board of directors determines its power and control functions. Indeed, the board plays a crucial role in helping management develop and plan company strategies, as well as in establishing the overall development direction, mission, and vision that will achieve operating objectives (Zahra & Pearce, 1989).

Our findings revealed that female independent directors impeded CVC investments; conversely, female directors with management backgrounds enhanced such investments. We also

² Le Hub de Bpifrance (<http://www.bpifrance-lehub.fr>).

found that the decision to adopt a CVC strategy was influenced by the firm's characteristics and governance attributes.

Our study provides several important contributions for academics as well as professionals. First, we contribute to CVC research by highlighting insights related to the effect of board diversity on CVC investments. In particular, we aimed to empirically assess the effect of board feminization, taking into account both the disciplinary and cognitive role of boards on CVC investments. These corporate governance issues are indeed of great importance for managers and regulators. Second, start-ups and capital investment fund managers should be concerned about the determinants of CVC fund availability.

The remainder of the paper is organized as follows. In the following section, we review the literature. Section 3 describes the data used in the analysis as well as the empirical methodology. Section 4 summarizes the results. Section 5 is dedicated for robustness test. Section 6 concludes and suggests future research avenues.

2. Theoretical background and hypotheses

Theories of governance argue that the composition of a board plays an essential role in making strategic decisions. Research shows that women's presence on corporate boards affects the governance of companies in significant ways (Carter et al., 2003; Hermalin & Weisbach, 2003; Adams & Ferreira, 2007).

In this paper, we aim to explore the impact of board feminization on French CVC investments. We look at issues of board feminization with regard to the main approaches of governance: disciplinary and cognitive approaches.

From an agency perspective, the board plays a role in controlling corporate managers and directing strategic decisions. Agency theory helps elucidate how women's presence on corporate

boards affects CVC investments. This is the mainstream theory used in research on boards of directors (Zahra & Pearce, 1989; Johnson et al., 1996; Dalton et al., 2007). Among the functions performed by boards are monitoring and control functions (Fama & Jensen, 1983). Monitoring and control are more effective when the corporate boards are diversified and the directors are independent (Carter et al., 2003; Hermalin & Weisbach, 2003; Adams & Ferreira, 2007). Independent directors, as opposed to their dependent counterparts, are better able to control managers (Fama and Jensen, 1983; Baysinger and Butler, 1985).

The presence of women is considered favorable to the independence of the board. According to Carter et al. (2003), women directors are much less connected to managers than their male counterparts. Women are less likely to have rubbed shoulders with managers during their studies or previous professional lives (Singh et al., 2008). Gender diversity leads to an improvement in the control role in corporate boards (Daily et al., 1999) and consequently to a reduction in agency costs (Jurkus et al., 2011). Martini et al. (2012) have stressed that an excess of control and excessive attention to wealth protection for shareholders may impede the propensity for investments in innovation, since they are characterized by a high level of uncertainty. Given these considerations, and since investment in CVC is time-consuming, expensive, risky, and uncertain, we can maintain that the presence of female directors influences CVC investments.

From a cognitive approach, corporate boards are not limited to their control role. Boards must provide businesses with resources to cope with the competitive environment. Their composition is akin to assembling a crucial portfolio of resources (Hillman et al., 2002)—that is, the resources on which their business activities depend. We find this concept in resource dependency theory (Pfeffer, 1972; Pfeffer & Salancik, 1978). This theory suggests that a firm's survival in a competitive environment depends in part on its access to scarce resources. Resource scarcities lead firms to implement innovation strategies that require alternative resources (Pfeffer & Salancik, 1978; Sherer and Lee, 2002) and to establish relationships that enable the firms to access such

resources (Van Witteloostuijn & Boone, 2006). According to resource dependency theory, a firm's strategic actions are derived from its relative access to various types of resources, including financial, physical, intellectual, and social resources. Prior studies on corporate boards that have employed resource dependency theory have asserted that board size and composition allow firms to gain critical resources (Hillman et al., 2007; Pearce & Zahra, 1992; Pfeffer, 1972). In particular, Hillman et al. (2007) and Ward and Forker (2017) have argued that female directors contribute many benefits to boards: corporates that feminize their boards make better use of their resources, broaden the pool of talent and competencies, and avoid problems related to skills shortage. Huse (2009) has suggested that female and male directors differ with regard to experiences, which may lead to differing opinions on corporate strategies. Chen et al. (2016) have argued that the presence of females on corporate boards is associated with more thorough decision-making and a greater tendency toward completeness and active oversight in evaluating new projects. Thus, the duration of time devoted to decision-making is longer when corporate boards include more women. Moreover, Robinson and Dechant (1997) and Pathan and Faff (2013) have stressed the role of females on boards, maintaining that they tend to work hard and have good communication and cooperation skills, which in turn improves decision making. Board feminization provides firms with a competitive advantage, one which could be extended through innovation (Ferreira, 2010).

Building on resource dependency theory, corporates with greater female board representation are more likely to explore new developments and business opportunities by investing in start-ups. Female directors contribute to firm decisions (Elstad and Ladegard, 2012). Compared to male directors, female directors tend to have different educational and professional backgrounds (Bear et al., 2010). Poletti-Hughes and Briano-Turrent (2019) have argued that the presence of women on boards leads to more informed and strategic actions to identify better investment opportunities for the corporate. They concluded that the presence of women on corporate boards

provides the boards with resources that can enable them to identify the best approach to create value through CVC investments.

The preceding discussion shows that the relationship between board feminization and CVC strategy is ambiguous and therefore constitutes an empirical issue. We thus formulated the following non-directional hypothesis:

Hypothesis 1: There is a relationship between board feminization and CVC strategy.

In France, the feminization of boards of directors remains a relatively new practice of good governance. However, the independence of directors and their skills have been an important part of the AFEP-MEDEF code (2018) since its drafting in 1995. It would, therefore, be relevant to understand to what extent the independence and skills of female directors have an impact on decision-making and more specifically on CVC strategy.

2.1. Independence as a moderator of board feminization–CVC investment relationship

The main task of the board of directors is to advise on strategy formulation and decision-making (Holmstrom, 2005; Adams & Ferreira, 2007). Boards play a crucial role in monitoring executive management to ensure that managers act in shareholders' best interests (Fama, 1980; Fama & Jensen, 1983). Terjesen et al. (2016) have pointed out that previous research has unanimously confirmed that independent directors increase board transparency and monitoring. The proportion of internal or independent directors on the board has an impact on the strategic decisions made by the managers. These independent directors should thus support CVC activities.

However, previous research conducted on the effect of board independence on R&D activities, which are similar to CVC in several respects, has shown that this effect is not always explicit. Some authors have found a positive relationship (Boone et al., 2007, in the US market; Chung et al., 2003, in the Japanese market), while others have identified a negative relationship (Baysinger et al., 1991). These latter results are inconsistent with agency theory. This could be explained by the fact that independent directors exercise financial control (Baysinger &

Hoskisson, 1990). Indeed, independent directors obtain information mainly through financial statements, while inside directors possess inside information by participating in decision-making processes. In such a context, managers will prefer short-term investments over long-term investments (Zahra, 1996). On the other hand, the presence of internal directors on the board of directors is accompanied by a strategic type of control. As a result, they encourage managers to invest in R&D and develop the company's core business. As such, we expect the presence of independent directors on boards to be negatively related to CVC investments. If, in addition, the independent directors are women, then this impact will be accentuated. Indeed, greater female representation on boards enhances their independence (Terjesen et al., 2016). Given the previous arguments, we propose the following hypothesis:

Hypothesis 2: CVC investments decrease with the presence of independent female directors.

2.2. Management skills as a moderator of board feminization–CVC investment relationship

According to the AFEP-MEDEF code (2018), French-listed companies should mention the biography of each director. Indeed, each member's diploma constitutes important information, as it reflects his or her knowledge and skills. In particular, in France, the selection of directors seems to occur based on elite educational qualifications from highly selective, major French schools (Davoine & Ravasi, 2013). Among these schools, we mainly mention the “*Ecole Nationale d'administration*,” the “*Ecole Polytechnique*,” and “HEC.” In the French system, these schools are elitist and hierarchically arranged institutions that select their students based on an entrance examination (Albouy & Wanecq, 2003). According to Maclean et al. (2006), in France, 39% of the directors studied in these major Parisian schools. Alexandre-Bailly et al. (2010) have highlighted the role played by elitist schools in the building of management skills. These skills are an important factor in successfully developing an innovative idea. Leiponen (2005) and Mohnen and Röllen (2005) supported this idea on the firm level and industry level, respectively. Concerning female directors' skills, Nekhili and Gatfaoui (2013) have argued that boards benefit

from the female directors' experience and skills. The authors emphasized that having a background in business is an important selection criterion used by firms to appoint female directors. If this framework is supported, then we would expect that having more women on boards, together with their educational backgrounds in management, would contribute to enhancing CVC investments.

The preceding arguments culminate in the following hypothesis:

Hypothesis 3: CVC investments increase with the presence of women directors with an educational background in management.

3. Method

Our purpose was to examine the relationship between board feminization and CVC investments in the French context. Additionally, we investigated the moderating effects of independence and management skills on this relationship.

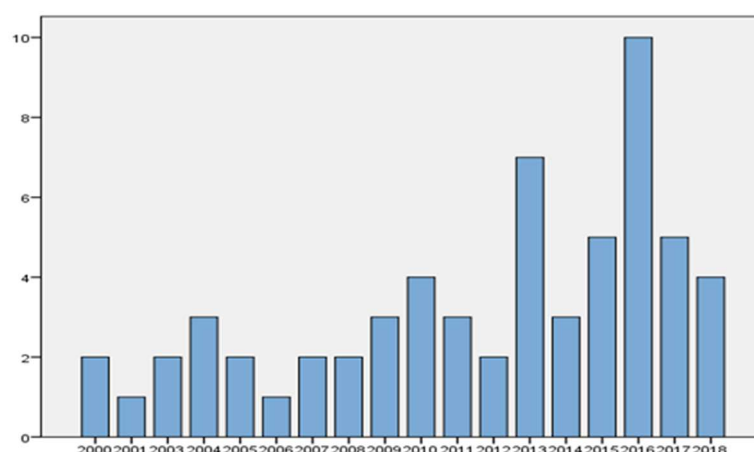
In this section, we detail methodological issues related to the identification of the dependent and explanatory variables as well as the empirical setting used to test the different hypotheses outlined above.

3.1. Sample

Our analysis focused on French firms that have made CVC investments. The data collection process covered the period from 2000 to 2018. We defined a firm as undertaking CVC if it had launched its own CVC fund or if it had joined one of the existing corporate funds. Based on this definition, we constructed a specifically collected dataset of CVC invested by French-listed companies (SBF 120 index). We compiled data from several sources, including annual reports of companies and multiple reports of different institutions and associations, all focusing on venture capital (Deloitte, Chausson Finance, and French Association of Investors for Growth). Overall, we

found that forty firms made CVC investments during the study period. Figure 1 depicts the annual distribution of CVC investments in terms of fund-creation or joining. One important period may be observed: the period stretching from 2013 to 2016. During this period, the CVC dynamic in France experienced significant growth. This may be explained by the tax-incentive scheme adopted by the French government in 2016, which was specifically aimed at reinforcing this type of strategy.

Figure 1. CVC strategy between 2000 and 2018



We selected our control sample from the SBF 120 index. In this way, our matching method respected firm size, measured by market capitalization, and location. The size and location criteria ensured that we could compare companies with similar operations in terms of scale, business model, and macroeconomic conditions. Further, we completed the matching procedure via two additional criteria: industry, to the extent possible, and period.

Hence, the dataset for our study comprised eighty firms: forty firms classified as having made CVC investments, and forty firms representing our control sample (firms that did not adopt a CVC strategy). The distribution of firms by business sector shows French firms that made CVC

investments belonged to different sectors. Table 1 illustrates this distribution according to the Industry Classification Benchmark used by Euronext.

Table 1. The distribution of firms by industry

Industry	Number	Percentage
Oil and Gas	4	10%
Basic Materials	3	7.50%
Industrials	13	32.50%
Consumer Goods	1	2.50%
Telecommunications	6	15%
Utilities	11	27.50%
Technology	2	5%
Total	40	100%

When a company runs several operations, these are considered to be independent; this is because funds created or joined in one year are different from those in the next year. Indeed, we considered the number of times a firm implemented a CVC strategy by creating or joining a corporate fund: 57.5% of the firms in our sample created or joined a fund only once during the study period, whereas 32.5% renewed the operation twice, and 10% renewed it three times over this same period. We allocated to each company that had created or joined a corporate fund a comparable firm that had never created or joined such funds in the same year. Consequently, the number of observations was related to the decision of whether to adopt a CVC strategy, not to the number of firms. Hence, our study was performed on a sample comprising 122 observations.

3.2. Econometric modeling

To infer the effect of board feminization on CVC investments, we applied two methods. First, we carried out a univariate analysis to compare the means of each independent variable, while also characterizing firms that decided to adopt CVC, as well as those that did not. Toward this end, we used lagged explanatory variables by one period, similar to previous studies (Zhang & Guan, 2018; Wu, 2017). This means that we calculated their values the year before the fund was created

or the year the firm joined an existing CVC fund. To check for the significance of the differences in means of each of our independent variables, we used mean t-tests for matched samples.

Second, to capture the relation between women's presence on boards and the decision to adopt a CVC strategy, we applied a multivariate logit model. This type of model is appropriate when the dependent variable is dichotomous and the independent variables are quantitative. To test the moderating effects of independence and management skills on the relationship between board feminization and CVC investments, we introduced interaction variables in our models.

Hence, we modeled the decision to adopt a CVC strategy as a function of a firm's board feminization, the cross effect of board independence and the percentage of women on the board, the cross effect of the background in management and the percentage of women on the board, and other control variables, as follows:

$$\begin{aligned} CVC\ STRATEGY_{i,t} = & \alpha_0 + \beta_1(WOCB_{i,t-1}) + \beta_2(INDEP_{i,t-1}) + \beta_3(EDUC.MGT_{i,t-1}) + \\ & \beta_4(WOCB_{i,t-1} \times INDEP_{i,t-1}) + \beta_5(WOCB_{i,t-1} \times EDUC.MGT_{i,t-1}) + \beta_6(BOARD.SIZE_{i,t-1}) + \\ & \beta_7(OWN.CONC_{i,t-1}) + \beta_8(MAJ.OWN_{i,t-1}) + \beta_9(FAM_{i,t-1}) + \beta_{10}(INSTIT_{i,t-1}) + \\ & \beta_{11}(DUA_{i,t-1}) + \beta_{12}(FEM.CEO_{i,t-1}) + \beta_{13}(FIRM.SIZE_{i,t-1}) + \beta_{14}(FIN.LEV_{i,t-1}) + \\ & \beta_{15}(ROE_{i,t-1}) + \beta_{16}(Q.TOBIN_{i,t-1}) + INDU + YEAR + \varepsilon_{i,t} \quad (1) \end{aligned}$$

The different variables are presented earlier, and $\varepsilon_{i,t}$ are the residuals that follow a logistic distribution. The probability that a firm would decide to adopt a CVC strategy was calculated as follows:

$$\Pr(CVC\ STRATEGY = 1) = \frac{e^Y}{e^Y + 1}, \text{ With } Y_i = \alpha + X' \beta + \varepsilon_i \quad (2)$$

Where X' is the vector of observations and β is the vector of coefficients. We assessed the significance of the estimated coefficients based on Wilcoxon z tests. Concerning the quality of our regressions, this was assessed by the pseudo R-squared and the likelihood ratios.

3.3. Variable selection

3.3.1. The dependent variable

We explored our previously mentioned research question by using the decision about whether to adopt a CVC strategy as the dependent variable. We dummy-coded this variable with a value of one (1) if the corporate had launched its own CVC fund or joined an existing one, and zero (0) otherwise.

3.3.2. The independent variables

Following previous studies, we operationalized women on corporate boards (WOCB) as the number of women on corporate boards (Bianco et al., 2015; Martini et al., 2012; Carter et al., 2003) and the proportion of women on corporate boards (Isidro & Sobral, 2015; Hafsi & Turgut, 2013; Chen et al., 2016; Al-Mamun et al., 2013; Martini et al., 2012; Adams & Ferreira, 2009). The variable board independence (denoted INDEP) was measured by the outside director ratio. The educational backgrounds considered in our analysis were proxied by the percentage of directors possessing a background in management (denoted EDU.MGT).

3.3.3. The control variables

In our estimations, we included several control variables. We controlled for specific characteristics of the board of directors, adding the following control variables: board size (denoted BOARD.SIZE and measured by the number of directors); ownership concentration (denoted OWN.CONC and measured by the percentage of shares held by the top three shareholders); majority shareholder ownership (denoted MAJ.OWN and proxied using a dummy variable that took the value of one [1] if one shareholder held more than 33.3%³ of shares, and zero [0] otherwise); family shareholder (denoted FAM and proxied by a dummy variable that took the value of one [1] if at least one shareholder was a family member, and zero [0] otherwise); shareholder which qualified as an institutional investor (denoted INSTI and proxied by a dummy variable that took the value of one if the major shareholder was an institutional investor, and zero

³ We considered that a majority shareholder holds more than 33.3% of shares. Calvi-Reveyron (2000) pointed out that the threshold of 33.3% corresponds to the blocking minority needed in the general assembly.

otherwise); duality (denoted DUA and proxied by a dummy variable that equaled one if the chair was also the CEO of the firm, and zero otherwise); female CEO (denoted FEM.CEO and proxied by a dummy variable that equaled one if the CEO was a woman, and zero otherwise); firm size (denoted FIRM.SIZE and proxied by the logarithm of total assets); financial leverage (denoted FIN.LEV and proxied by the debt ratio); profitability (denoted ROE and proxied by the return on equity ratio); and growth opportunities (denoted Q.TOBIN and proxied by the Q Tobin ratio). We also considered industry and calendar effects. The industry effects were considered by including industry dummies (denoted INDU). These variables took a value of one when the firm belonged to the sector in question, for each sector of the Industry Classification Benchmark (ICB), and zero otherwise. Finally, the calendar effects were considered by using year dummies (denoted YEAR). These variables took the value of one if the decision to make CVC occurred during the year y ($y=2000, \dots, 2018$), and zero otherwise.

Except for the decision to adopt CVC and the number of CVC funds created or joined, all the other variables were taken from the Bloomberg database. Data concerning directors' qualifications were gathered based on their curriculum vitae, also available on Bloomberg. Table 2 provides a summary of all the variables used in this research.

Table 2. List of variables

Variable	Description
Dependent variable	
Decision to adopt CVC (<i>CVC STRATEGY</i>)	A dummy variable that takes the value of 1 if the firm launched its own CVC fund or joined an existing one, and 0 otherwise
Variables of interests	
Female presence on corporate boards (<i>WOCB Num</i>)	Number of women on the corporate board
Female presence on corporate boards (<i>WOCB Pro</i>)	Proportion of women on the corporate board

Board independence (<i>INDEP</i>)	Proportion of independent directors on the corporate board
Educational background in management (<i>EDU.MGT</i>)	Proportion of board directors with a background in management
Control variables	
Board size (<i>BOARD.SIZE</i>)	Number of directors on the corporate board
Ownership concentration (<i>OWN.CONC</i>)	Percentage of shares held by the top three shareholders
Majority shareholder ownership (<i>MAJ.OWN</i>)	A dummy variable that takes the value of 1 if one shareholder holds more than 33.3% of the ownership, and 0 otherwise
Family shareholders (<i>FAM</i>)	A dummy variable that takes the value of 1 if the large shareholder is a family, and 0 otherwise
Institutional investors (<i>INSTI</i>)	A dummy variable that takes the value of 1 if the major shareholder is an institutional investor, and 0 otherwise
Duality (<i>DUA</i>)	A dummy variable that takes the value of 1 if the CEO is also chair of the board, and 0 otherwise
Female CEO (<i>FEM.CEO</i>)	A dummy variable that takes the value of 1 if the CEO is a woman, and 0 otherwise
Firm size (<i>FIRM.SIZE</i>)	Natural logarithm of total assets
Financial leverage (<i>FIN.LEV</i>)	Financial leverage is measured as the fiscal year-end ratio of debt to book value of total assets
Growth (<i>Q.TOBIN</i>)	Tobin's Q is measured as the ratio of the sum of the market value of equity plus the book value of debt, all divided by the book value of total assets
Profitability (<i>ROE</i>)	Return on equity ratio measured as income before extraordinary items divided by total equity
Industry (<i>INDU</i>)	A dummy variable that takes the value of 1 if the firm operates in a given industry following the Industry Classification Benchmark (ICB), and 0 otherwise
Year (<i>YEAR</i>)	A dummy variable that takes the value of 1 in the year of the CVC strategy, and 0 otherwise

4. Results and discussion

Table 3 presented below provides the summary statistics for the different variables used in our study: board characteristics and ownership characteristics. We report the mean, median, and standard deviation for each variable for the full sample, as well as a breakdown for firms which made CVC investments and comparable firms which did not.

Table 3. Summary statistics

Variables	Full sample				CVC investments	No CVC investments	Difference	T-statistics
	N	Mean	Median	Standard deviation	Mean	Mean	(CVC–No CVC)	
<i>WOCB (NUM)</i>	122	2.440	2.000	1.868	2.840	2.050	0.790	2.371**
<i>WOCB (PRO)</i>	122	0.198	0.167	0.153	0.218	0.178	0.040	1.457
<i>INDEP</i>	122	0.547	0.531	0.205	0.570	0.523	0.047	1.268
<i>EDUC.MGT</i>	122	0.335	0.348	0.174	0.442	0.229	0.213	8.512***
<i>BOARD.SIZE</i>	122	12.270	12.000	3.792	13.590	10.950	2.640	4.085***
<i>OWN.CONC</i>	122	71.821	85.315	29.172	78.382	65.261	13.120	2.539**
<i>MAJ.OWN</i>	122	0.754	1.000	0.432	0.869	0.639	0.230	3.029***
<i>FAM</i>	122	0.340	0.000	0.474	0.480	0.200	0.280	3.382***
<i>INSTI</i>	122	0.640	1.000	0.482	0.560	0.720	−0.160	−1.898**
<i>DUA</i>	122	0.610	1.000	0.491	0.620	0.590	0.030	0.368
<i>FEM.CEO</i>	122	0.520	1.000	0.501	0.540	0.510	0.030	0.360
<i>FIRM.SIZE</i>	122	7.589	7.619	2.055	8.403	6.775	1.628	4.749**
<i>FIN.LEV</i>	122	26.567	26.500	14.974	22.631	30.503	−7.871	−2.997***
<i>Q.TOBIN</i>	122	0.242	0.230	0.074	0.272	0.211	0.061	4.926***
<i>ROE</i>	122	12.034	11.875	13.935	15.265	8.804	6.461	2.622**

This table provides descriptive statistics for all variables used in the analysis. It also portrays the results of univariate tests of differences between firms with and without CVC investments. The sample is composed of 122 firms over 2000–2018. *CVC STRATEGY* is a dummy variable that takes the value of 1 if the firm launched its own CVC fund or joined an existing one, and 0 otherwise. *WOCB Num* is the number of women on the corporate board. *WOCB Pro* is the proportion of women on the corporate board. *INDEP* is the proportion of independent directors on the corporate board. *EDUC.MGT* is the proportion of board directors with a background in management. *BOARD.SIZE* is the number of directors on the corporate board. *OWN.CONC* is the percentage of shares held by the top three shareholders. *MAJ.OWN* is a dummy variable that takes the value of 1 if one shareholder holds more than 33.3% of the ownership, and 0 otherwise. *FAM* is a dummy variable that takes the value of 1 if the large shareholder is a family, and 0 otherwise. *INSTI* is a dummy variable that takes the value of 1 if the major shareholder is an institutional investor, and 0 otherwise. *DUA* is a dummy variable that takes the value of 1 if the CEO is also chair of the board, and 0 otherwise. *FEM.CEO* is a dummy variable that takes the value of 1 if the CEO is a woman, and 0 otherwise. *FIRM.SIZE* is the natural logarithm of total assets. *FIN.LEV* is financial leverage. It is measured as the fiscal year-end ratio of debt to book value of total assets. *Q.TOBIN* is measured as the ratio of the sum of the market value of equity plus the book value of debt, all divided by the book value of total assets. *ROE* is the return on equity ratio measured as income before extraordinary items divided by total equity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The summary statistics for the full sample show that, on average, the board has 12.3 directors, 55% of whom are outsiders. In our sample, mean board feminization is close to 20%, and there are on average 2.44 women on the boards. This seems to reflect a tokenistic approach to increasing the percentage of female board members by a minority of listed companies (Adams & Ferreira, 2008). Despite the evolution of French society, women remain under-represented on corporate

boards of French-listed companies (Toumi et al., 2016). French companies still have a long way to go to reach the mandatory quota of 40% of women on corporate boards.

Moreover, the t-tests for differences in variable means showed that the average number of women on the corporate boards was 2.8 for firms that decided to adopt CVC compared to 2.09 for those that did not make such a decision. The mean difference for this measure of board feminization was statistically significant at the 5% level. However, regarding the proportion of women on corporate boards, we observed no significant difference between firms that made CVC investments and comparable firms which did not. This can be explained by the fact that regardless of their strategies, French companies are seeking to move closer to the feminization quota imposed by law.

We also found that the percentage of directors possessing a background in management was 38.5% and 19.2% for firms which made CVC investments and for firms which did not, respectively. The mean difference for this variable was statistically significant at the 1% level.

Corporate governance of French firms is characterized by a high ownership concentration. According to both the median and mean values, ownership is concentrated. The mean (median) percentage of shares held by the top three shareholders was 71% (85%). The mean difference for the ownership concentration was statistically significant at the 5% level. Firms adopting a CVC strategy possessed a greater percentage of shares held by the top three shareholders than comparable companies which did not adopt a CVC strategy. Moreover, 74% of companies had their shareholdings concentrated in the hands of a majority shareholder (i.e., one who owned more than 33.3% of the shares).

We should note here that the French market is characterized by a high concentration. The first shareholders hold a significant share of capital (La Porta et al., 2000; Claessens et al., 2002).

Concerning shareholder identity, for 45% of the companies in the sample, there was a family shareholder; for 62% of the companies, the major shareholder was an institutional investor.

Finally, corporates which made CVC investments differed from those which did not in several other respects: board size, the presence of a major shareholder, the presence of a family shareholder, and the presence of institutional investors.

Before running the regression, we calculated pairwise correlations between variables and performed a multicollinearity test using the variance inflation factor (VIF). We report both tests in Table 4.

Table 4. Pairwise Pearson correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 WOCB (NUM)	1														
2 WOCB (PRO)	0.871**	1													
3 INDEP	-0.039	-0.044	1												
4 EDUC.MGT	0.085	0.017	0.176	1											
5 BOARD.SIZE	0.412**	0.027	-0.070	0.139	1										
6 OWN.CONC	0.128	-0.079	-0.008	0.037	0.389**	1									
7 MAJ.OWN	0.105	-0.098	-0.006	0.138	0.409**	0.766**	1								
8 FAM	0.213*	0.190*	-0.086	0.113	0.252**	0.132	0.124	1							
9 INSTI	-0.106	-0.144	-0.019	-0.096	-0.023	-0.136	0.007	-0.044	1						
10 DUA	-0.052	-0.067	-0.017	0.100	-0.062	-0.113	0.086	-0.102	-0.116	1					
11 FEM.CEO	0.015	0.025	0.091	0.039	-0.080	-0.066	0.028	0.087	-0.031	0.006	1				
12 FIRM.SIZE	0.155	0.096	0.034	0.289**	0.150	0.122	0.212*	0.242**	-0.008	0.015	0.156	1			
13 FIN.LEV	-0.066	0.009	-0.209*	-0.322**	-0.166	-0.063	-0.077	-0.166	-0.022	0.082	-0.107	-0.067	1		
14 ROE	0.013	-0.034	0.177	0.264**	0.190*	0.090	0.145	0.088	-0.033	0.012	0.094	0.067	-0.495**	1	
15 QTOB	0.037	0.015	-0.086	0.239**	0.119	0.076	0.110	0.165	-0.034	-0.080	0.021	0.188*	-0.182*	0.053	1
VIF	1.270	1.095	1.127	1.342	1.353	2.988	3.058	1.210	1.150	1.186	1.089	1.232	1.514	1.400	1.149

This table provides the Pearson correlation matrix and VIFs for all variables used in the analysis. The sample is composed of 122 firms over 2000–2018. *WOCB Num* is the number of women on the corporate board. *WOCB Pro* is the proportion of women on the corporate board. *INDEP* is the proportion of independent directors on the corporate board. *EDUC.MGT* is the proportion of board directors with a background in management. *BOARD.SIZE* is the number of directors on the corporate board. *OWN.CONC* is the percentage of shares held by the top three shareholders. *MAJ.OWN* is a dummy variable that takes the value of 1 if one shareholder holds more than 33.3% of the ownership, and 0 otherwise. *FAM* is a dummy variable that takes the value of 1 if the large shareholder is a family, and 0 otherwise. *INSTI* is a dummy variable that takes the value of 1 if the major shareholder is an institutional investor, and 0 otherwise. *DUA* is a dummy variable that takes the value of 1 if the CEO is also chair of the board, and 0 otherwise. *FEM.CEO* is a dummy variable that takes the value of 1 if the CEO is a woman and 0 otherwise. *FIRM.SIZE* is the natural logarithm of total assets. *FIN.LEV* is financial leverage. It is measured as the fiscal year-end ratio of debt to book value of total assets. *Q.TOBIN* is measured as the ratio of the sum of the market value of equity plus the book value of debt, all divided by the book value of total assets. *ROE* is the return on equity ratio measured as income before extraordinary items divided by total equity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4 presents the correlations between all the variables used in the model, as well as the values of variance inflation factors (VIF). We did not observe any serious problem of multicollinearity, since all the VIFs were below ten (Kennedy, 1992).

Furthermore, according to Mela and Kopalle (2002), a correlation coefficient equal to or above 0.7 in absolute value may cause cross-multicollinearity problems. In this study, for most pairs of variables which were significantly correlated, the coefficients were not high enough to give rise to a multicollinearity issue, except for majority ownership and ownership concentration. Indeed, we observed that the correlation coefficient between these variables was 0.766.

To empirically assess to what extent women's presence on the board can explain the decision to adopt a CVC strategy, we estimated a series of regression models. Models 1 and 2 used the proportion of women on the board of directors as a measure of female presence on corporate boards. Models 3 and 4 included the number of women on corporate boards instead of their proportion. Then, to avoid the effects of potential multicollinearity, we did not introduce the correlated variables in the same regression. Table 5 summarizes the results of the logistic regressions.

Table 5. Results of the logistic regressions

Variables	Model 1	Model 2	Model 3	Model 4
<i>WOCB (PRO)</i>	2.573 (0.860)	1.738 (0.290)		
<i>WOCB (NUM)</i>			2.645 (0.144)	2.331 (0.146)
<i>INDEP</i>	15.706** (0.034)	16.838** (0.042)	11.759 (0.16)	13.322 (0.121)
<i>EDUC.MGT</i>	−1.993 (0.7771)	−5.472 (0.449)	−6.926 (0.378)	−5.923 (0.411)
<i>WOCBxINDEP</i>	−9.315** (0.083)	−10.341** (0.062)	−6.239* (0.027)	−6.887* (0.022)
<i>WOCBxEDUC.MGT</i>	18.903** (0.074)	27.451** (0.037)	24.105** (0.040)	23.783** (0.034)
<i>BOARD.SIZE</i>	0.406 (0.211)	0.482 (0.107)	0.476 (0.135)	0.693* (0.054)
<i>OWN.CONC</i>	0.04 (0.298)		0.052 (0.260)	
<i>MAJ.OWN</i>		−4.206 (0.150)		−3.217 (0.265)
<i>FAM</i>	6.065** (0.084)	9.009** (0.07)	7.288** (0.048)	7.372* (0.092)
<i>INSTI</i>	−3.036** (0.089)	−2.853 (0.146)	−3.982** (0.075)	−3.295 (0.116)
<i>DUA</i>	0.355 (0.900)	−1.569 (0.552)	2.571 (0.425)	0.118 (0.965)
<i>FEM.CEO</i>	1.196 (0.419)	−0.450 (0.737)	2.438 (0.209)	−0.016 (0.991)
<i>FIRM.SIZE</i>	1.032* (0.098)	1.809** (0.046)	0.899 (0.154)	1.511* (0.081)
<i>FIN.LEV</i>	0.165 (0.159)	0.258* (0.069)	0.196 (0.133)	0.229* (0.089)
<i>ROE</i>	0.132 (0.141)	0.177** (0.049)	0.125 (0.176)	0.132 (0.104)
<i>Q. TOBIN</i>	33.441** (0.035)	25.234** (0.032)	41.600** (0.031)	27.284** (0.034)
<i>INDU</i>	Included	Included	Included	Included
<i>YEAR</i>	Included	Included	Included	Included
Constant	−41.920 (0.954)	−36.669 (0.991)	−38.502 (0.975)	−33.236 (0.973)
N	122	122	122	122
Pseudo R ²	0.875	0.879	0.885	0.884
Log likelihood	−19.428	−18.909	−18.079	−18.195
Likelihood ratio (Khi ²)	130.272***	131.309***	132.969***	132.737***

This table reports results from regressing *CVC STRATEGY* on board gender diversity (*WOCB [PRO]* and *WOCB [NUM]*) and controls. The sample is composed of 122 firms over 2000–2018. *CVC STRATEGY* is a dummy variable that takes the value of 1 if the firm launched its own CVC fund or joined an existing one, and 0 otherwise. *WOCB Num* is the number of women on the corporate board. *WOCB Pro* is the proportion of women on the corporate board. *INDEP* is the proportion of independent directors on the corporate board. *EDU.MGT* is the proportion of board directors with a background in management. *BOARD.SIZE* is the number of directors on the corporate board. *OWN.CONC* is the percentage of shares held by the top three shareholders. *MAJ.OWN* is a dummy variable that takes the value of 1 if one shareholder holds more than 33.3% of the ownership, and 0 otherwise. *FAM* is a dummy variable that takes the value of 1 if the large shareholder is a family, and 0 otherwise. *INSTI* is a dummy variable that takes the value of 1 if the major shareholder is an institutional investor, and 0 otherwise. *DUA* is a dummy variable that takes the value of 1 if the CEO is also chair of the board, and 0 otherwise. *FEM.CEO* is a dummy variable that takes the value of 1 if the CEO is a woman, and 0 otherwise. *FIRM.SIZE* is the natural logarithm of total assets. *FIN.LEV* is financial leverage. It is measured as the fiscal year-end ratio of debt to book value of total assets. *Q.TOBIN* is measured as the ratio of the sum of the market value of equity plus the book value of debt, all divided by the book value of total assets. *ROE* is the return on equity ratio measured as income before extraordinary items divided by total equity. *INDU* is a dummy variable that takes the value of 1 if the firm operates in a given industry following the Industry Classification Benchmark (ICB), and 0 otherwise. *YEAR* is a dummy variable that takes the value of 1 in the year of the CVC strategy, and 0 otherwise. For each explanatory variable, the value of the regression coefficient is followed by the p values of the Wald tests (in brackets). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The findings emphasize that women's presence on corporate boards has no significant impact on the decision to make CVC investments. This is in line with the findings of Galia and Zenou (2013). Their results showed evidence of the influence of board diversity on all types of innovation (product, organizational, and marketing) except process innovation, where they defined the innovation process as including R&D, cooperation, market studies, identification of customer needs, production process, organization of work, workers' involvement, and commercialization of the innovation. Indeed, in this regard, adopting a CVC strategy can be assimilated with process innovation. This result may be explained by the fact that the appointment of female directors to the corporate boards of these companies is recent and was made in compliance with the law. For Pathan and Faff (2013), in such a situation, the composition of the board is more focused on the control of the regularity of managers' functioning than on the logic of skills or innovation. It is therefore questionable whether a qualitative glass ceiling (i.e., bias like gender mandates) is not substituting for a quantitative glass ceiling (i.e., the low historical proportion of female administrators).

The term "glass ceiling" was coined by Hymowitz and Schellhardt in 1986. A glass ceiling is a set of artificial barriers created by certain prejudices and stereotypes that works to prevent qualified women from advancing in an organization (Toé, 2014). Indeed, according to Grégoir et al. (2013), women are less present than men on specialized committees in which decisions are made. The authors added that the increase in the rate of female appointments to corporate boards since 2010 has mainly concerned the status of independent and employee representatives. Representatives of newly nominated shareholders are still overwhelmingly male.

However, the decision to adopt a CVC strategy is negatively and significantly influenced by the cross-effect of board feminization and board independence. As such, we may state that corporates that appoint independent female directors are the least likely to adopt a CVC strategy.

This result is consistent with the findings of Min (2018), who argued that improved governance by appointing outside directors may have a negative effect on the firm's corporate growth strategy.

Moreover, our results established a positive and significant link between the cross-effect of female board representation and the percentage of directors possessing a background in management and the decision to adopt a CVC strategy. This relationship holds with respect to different estimation models. This result demonstrates that firms making CVC investments and which have appointed female directors have undergone management studies. This result corroborates the resource-based view hypothesis, which suggests that the composition and skills of the board of directors play a crucial role in exploring new business opportunities. More specifically, Calabro (2011) has highlighted that the demographic attributes of directors (i.e., their educational levels, knowledge, and expertise) can be strong drivers of innovations.

Hence, based on our results, we argue that the appointment of women to corporate boards should be based more on their statutory (dependent vs. independent) and background attributes than on the blind implementation of gender quotas. This is consistent with Gull et al. (2018), who studied the effect of specific attributes of female directors on earnings management and found evidence to assert that considering the statutory and demographic attributes of female directors is essential to investigating the relationship between female directors and earnings management.

Regarding control variables, the results showed a positive effect of board size in explaining the decision to make CVC investments. This finding enriches the issue of board size, suggesting that large boards may permit the inclusion of a variety of perspectives on corporate strategy (Pearce & Zahra, 1992). Our finding is in accordance with Zahra et al. (2000), who suggested that an average-sized board is better able to support innovation. Indeed, a large board of directors can allow a firm to benefit from the knowledge and experience of its members. Such a board can provide a corporation with new growth opportunities and consequently promote investment in innovation (Daellenbach et al., 1999; Carter et al., 2003). However, this positive effect of board

size on CVC investments is not consistent with findings from previous research, which have shown that board size has a negative impact on a board's ability to initiate strategic actions (Chouaibi et al., 2009; Galia & Zenou, 2012; Goodstein et al., 1994) and manage internal dynamics in the face of complex environments (Goodstein et al., 1994).

Once we had distinguished across types of shareholders, we found a positive and significant relationship between family shareholders and CVC investments. Family shareholders have control over managers because they are more familiar with the company (Anderson & Reeb, 2003). They can therefore exert strong influence over managers regarding the adoption of CVC investments. Thus, families favor long-term projects (Charlier & Lambert, 2013), such as CVC investments. We also uncovered evidence of a negative and significant relationship between the major shareholder as an institutional investor and CVC investments. This is in line with Anokhin et al. (2016): the presence of institutional investors has a negative influence on CVC investments. This is because institutional investors are not interested in long-term investment projects. Moreover, these investors are sensitive to tangible elements that allow them to communicate about their funds to their potential clients. However, investment vehicles like CVC constitute an exploratory and risky form of investment, one which is rarely present in the management universe of collective investment in transferable securities (UCITS), apart from a few innovation-focused mutual funds.

Regarding firm characteristics, we found that French firms that adopt CVC strategies are large, leveraged, profitable, and have significant growth opportunities.

5. Robustness tests

We performed several additional estimates to check the robustness of the results to the choice of variables. We checked the robustness of our findings to alternative measures of our

independent variable of interest—board feminization. Indeed, one might argue that our findings were driven by the board feminization measure and that the use of an alternative measure would likely remedy this issue.

To address this issue, we replaced the dependent variable from our main model with a dummy variable that took the value of one (1) if the firm had at least one female director on its board, and zero (0) otherwise (Dang & Vo, 2014; Al-Mamun et al., 2013). In Models 1 and 2, shown in Table 6, the estimated coefficients on the decision to adopt a CVC strategy show similar results to those in the main analysis section, indicating that our main evidence did not suffer from the use of an alternative proxy for board feminization.

Some researchers (Konrad et al., 2008; Torchia et al., 2011) have pointed out that the feminization of corporate boards causes fundamental change only in the corporate boards and would thus make a real contribution to the decision-making process if the boards included at least three women. Consequently, we considered the critical mass of three and dummy-coded the number of female directors, with a value of one if the boards included at least three women, and zero otherwise. In general, the results of Models 3 and 4, shown in Table 6, are very similar to those reported previously. However, using this new proxy of the feminization board, we found a significant effect of the presence of more than three women on the board on the decision to engage in CVC investments. This is in line with the results of Torchia et al. (2011), who found that increasing the number of women on boards to at least three enhances the level of firm innovation.

Table 6. Results of logistic regressions using alternative proxies for board feminization

Variables	Model 1	Model 2	Model 3	Model 4
<i>WOCB</i> (at least one woman)	2.016 (0.820)	1.570 (0.569)		
<i>WOCB</i> (at least three women)			14.061** (5.177)	8.369*** (7.450)
<i>INDEP</i>	16.368** (5.625)	17.152** (5.305)	15.902** (4.502)	13.226** (0.121)
<i>EDUC.MGT</i>	−4.126 (0.370)	−2.918 (0.231)	−16.748 (2.270)	−5.138 (0.943)
<i>WOCBxINDEP</i>	−8.322** (3.625)	−8.865** (3.711)	−7.820** (3.669)	−4.806** (4.108)
<i>WCOBxEDUC.MGT</i>	17.384** (3.726)	17.879** (3.787)	28.216** (5.626)	16.972*** (4.725)
<i>BOARD.SIZE</i>	0.377 (2.199)	0.516* (3.241)	0.265 (1.149)	0.501** (0.054)
<i>OWN.CONC</i>	0.036 (1.017)		0.052 (1.603)	
<i>MAJ.OWN</i>		−1.965 (0.714)		0.619 (0.178)
<i>FAM</i>	5.516** (3.118)	6.300 (2.686)	3.759** (3.698)	2.767** (3.674)
<i>INSTI</i>	−3.110** (3.262)	−2.944** (2.755)	−6.248** (4.537)	−5.704*** (8.550)
<i>DUA</i>	1.159 (0.193)	0.158 (0.004)	−1.285 (0.483)	−0.308 (0.045)
<i>FEM.CEO</i>	1.002 (0.504)	−0.169 (0.016)	0.328 (0.049)	0.169 (0.025)
<i>FIRM.SIZE</i>	1.004* (2.700)	1.241** (2.843)	1.695** (3.844)	1.246*** (6.941)
<i>FIN.LEV</i>	0.148 (1.791)	0.183 (2.571)	0.058 (0.670)	0.059 (1.663)
<i>ROE</i>	0.111 (1.757)	0.114 (2.138)	0.041 (0.844)	0.048 (1.114)
<i>Q.TOBIN</i>	31.771** (4.469)	24.129** (2.138)	39.150** (4.243)	27.898*** (9.611)
<i>INDU</i>	Included	Included	Included	Included
<i>YEAR</i>	Included	Included	Included	Included
Constant	−39.928 (0.01)	−35.807 (0.09)	−29.840** (5.725)	−36.215 (11.963)
N	122	122	122	122
Pseudo R ²	0.878	0.876	0.900	0.865
Log likelihood	−19.043	−19.261	−15.940	−20.685
Likelihood ratio (Khi ²)	131.041***	130.606***	169.128***	127.757***

This table reports results from regressing *CVC STRATEGY* on alternative proxies of board gender diversity (*WOCB* [at least one woman]) and *WOCB* [at least three women]) and controls. The sample is composed of 122 firms over 2000–2018. *CVC STRATEGY* is a dummy variable that takes the value of 1 if the firm launched its own CVC fund or joined an existing one, and 0 otherwise. *WOCB Num* is the number of women on the corporate board. *WOCB Pro* is the proportion of women on the corporate board. *INDEP* is the proportion of independent directors on the corporate board. *EDUC.MGT* is the proportion of board directors with a background in management. *BOARD.SIZE* is the number of directors on the corporate board. *OWN.CONC* is the percentage of shares held by the top three shareholders. *MAJ.OWN* is a dummy variable that takes the value of 1 if one shareholder holds more than 33.3% of the ownership, and 0 otherwise. *FAM* is a dummy variable that takes the value of 1 if the large shareholder is a family, and 0 otherwise. *INSTI* is a dummy variable that takes the value of 1 if the major shareholder is an institutional investor, and 0 otherwise. *DUA* is a dummy variable that takes the value of 1 if the CEO is also chair of the board, and 0 otherwise. *FEM.CEO* is a dummy variable that takes the value of 1 if the CEO is a woman, and 0 otherwise. *FIRM.SIZE* is the natural logarithm of total assets. *FIN.LEV* is financial leverage. It is measured as the fiscal year-end ratio of debt to book value of total assets. *Q.TOBIN* is measured as the ratio of the sum of the market value of equity plus the book value of debt, all divided by the book value of total assets. *ROE* is the return on equity ratio measured as income before extraordinary items divided by total equity. *INDU* is a dummy variable that takes the value of 1 if the firm operates in a given industry following the Industry Classification Benchmark (ICB), and 0 otherwise. *YEAR* is a dummy variable that takes the value of 1 in the year of the CVC strategy, and 0 otherwise. For each explanatory variable, the value of the regression coefficient is followed by the p values of the Wald tests (in brackets). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

6. Conclusion

Today, many governments are becoming more aware of the role of gender diversity on corporate boards. The French government has passed legislation imposing a quota of 40% for the number of women on boards.

The benefit of gender diversity for the board of directors is the subject of ongoing debate, both in business and general media. Chen et al. (2016) have argued that this topic is not only a subject of scientific curiosity for researchers but is also of great importance regarding practical implications for corporations. Many papers interested in this issue have focused on the implications of board feminization for a firm's corporate governance, performance, strategic behavior such as mergers and acquisitions, and innovative investments by considering various forms of innovation.

Despite the constant increase in CVC commitments in recent years in France, the issue of the impact of the feminization of the board of directors on the decision to adopt CVC strategies remains unexplored.

This study narrowed this gap in the literature by examining 122 CVC strategies adopted by French firms between 2000 and 2018. Independent of the board feminization proxy and the period of study, our findings can be summarized as follows.

After controlling for board size, ownership concentration, and different types of shareholders, we found no statistically significant relationship between the presence of women on the board and the decision to adopt a CVC strategy. This result can be explained by the fact that the appointment of women directors to corporate boards is recent, and its primary purpose has been to comply with mandatory regulations. These regulations have not yet “shattered” the glass ceiling that prevents women from holding positions of responsibility in large companies. However, this result does not hold when the independence and background of female directors are taken into account, thus demonstrating that the decision to adopt a CVC strategy requires certain skills—in particular, an

educational background in management, as well as demonstrable independence. Consistent with the findings of Gull et al. (2018), examining the impact of board feminization without considering the attributes of women directors may lead to inconclusive results.

Our study contributes to expanding the existing knowledge of corporate entrepreneurship by introducing a new governing context that favors the presence of women on boards. This study also complements existing academic research on the links between board gender diversity and different outcomes by considering specific (independence and background in management) attributes of female directors. Our findings have important implications for managers and regulators regarding female directorship. Thus, the decision to appoint women to corporate boards should be based on specific criteria (e.g., management background and independence) rather than on the blind implementation of a mandatory quota of gender diversity.

References

- Adams, R., Ferreira, D., 2007. A theory of friendly boards. *J. Finance*. 62 (1), 217–250.
- Adams, R., Ferreira, D., 2008. Do directors perform for pay? *J. Acc. Econ.* 46 (1), 154–171.
- Adams R. and Ferreira D., 2009. Women in the boardroom and their impact on governance and performance. *J. Financ. Econ.* 94 (2), 291–309.
- Albouy, V., Wanecq, T., 2003. [in French] Social inequalities in access to the ‘grandes écoles’. *Econ. Statist.* 361, 27–52.
- Alexandre-Bailly, J., Festing, M., Jonczyk, C., 2010. Background, identification and training of executives in France and Germany. In F. Bournois, J. Duval-Hamel, S. Roussillon, J.-L. Scaringella (Eds.), *Handbook of Top-Management*, 242–249, New York/ Houndmills: Palgrave Macmillan.
- Ahern K.R., Dittmar A.K., 2012. The changing of the boards: the impact on firm valuation of mandated female board representation. *Q. J. Econ.* 127 (1), 137–197.
- Al-Mamun, A., Yasser, Q. R., Entebang, H., Nathan, T. M., 2013. Gender diversity and economic performance of firms: evidences from emerging market. *J. Econ. Dev. Manag. Financ. Marke.* 5 (2), 100–110.
- Anderson, R., Reeb, D., 2003. Founding-family ownership and firm performance: evidence from the S&P 500. *J. Finance*. 58 (3), 1301–1328.
- Anokhin, S., Peck, S., Wincent, J., 2016. Corporate venture capital: the role of governance factors. *J. Bus. Res.* 69 (11), 4744 – 4749.
- Apesteguia, J., Azmat, G., Iriberry, N., 2012. The impact of gender composition on team performance and decision-making: evidence from the field. *Manag. Scienc.* 58 (1), 78–93.
- Bahri, K. F., Said, K., 2016. [in French] Asymmetrical alliances and innovation dynamics: which articulation? *Rev. Manag. Scienc.* 281-282 (5), 35-44.
- Balsmeier, B., Buchwald, A., Stiebale, J., 2014. Outside directors on the board and innovative firm performance. *Res. Policy*. 43 (10), 1800–1815.
- Basu, S., Phelps, C., Kotha, S., 2011. Towards understanding who makes corporate venture capital investments and why. *J. Bus. Ventur.* 26 (2), 153–171.
- Baysinger, B.D., Butler, H.N., 1985. Corporate governance and the board of directors: value effects of changes in board composition. *J. Law. Econ. Org.* 1 (1), 101–124.
- Baysinger, B.D., Hoskisson, R.E., 1990. The composition of boards of directors and strategic control: effects on corporate strategy. *Acad. Manag. Rev.* 15 (1), 2–87.
- Baysinger, B.D., Kosnik, R.D., Turk T.A., 1991. Effects of board and ownership structure on corporate R&D strategy. *Acad. Manag. J.* 34 (1), 205–214.
- Bear, S., Rahman, N., Post, C., 2010. The impact of board diversity and gender composition on corporate social responsibility and firm reputation. *J. Bus. Ethics.* 97 (2), 207–221.
- Bianco, M., Ciavarella, A., Signoretti, R., 2015. Women on corporate boards in Italy: the role of family connections. *Corp. Gov. Int. Rev.* 23 (2), 129–144.
- Boone, A.L., Casares, F.L., Karpoff, J.M., Raheja, C.G. 2007. The determinants of corporate board size and composition: an empirical analysis. *J. Financ. Econ.* 85 (1), 66–101.

- Brinette, S., Khemiri, S., 2019. Identifying the determinants of corporate venture capital strategy: evidence from French firms. *Int. J. Entrep. Small. Bus.* 37 (1), 152–166.
- Calabro, A., 2011. Boards of directors and state-owned enterprises' innovation. In *Governance structure and mechanisms in public service organizations—theories, evidence and future directions*, 93–120, Springer, Berlin.
- Campbell, K., Minguez-Vera, A., 2008. Gender diversity in the boardroom and firm financial performance. *J. Bus. Ethics.* 83 (3), 435–451.
- Calvi-Reveyron M., 2000. [in French] Does family capitalism, in a French context, induce fewer dividends than other forms of shareholding? *Finance. Control. Strategy.* 3 (1), 81–116.
- Mela, C.F., Kopalle, P.K., 2002. The impact of collinearity on regression analysis: the asymmetric effect of negative and positive correlations. *Appl. Econ.* 34 (6), 667–677.
- Carter, D.A., Simkins, B.J., Simpson, W.G., 2003. Corporate governance, board diversity, and firm value. *Financ. Rev.* 38 (1), 35–53.
- Charlier, P., Lambert, G., 2013. [in French] Modes of organization and performances of French family's firms according to the agency conflicts. *Finance. Control. Strategy.* 16 (2), 1–30.
- Chemmanur, T.J., Loutskina, E., Tian, X. 2014). Corporate venture capital, value creation, and innovation. *Rev. Financ. Stud.* 27 (8), 2434–2473.
- Chen, G., Crossland, C., Huang, S., 2016. Female board representation and corporate acquisition intensity. *Strateg. Manag. J.* 37 (2), 303–313.
- Chouaibi, J., Boujelbene, Y., Affes, H., 2009. Characteristics of the board of directors and involvement in innovation activities: a cognitive perspective. *Corp. Board. Role. Duties. Compos.* 5 (3), 33–44.
- Chung, K., Wright, P., Kedia, B., 2003. Corporate governance and market valuation of capital and R&D investments. *Rev. Financ. Econ.* 12 (2), 161–172.
- Claessens, S., Djankov, S., Fan, J.P.H., Lang, L.H.P. 2002. Disentangling the incentive and entrenchment effects of large shareholdings. *J. Finance.* 57 (6), 2741–2771.
- Covin, J., Miles, M., 2007. The strategic use of corporate venturing. *Entrepr. Theory. Pract.* 31(2), 183–207.
- Daellenbach, U.S., McCarthy, A.M., Schoenecker, T.S., 1999. Commitment to innovation: the impact of top management team characteristics. *R&D. Manag.* 29 (3), 199 –208.
- Daily, C., Certo, S., Dalton, D., 1999. A decade of corporate women: some progress in the boardroom, none in the executive suite. *Strateg. Manag. J.* 20 (1), 93–99.
- Dalton, D.R., Hitt, M.A., Certo, S.T., Dalton, C.M., 2007. The fundamental agency problem and its mitigation. *Acad. Manag. Ann.* 1 (1), 1–64.
- Dang, R., Vo, L.C., 2014. The influence of top management team characteristics on the presence of women on corporate board. *Rev. Manag. Avenir.* 71, 91–110.
- Dang, R., Nguyen, D.K., 2016. Does board gender diversity make a difference? New evidence from quantile regression analysis. *Manag. Int.* 20 (2), 95–106.
- Davoine, E., Ravasi, C., 2013. The relative stability of national career patterns in European top management careers in the age of globalization: A comparative study in France/ Germany/Great Britain and Switzerland. *Europ. Manag. J.* 31 (2), 152–163.

- Del Giudice, M., Garcia-Perez, A., Scuotto, V., Orlando, B., 2019. Are social enterprises technological innovative? A quantitative analysis on social entrepreneurs in emerging countries. *Technol. Forecast. Social Change*, 148, 119704.
- Elstad, B., Ladegard, G., 2012. Women on corporate boards: key influencers or tokens? *J. Manag. Gov.* 16 (4), 595–615.
- Dushnitsky, G., Shaver, J.M. 2009. Limitations to interorganizational knowledge acquisition: the paradox of corporate venture capital. *Strat. Manag. J.* 30 (10), 1045–1064.
- Fama, E., 1980. Agency problems and the theory of the firm. *J. Political. Econ.* 88 (2), 288–307.
- Fama, E., Jensen, M., 1983. Separation of ownership and control. *J. Law. Econ.* 26 (2), 301–325.
- Ferraris, A., Devalle, A., Ciampi, F., Couturier, J., 2019. Are global R&D partnerships enough to increase a company's innovation performance? The role of search and integrative capacities, *Technol. Forecast. Social Change*, 149, 119750.
- Ferreira, J.J.M., 2010. Corporate entrepreneurship and small firms' growth. *Int. J. Entrep. Small. Bus.* 10 (3), 386–409.
- Franko, L.G., 1989. Global corporate competition: Who's winning, who's losing, and the R&D factor as one reason why. *Strat. Manag. J.* 10 (5), 449–474.
- Jurkus, A., Park, F., Chuland, J., Woodard, L.S., 2011. Women in top management and agency costs. *J. Bus. Res.* 64 (2), 180–186.
- Galia, F., Zenou, E., 2013. [in French] Does board diversity influence innovation? The impact of gender and age diversity on different types of innovation. *Rev. Manag. Avenir*, 66, 152–181.
- Galia, F., Zenou, E., 2012. Board composition and forms of innovation, does diversity make a difference? *Eur. J. Int. Manag.* 6 (6), 630–650.
- Goodstein J., Gautam K., Boeker W., 1994. The effects of board size and diversity on strategic change. *Strat. Manag. J.* 15(3), 241–250.
- Grégoir, S., Maury, T.P., Palomino, F., 2013. [in French] The board feminization of large companies in France: beyond appearances. EDHEC Business School working paper, http://docs.edhec-risk.com/rsc/130715/EDHEC_PP_Feminisation_CA.pdf
- Gull, A.A., Nekhili, M., Nagati, H., Chtioui, T., 2018. Beyond gender diversity: how specific attributes of female directors affect earnings management. *Br. Account. Rev.* 50 (3), 255–274.
- Hafsi, T., Turgut, G., 2013. Boardroom diversity and its effect on social performance: conceptualization and empirical evidence. *J. Bus. Ethics.* 112 (3), 463–479.
- Hamouti, R., Robert, F., Le Roy, F., 2014. Individual strategy, vertical cooperation strategy or cooperation strategy. What is the best strategy for product innovation? *Innovations.* 43 (1), 135–161.
- Hermalin, B., Weisbach, M.S., 2003. Boards of directors as an endogenously determined institution: a survey of the economic literature. *Econ. Policy. Rev.* 9 (1), 7–26.
- Hillman, A.J, Cannella, A.A., Harris, I., 2002. Women and racial minorities in the boardroom: how do they differ? *J. Manag.* 28 (6), 747–63.
- Hillman, A.J., Shropshire, C., Cannella, A.A., 2007. Organizational predictors of women on corporate boards. *Acad. Manag. J.* 50 (4), 941–952.

- Hitt, M., Hoskisson, R., Kim, H., 1997. International diversification: effects on innovation and firm performance in product-diversified firms. *Acad. Manag. J.* 40 (4), 767–798.
- Holmstrom, B., 2005. Pay without performance and the managerial power hypothesis: a comment. *J. Corp. Law.* 30, 703–713.
- Huse, M., 2009. *The value creating board: corporate governance and organizational behavior*. 542 pages, London and New York, Routledge.
- Hymowitz, C., Schelhardt, T.D., 1986. The glass-ceiling: why women can't seem to break the invisible barrier that blocks them from top jobs. *The Wall Street Journal*, 24 March, 1–4.
- Ibarra H., 2012. Despite quotas, there's rough road ahead for women in Europe. *Harvard Business Review Blog Network*, 14 November. <http://blogs.hbr.org/2012/11/despite-quotas-theres-rough-road-aheadfor-women-in/>
- Isidro, H., Sobral, M., 2015. The effects of women on corporate boards on firm value, financial performance, and ethical and social compliance. *J. Bus. Ethics.* 132 (1), 1–19.
- Johnson, J.L., Daily, C.M., Ellstrand, A.E., 1996. Boards of directors: a review and research agenda. *J. Manag.* 22 (3), 409–438.
- Kennedy, P. 1992. *A guide to econometrics*, 598 pages, Cambridge, MA, MIT Press.
- Konrad, A.M., Vicki, K., Sumru, E., 2008. Critical mass: the impact of three or more women on corporate boards. *Organ. Dyn.* 37 (2), 145–164.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 2000. Investor protection and corporate governance. *J. Financ. Econ.* 58 (1), 3–27.
- Leiponen, A., 2005. Skills and innovation. *Int. J. Indus. Organ.* 23 (5-6), 303–323.
- Lerner, J., 2012. *The architecture of innovation: The economics of creative organizations*. 224 pages, Cambridge, Harvard Business Review Press.
- Maclean M., Harvey C., Press J., 2006. Business elites and corporate governance in France and the UK. 1–22, In *French Politics, Society and Culture*. Palgrave Macmillan, London.
- Mahadeo, J.D., Soobaroyen, T., Hanuman, V., 2012. Board composition and financial performance: uncovering the effects of diversity in an emerging economy. *J. Bus. Ethics.* 105 (3), 375–388.
- Martini, A., Laugen, B.T., Gastaldi, L., Corso, M., 2012. Continuous innovation: towards a paradoxical, ambidextrous combination of exploration and exploitation. *Int. J. Technol. Manag.* 61(1), 1–22.
- Merchant N., 2011. Quotas for women on boards are wrong. *Harvard Business Review Blog Network*, 1 September. <http://blogs.hbr.org/2011/09/quotas-for-women-onboards-are/>
- Miller, T., Triana, M.D.C., 2009. Demographic diversity in the boardroom: mediators of the board diversity–firm performance relationship. *J. Manag. Stud.* 46 (5), 755–786.
- Min, B.S., 2018. Effects of outsider's monitoring on capital structure and corporate growth strategy: evidence from a natural experiment. *Journal of Business Ethics.* 152 (2), 459–475.
- Mohnen, P., Röller, L.H, 2005. Complementarities in innovation policy. *Eur. Econ. Rev.* 49 (6), 1431–1450.
- Narula, R., 2002. Innovation systems and “inertia” in R&D location: Norwegian firms and the role of systemic lock-in. *Res. Policy.* 31 (5), 795–816.

- Nekhili, M., Gatfaoui, H., 2013. Are demographic attributes and firm characteristics drivers of gender diversity? investigating women's positions on French boards of directors. *J. Bus. Ethics.* 118 (2), 227–249.
- Noyes, E., Brush, C., Hatten, K., Smith-Doerr, L., 2014. Firm network position and corporate venture capital investment. *J. Small. Bus. Manag.* 52 (4), 713–731.
- Oxley, J., Sampson, R., 2004. The scope and governance of international R&D alliances. *Strat. Manag. J.* 25 (8-9), 723–749.
- Pathan, S., Faff, R., 2013. Does board structure in banks really affect their performance? *J. Bank. Financ.* 37 (5), 1573–1589.
- Pearce, J., Zahra, S., 1992. Board composition from a strategic contingency perspective. *J. Manag. Stud.* 29 (4), 411–438.
- Pfeffer, J., 1972. Size and composition of corporate boards of directors: the organization and its environment. *Adm. Sci. Q.* 17 (2), 218–228.
- Pfeffer, J., Salancik, G., 1978. *The external control of organizations: a resource dependence Perspective*, 336 pages, Harper & Row.
- Poletti-Hughes, J., Briano -Turrent, G., 2019. Gender diversity on the board of directors and corporate risk: a behavioral agency theory perspective. *Int. Rev. Financ. Anal.* 62, 80–90.
- Reichardt, B., Weber, C., 2006. Corporate venture capital in Germany: a comparative analysis of 2000 and 2003, *Technol. Forecast. Social Change*, 73, 813–834.
- Robinson, G., Dechant, K., 1997. Building a business case for diversity. *Acad. Manag. Executive.* 11, 21–30.
- Sherer, P.D., Lee, K., 2002. Institutional change in large law firms: a resource dependency and institutional oerspective. *Acad. Manag.* 45 (1), 102–119.
- Singh, V., Terjesen, S., Vinnicombe, S., 2008. Newly appointed directors in the boardroom: how do women and men differ. *Eur. Manag. J.* 26 (1), 48–58.
- Terjesen, S., Couto, E.B., Morais, F.P., 2016. Does the presence of independent and female directors impact firm performance? A multi-country study of board diversity. *J. Manag. Gov.* 20 (3), 447–483.
- Toé, M., 2014. The individual determinants of the glass ceiling: the case of the composition of the governance bodies of French listed companies. *Manag. Int.* 18 (4), 48–67.
- Torchia, M., Calabrò, A., Huse, M., 2011. Women directors on corporate boards: from tokenism to critical mass. *J. Bus. Ethics.* 102 (2), 299–317.
- Toumi, N., Benkraiem, R., Hamrouni, A., 2016. Board director disciplinary and cognitive influence on corporate value creation. *Corp. Gov.* 16 (3), 564–578.
- Van Witteloostuijn, A., Boone, C., 2006. A resource-based theory of market structure and organizational form. *Acad. Manag. Rev.* 31(2), 409–426.
- Ward, A.M., Forker, J., 2017. Financial management effectiveness and board gender diversity in member-governed, community financial institutions. *J. Bus. Ethics.* 141 (2), 351–366.
- Wu, A., 2017. The signal effect of government R&D subsidies in China: does ownership matter? *Technol. Forecast. Social Change*, 117, 339–345.
- Zahra, S., 1996. Governance, ownership, and corporate entrepreneurship: the moderating impact of industry technological opportunities. *Acad. Manag. J.* 39 (6), 1713–1735.

- Zahra, S.A., Pearce J.A., 1989. Board of directors and corporate financial performance: a review and integrative model. *J. Manag.* 15 (2), 291–334.
- Zahra, S.A., Neubaum, D.O., Huse, M., 2000. Entrepreneurship in medium-size companies: exploring the effects of ownership and governance systems. *J. Manag.* 26 (5), 947–976.
- Zahra, S.A., Covin, J., 1995. Contextual influences on the corporate entrepreneurship-performance relationship: a longitudinal analysis. *J. Bus. Ventur.* 10 (1), 43–58.
- Zhang, J.J., Guan, J., 2018. The time-varying impacts of government incentives on innovation. *Technol. Forecast. Social Change*, 135, 132–144.