Does board gender diversity affect firm risk-taking? Evidence from the French stock market

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Abstract Drawing from a sample of French companies that made up the SBF 120 index over the period 2006-2010 (before the enactment of the law Copé-Zimmermann law on gender quota), this paper investigates the relationship between board gender diversity and firm risk taking (measured by the variability of the return on assets). Consistent with Nielsen and Huse (2010), this research design and findings shed light on the contribution of female directors on board's strategic issue. We go beyond demography and try to open the "black box" of board behavior by drawing upon the agency theory and the resource dependence resource.

Keywords: women on corporate boards; risk-taking; gender diversity; endogeneity.

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1 Introduction

The growing interest towards gender differences in firm's decision making especially corporate risk-taking has arisen due significant inroads women made in the boardroom (Terjesen, et al. 2009) and the recognition that these stereotype may generate discrimination and institutional barriers for women's progression in the organization (Powell and Ansic 1997). The common stereotype is that women are more risk averse than men. Indeed, empirical evidence tends to point out women take less risk than men. Byrnes, et al. (1999), based over 150 studies examining gender differences in risk perception, concluded that "male participants are more likely to take risks than female participants" (p. 377). Understanding if this assertion is accurate regarding corporate outcomes is a matter of importance in the French context given the enactment of the "Copé-Zimmermann" in January 2011, which requires that companies include 40% of women on their corporate board, effective as from January 1, 2017. As Sila, et al. (2016) point out, if boards with female directors wisely and effectively, these firms may suffer from a lack of competitiveness compared with those of its main competitors. Consequently, examining the effect of women on corporate boards (WOCB) on corporate risk-taking is a crucial issue.

Gender differences have been examined in different corporate setting; for instance, stock trading behaviour (Barber and Odean 2001), corporate financial and investment decisions (Huang and Kisgen 2013), female leadership and wages between genders (Tate and Yang 2015) or corporate takeovers bids (Levi, et al. 2014).

Numerous studies have addressed the impact of corporate governance on corporate risk-taking. For instance, Jiraporn, et al. (2015) find that effective governance exhibit a significant lower level of risk, by constraining managers to cut back risky investments. Furthermore, a lot of studies have shown that executive compensation, a pillar of corporate governance, affects corporate risk-taking (e.g., Hayes, et al. 2012, Armstrong and Vashishtha 2012). In the Japanese context, Nakano and Nguyen (2012) found that larger boards is negatively and significantly correlated with corporate risk-taking. Finally, Faccio, et al. (2011) have documented that firms controlled by diversified large shareholders take fewer risks than firms controlled by non-diversified large shareholders.

All these studies suggest that gender and corporate governance mechanisms have a significant effect on corporate decisions.

To date, the existing literature has specifically examined how the gender of CEO affects risk-taking (Faccio, et al. 2016), how the composition of a bank's composition team affects bank risk-taking (Berger, et al. 2014) and how women make different corporate financial and investment decisions than their male counterparts (Huang and Kisgen 2013). However, although these studies provide some very interesting gender-related results regarding major corporate decisions, these studies do not specifically examine the involvement of women's representation on corporate boards on corporate risk-taking.

Existing studies that specifically examined the relationship between board gender diversity and corporate risk-taking exhibit contrasting results. Based on a sample of US firms over the period 1996-2010, Sila, et al. (2016) found that there is no evidence that WOCB have any significant influence on corporate risk-taking. Furthermore, these authors showed that board gender diversity does not affect policy measures or an operating measure of risk. Conversely, drawn from a sample of Tunisian listed companies over the period 1997-2010, Loukil and Yousfi (2016) found that WOCB have a positive and significant impact on investment opportunities. We argue that these contrasting results may be explained by the state of development of financial markets, the economic level of countries, the size of the sample or the econometric specification used (controlling for endogeneity). In essence, the overall meaning of the body of research should rely on the efficacity of the research methodology in each paper. In our opinion, the paper conducted by Sila, et al. (2016) seems more convincing. However, more investigation examining the relationship between board gender diversity and corporate risk-taking is warranted.

The study makes several contributions to the literature on women directors and corporate risk-taking. First, this study makes a theoretical contribution to the literature on women directors by examining if by being significantly different from men, WOCB have any effect on corporate outcomes, as documented by Adams and Ferreira (2009) or Matsa and Miller (2013), among others. Fundamentally, as suggested by Adams and Funk (2012), female directors may be different, not because they are different from men, but because they differ from the population of male directors in terms of demographics traits, human and social capital (Singh, et al. 2008, Hillman, et al. 2002). In the French context, Dang, et al. (2014) show some significant differences between men and female directors regarding age, education or expertise profile. Thus, following Milliken and Martins (1996), we try to examine if the differences of female directors regarding social capital, human capital and demographics (Johnson, et al. 2013) affect corporate outcomes, such as corporate risk-taking.

This paper also makes a contribution to the literature on corporate risk-taking by examining the relationship between board gender diversity and corporate risk-taking in France, which has a civil law system (Weimer and Pape 1999). We argue that the differences in outcomes between the studies of Sila, et al. (2016) and Loukil and Yousfi (2016) may be attributed to differences between the US and Tunisia. Indeed, John, et al. (2008) have shown that better investor protection could lead firms to implement riskier corporate policies which generate value creation for shareholders. Conversely, low investor protection can affect corporate risk-taking, by adopting for instance conservative corporate risk policy. Regarding WOCB, Grosvold and Brammer (2011) argue that national institutional systems may shape the proportion of WOCB and may affect women's effect on corporate

outcomes. Consequently, this study extends the literature by providing evidence from the French context and by bridging the existing differences.

Finally, consistent with Sila, et al. (2016), this study investigates the relationship between board gender diversity and corporate risk-taking in a dynamic framework by controlling properly the problem of endogeneity. By taking into account this issue and other potential sources of endogeneity (including omitted unobservable firm characteristics, simultaneity and time-invariant unobserved heterogeneity), we expect to achieve more reliable inferences regarding the causal relationship between WOCB and corporate risk-taking. One of the drawbacks of the study of Loukil and Yousfi (2016) is to investigate this relationship in a static perspective. Therefore, we contribute to the literature from an empirical and methodological standpoint.

The purpose of this paper is to investigate the relationship between board gender diversity and corporate risk-taking. Specifically, it examines *whether* women on corporate boards have any effect on firm risk-taking using a sample of French companies that made up the SBF 120 Index of *Euronext* Paris over the period 2006-2010.

The structure of the paper is as follows. Section 2 presents a review of the literature. Section 3 the research design. Section 4 presents the main empirical results. Finally, concluding remarks are given in section 5.

2. Literature review

2.1. Theoretical framework

According to Nelson (2012), "the statement "women are more risk averse than men" is fundamentally a metaphysical assertion about unobservable essences or characteristics, and therefore cannot be empirically proven or disproven" (p. 29). Supported by a review of empirical literature, paying attention to the "misleading nature of generic beliefs and statements, the proper interpretation of statistical results and the quantitative magnitudes of detectable differences and similarities" (Nelson, 2012, p. 29), the author considers the widespread acceptance of "women's strongest aversion of risk" more rooted in sex bias (and gender stereotypes) than in reality. Thus, Nelson (2012) suggests to pay more attention to the "quantitative sizes of differences and similarities, and a more careful interpretation of aggregate results" (p. 29), to improve the robustness of the empirical achievements.

Nevertheless, empirical studies have pointed the stronger women's aversion to risk taking in household holdings of risky assets ("single women exhibit relatively more risk aversion in financial decision making than single men", as demonstrated by Jianakoplos and Bernasek 1998 using U.S. sample data[5]) as well in business strategic decision-making. Empirical researches provide, particularly, evidence for the effect of CEO and other senior executives' gender on risk-taking (Huang and Kisgen 2013, Faccio, et al. 2016). Where Adams and Ragunathan (2015) examined when and how board diversity affects bank risk-taking (paying attention to temporal, spatial and phenomenological conditions), Charness and Gneezy (2012) provide strong evidence (and consistent results) for gender differences in risk taking and demonstrate, assembling and using data from 15 sets of experiments with one simple underlying investment game, that men tend to take more financial risks than women; thus, women appear to be more financially risk averse than men.

Contribution to an embryonal scientific literature relating economic preference parameters to psychological and psycho-sociological measures (*in primis* gender), Borghans, et al. (2009) support this hypothesis, underlying gender differences in risk aversion (women are more risk-averse than men) and ambiguity aversion. Moreover, Perryman, et al. (2016) found that firms with greater gender diversity in top management teams' show a lower firm risk and deliver better performance, underling the moderating effect of gender diversity on executive compensation[6].

Thus, testing the hypothesis that board gender diversity influences firm risk taking can be viewed as a crucial research question at a time when several European Countries (among them Belgium, France, Norway and Italy) intensify institutional pressure to increase gender diversity in Corporate Boards and pass specific legislation mandating more female board (*quota laws*) to rise the female directors proportion as well as to achieve WOCB's critical mass (Gul, et al. 2011, Konrad, et al. 2008).

Prolegomenon to an investigation of the economic consequences of an increased representation of WOCB, examining the impact of board feminization on risk taking needs to cross a sociological and psychological perspective with a strategical and financial approach.

Review of literature in psycho-sociology, gender studies and management points out a women's less risk appetite (compared with men), according with psychological attitudes and gender behavior, because of women's favorable traits in value judgment, risk assessment, decision-making attitude (e.g., Jones and Gautschi 1988,

[5] Jianakoplos and Bernasek (1998) underline that "as wealth increases, the proportion of wealth held as risky assets is estimated to increase by a smaller amount for single women than for single men. [Nevertheless] gender differences in financial risk taking are also influenced by age, race and number of children" (p. 620). According to these authors, the greater financial risk aversion should partially explain US women's lower levels of wealth compared with men's.

[6] Perryman, et al. (2016) underline that female executives are less payed than their male executive, even at the TMT level. Nevertheless, when gender diversity increases, the salary-differences between genders decrease.

Peterson, et al. 1991, Jianakoplos and Bernasek 1998, Bernasek and Shwiff 2001, Chung and Monroe, 1998, 2001; Ray 2005; Trinidad and Normore, 2005; Chen, Ni & Tong, 2016).
The cognitive contribution (developing, sharing and crossing information and knowledge) of WOCB as well as their advisory and monitoring role and their positive impact on board behavior and financial reporting quality have been pointed out (Daily, et al. 1999, Adams and Ferreira 2009, Gul, et al. 2011).

Nevertheless, the female directors' aversion to risk can be explained focusing on their socially-dominated position in the boards: lack of self-confidence, self-censorship, "abhorrence of error", fear of exclusion as a sanction for failure, "angst of *exit*" / anxiety of being excluded as, *loyalty* and dominated/marginalized actors' passivity, reduction of WOCB to silence – deficit of *voice* (Barber and Odean 2001, Byrnes, et al. 1999; see also Hirschman 1970). Accordingly, the femininization of the board could or should improve (or harden) risk monitoring, when "boards of directors face heightened expectations regarding their role in risk oversight" (Sila, et al. 2016, p. 26).

2.2. Sample and data

Using a sample of US firms from 1996-2010, Sila et *al.* (2015) investigate the impact of board gender diversity and risk-taking in non-financial firms. They identify a causal effect of female directors on risk, using a dynamic model that controls for reverse causality and points out unobservable firm factors influencing both appointments of feminine directors and firm risk taking (as well as firm size, board size, leverage…).

Even if the authors do not find any significant evidence of the impact of feminization of boardrooms on equity risk, their findings must be mitigated. In fact, they show that the negative relationship between the two variables (WOCB level and equity risk) is spurious and "driven by unobserved between-firm heterogeneous factors" (Sila et *al.*, 2015, p. 26).

Investigating the impact of board gender diversity on firm risk-taking in a developing market (grounded on a small sample of 30 Tunisian-listed firms between 1997 and 2010), Loukil and Yousfi (2016) show that "women have a risk perception that leads to risk avoidance behavior: the presence of women directors, even when there is one woman director, is positively associated with cash ratio" (p. 66). However, the authors show no significant relationship between feminization of the board and propensity to take strategic or financial risk-taking. Nevertheless, politically, institutionally and state-appointed women in the boardroom have a positive effect on cash holding and investment opportunities political-network as a support for legitimacy). Thus, Loukil and Yousfi (2016) take evidence for women directors' adversity to risk. These conclusions join the key results of Faccio, et al. (2016), who demonstrate, analyzing a sample of continental European companies, that firms run by female CEOs tend to have lower leverage, less volatile earnings and a higher chance of survival than similar companies led by male CEOs. Mobilizing a dynamic perspective, Faccio, et al. (2016) show, additionally, that transitions from male to female CEOs (or vice-versa) are related with economically and statistically significant reductions (or increases) in corporate risk-taking.

Accordingly, Chen, et al. (2016) underline that female directors improve board effectiveness in risk management with respect to R&D investment. In fact, the feminization of the boards helps to reduce the positive relationship between R&D investment and future performance volatility. Thus, firms having more feminized boards exhibit a lower adverse effect of R&D on the cost of debt.

Loukil and Yousfi (2016) underline, specularly, the reverse phenomena, founding that foreign investors do not invest in firms having gender-diverse boards. Investing in a company led by a non-gender-homogeneous board should be looked, for a gender-non-blind investor, as "risk taking" (sexist, devaluating and depreciative stereotypes disqualifying women as professional leaders -even if WOCB are paradoxically more "cautious" (careful and thoughtful) than their masculine homologues).

3 Research design

3.1. Sample and data

The initial sample for this study consists of all the companies listed on the SBF[7] 120 Index of *Euronext* Paris over the period 2006-2010 (at December 31 each year). The SBF 120 Index is a capitalization-weighted index which gathers the 120 largest companies by market capitalization and by trading volume on Euronext Paris. Following standard practice, we exclude financial firms (SIC codes 6000–6999) and utility firms (SIC codes 4900–4999) to the extent that they are subject to regulatory supervision affecting their governance system (e.g., Subrahmanyam, et al. 1997). The final dataset consists of an unbalanced panel of 116 firms and 478 firm-year observations.

The data pertaining to boards of directors (the gender of a director, the size and the independence of a board of directors) come from the French database *Artenia DataCG* (*IODS*). The financial data come are from *Bloomberg* database.

[7] The acronym "SBF" stands for *Société des bourses françaises*.

3.2. Measure of variables

3.2.1. Dependent variable

Following previous studies (e.g., Faccio, et al. 2016, Li, et al. 2013, Hilary and Hui 2009), we choose as our primary measure of corporate risk-taking (RISK) the standard deviation of return on assets (ROA), σ(ROA). Specifically, σ(ROA) is the volatility of the firm's operating ROA, defined as the ratio of earnings before interest and taxes to total assets. Volatility of returns is a standard proxy for in risk in the financial economics literature. According to John, et al. (2008) and Zhang (2009), this variable captures the degree of risk-taking in firms' operations through the volatility of corporate earnings. The underlying assumption is that riskier corporate operations lead to more volatility earnings. Consistent with Faccio, et al. (2016), we calculate σ(ROA) over a 5-year overlapping windows (2006-2010, 2007-2011, 2008-2012, 2009-2013 and 2010-2014).

3.2.2. Independent variable

In this study, we measure board gender diversity through the Blau's (1977) index heterogeneity, measured as: $(1 - \sum \rho_i^2)$, where ρ_i is the percentage of board members in each category (female and male directors). Blau's index can range from 0 (when there is no female directors) to 0.50 (which occurs when board encompasses an equal number of female and male directors).

Unlike Sila, et al. (2016), we rather used the Blau's index than the proportion of female directors to the extent that Harrison and Klein (2007) suggested this index is an optimal measure of diversity that captures variation within a group of people. Furthermore, the Blau's index meets fundamental criteria which are seen as to be a reliable proxy of diversity (Miller and del Carmen Triana 2009): this index has a zero value indicating complete homogeneity, a value that tends towards one indicates greater diversity, the index does not encompass negative values, and it is not unbounded. Finally, the Blau's index is not skewed towards any proportion of category (i.e. gender) (Harrison and Sin 2006).

3.2.3. Control variables

Consistent with Sila, et al. (2016), we assume that there are unobserved factors influencing both firm risk-taking and board gender diversity across time. Therefore, we rely on the existing literature identify a set of control variables in Equ. [1]. First, we control for the effect of firm size (SIZE), which we measure using the natural log of total assets (in millions of Euros) (Faccio, et al. 2016). Generally, small firms are more likely to be risk-averse than large firms. We therefore expect a negative relationship between firm size and our measure of risk-taking. Second, we control for firm's leverage (LEVERAGE) defined as the ratio of total debt to total assets (Faccio, et al. 2011). We argue that if firm's leverage increases, its level of risk would increase. This will probably lead to higher earnings volatility. Third, we control for profitability through the return on assets (ROA) defined previously for two reasons: (a) high ROA volatility can be a reflection of poor management ability rather risk-taking choices (Faccio, et al. 2011) and (b) low profitability could lead with more risk-taking, resulting in earnings volatility (Boubakri, et al. 2013). Fourth, we control for firm growth (GROWTH) calculated as the annual grow rate of sales (Faccio, et al. 2011). This variable captures the influence of growth opportunities specific to each firm. Finally, we control for the age of the firm (AGE), which is the number of years since the inception of the firm (Majumdar 1997). We used the natural log of AGE.

Additionally, we control for a number of board characteristic variables that may influence risk-taking (Sila, et al. 2016). We first control for board size (BSIZE) defined as the number of directors on the board. Following Yermack (1996), we used the natural log of BSIZE. It is argued that large board can both lead to compromises and a slower decision-making, which in turn induce less risky behavior (e.g., Sah and Stiglitz 1991). Next, we control for board independence (BINDEP), as the percentage of unaffiliated independent director on the board according the Bouton's (2002) report.[8] Indeed, agency theory (Fama and Jensen 1983) argue that the independent directors are more likely to be concerned by shareholder wealth, which in turn could induce higher risk-taking.

An overview of the variables used in this study and their definitions is provided in Table 1.

[Place Table 1 here]

3.3. Model and estimation method

3.3.1. Model

The following is our regression model:

$$\sigma(\text{RISK})_{i,(t,t+4)} = \alpha + \beta_1 (\text{RISK})_{i,t-1} + \beta_2 (\text{BLAU})_{i,t} + \beta_3 (\text{LEVERAGE})_{i,t} + \beta_4 (\text{ROA})_{i,t} + \beta_5 (\text{ROA})_{i,t} + \beta_6 (\text{GROWTH})_{i,t} + \beta_7 (\text{AGE})_{i,t} + \beta_8 (\text{BSIZE})_{i,t} + \beta_9 (\text{BINDEP})_{i,t} + \psi_t + \eta_i + \varepsilon_{i,t} \quad [1]$$

[8] Following the financial scandals (e.g., Vivendi Universal), the AFEP and MEDEF (the French Employers' Association) requested in 2002 to re-examine the French corporate governance principles. The Bouton report contained stricter recommendations, in particular board independence.

where *i* denotes firms in the sample (*i* = 1, 2, …, 116); *t* refers to time period (*t* = 2006, 2007, … 2010). Finally, the expressions, ψ_t, ηi and $\varepsilon_{i,t}$ refer to unobserved firm fixed-effects, time-specific effects that are time-variant and common to all companies and the classical error term which is assumed to be independent and identically distributed, respectively.

3.3.2. Estimation model

Wintoki, et al. (2012) argue that any corporate financial decisions are likely to be dynamic, namely the past action itself may proxy for some unobservable important firm attributes that may determine current action. These authors refer to this relationship as "dynamic endogeneity". They also argue that using the traditional static model to estimate Equ. [1] may, by ignoring the dynamic endogeneity, induce biased inferences.

Furthermore, Adams, et al. (2010) underlie that there is a general consensus in the literature suggesting that board structures are exogeneous. For instance, Hermalin and Weisbach (1998, 2003) present theoretical as well as empirical evidence suggesting that board structures are more likely to by endogenous. This endogeneity issue may create estimation problems. It could therefore be assumed that WOCB are a deliberate choice made by firm that must be considered when estimating the relationship between corporate risk-taking and board gender diversity.

According to Sila, et al. (2016), two alternative explanations must be considered. Firstly, omitted unobservable firm characteristics (both fixed and variable across time) may affect both the appointment of female directors and corporate risk-taking. Even if Equ. [1] is based on the existing literature, some firm-specific unobservable variables, such as religion (Hilary and Hui 2009) or culture (Li, et al. 2013), are not included in our specification. Indeed, they are difficult observable or measurable. We acknowledge this limit of our model. Secondly, according to Adams and Ferreira (2009), there are reasons to assume that reverse causality might be also present in Equ. [1]. Specifically, risky firms may be willing to appoint female directors, but it is also possible that WOCB significantly influence corporate risk-taking.

For all those reasons, we first follow Arellano and Bond (1991) by including in Equ. [1] lagged dependent variable, $(RISK)_{i,t-1}$. Second, in order to control for the endogeneity of both financial decisions and board structure (including firm effect), we carry out the Arellano and Bover (1995) and Blundell and Bond (1998) dynamic GMM estimator.

Specifically, consistent with Wintoki, et al. (2012), we used the BB (Blundell-Bond) two-step system GMM as our main estimation technique to alleviate the concerns regarding dynamic panel bias and endogeneity. The two-step System GMM technique involves a system of equations in differences and in levels, allowing to treat all the explanatory variables in Equ. [1] as endogenous, except firm age (AGE) and the *year dummies*. Finally, we employed a finite-sample corrected estimate of variance, suggested by Windmeijer (2005) in order to take into account the concern of Blundell and Bond (1998) regarding the downward-biased tendency of standard errors estimated by the two-step System GMM approach for small samples.

Consistent with Bond (2002), our system GMM estimators are compared with simpler estimator, such as pooled OLS or fixed-effects (FE) in order to detect potential biases in previous empirical studies, as Faccio, et al. (2011), among others, used OLS and fixed-effects methods in their study.

3.3.3. Descriptive statistics and correlation analysis

Table 2 presents descriptive statistics of all the variables. The mean (median) five-year volatility of ROA is 2.912 (3.282). This is lower than the numbers reported by Faccio, et al. (2016) worldwide with a value of 4.80 (3.00). The average Blau score in our sample is 0.157 where the highest possible Blau score is 0.49. About 68% of firms in our sample have at least one female director (unreported). Companies in our sample appear to be relatively profitable, with an average ROA of 4.48%. The samples firms have a low debt expose, with an average (median) leverage of 26.31% (22.92%). Furthermore, they exhibit a wide range of growth rates, with a mean (median) annual rate of growth of sales of 8.11% (6.00%). Finally, the average (median) firm in our sample is 37 (44) years old.

[Place Table 2 here]

Table 3 reports the correlations among our variables. As a rule of thumb, a correlation of 0.70 or higher in absolute value may indicate a multicollinearity issue. Table 3 shows that the highest correlation of 0.52 appears between firm size and board independence. This figure is significantly below the threshold of 0.70. Furthermore, check for multicollinearity by calculating variance inflation factors (VIF). The highest observed VIF value in our study variables is 1.53, which is well below the conventional cut-off of 10.0 (Chatterjee and Hadi 2012). Consequently, we concluded that multicollinearity had little impact on our further analysis.[9]

[Place Table 3 here]

[9] Sila, et al. (2016) used as their measure of firm risk: total risk, systematic risk and idiosyncratic risk.

4. Results

Table 4 presents the results of Equ. [1]. Regardless of the method used – pooled OLS, FE method or two-step system GMM estimator with the Windmeijer (2005) finite-sample correction – **we do not find any support of the view that female directors reduce corporate risk-taking**. Indeed, none of the coefficients related to board gender diversity are significant at the 10% level. Our results are consistent with Sila, et al. (2016) who, for a sample of US firms over the period 1996-2010, **do not find any evidence that women on corporate boards influence significantly equity risk.** Our results contrast with those reported by Faccio, et al. (2016) who find, for a sample of continental European companies, that firms run by female CEOs tend to have a financing and investment policy that are less risky than similar firms run by male CEOs.

As shown in Table 4, the coefficient associated to the lag of the dependent variable in column 3 is positive and significant (at the 1% level) correlated to corporate risk-taking. This finding indicates the relationship between board gender diversity and corporate risk-taking is likely to be robust to dynamic endogeneity. This result is consistent with Sila, et al. (2016).

Table 4 also reports the Hansen test of overidentification, for which the null hypothesis is that the instruments are valid. It shows that despite the fact that our model is over-identified (due to the use of many lags as instruments in Equ. [1]), it is insignificant at the 10% level. This means that past values of corporate risk-taking, board gender diversity and firm characteristics are exogenous. In addition, the AR(1) and AR(2) tests, with the null of no autocorrelation in the residuals of the difference equation, suggest that there is no evidence of second-order autocorrelation in the residuals. Overall, the specification tests reveal no evidence that our instruments used in Equ. [1] are endogeneous.

[Place Table 4 here]

5. Concluding remarks

This study is subject to some caveats. First, even if our findings corroborate Sila, et al.'s (2016) finding, the sample concerns French companies, a Latin country (Weimer and Pape 1999). Consistent with Francoeur, et al. (2008), cultural differences may imply that our findings may not be generalize to other countries, even within Europe. We therefore propose that our study may be reconsidered in other Latin countries (such Spain, Italy or Belgium) which are close to France in terms of systems of corporate governance, or to Germanic countries (such as Germany or Finland) (Weimer and Pape 1999). Grosvold and Brammer (2011) argue that institutional and cultural context play a significant role when examining the effect of board gender diversity. Second, our findings may not be generalized to SMEs (small and medium enterprises) or privately held firms. In France, SMEs make up 97% of the economic fabric.[10] Brunninge, et al. (2007) argue that corporate governance among SMEs are likely to be different from large companies in terms of ownership, board of directors and top management teams. Consequently, these differences may alleviate or temper the weight and the influence of WOCB on corporate risk-taking. The contrasting findings of Mínguez-Vera and Martin (2011) and Martín-Ugedo and Minguez-Vera (2014) regarding firm performance, move in that direction. Durand and Vargas (2003) also suggest that private firms significantly differ public firms in terms of agency problems and corporate governance. Therefore, our results may not apply. A robust investigation of the impact of gender diversity in Corporate Boards on firm risk taking calls to take in account the reverse causality. If firm appointment of more female directors could reduce firm risk-taking in strategic choices and investment decisions (according to a presupposed women's adversity to risk), we must jointly consider the inverse hypothesis: are the riskier firms appointing more WOCB, taking the risk to become less competitive players in their industries? In addition, appointing scarce WOCB should encourage excessive risk-taking in strategic (masculine-standard-dominated) field such as finance. Nelson (2012, 2016) abounds in this sense: regarding the issue of risk, "exaggerated and stereotyped beliefs in the existence of sex-based differences may lead to suboptimal results in economic efficiency and equity. These may arise both through discriminatory treatment and through the encouragement of excessive risk-taking in important economic domains such as finance and the environment" (Nelson, 2012:29). In addition, the effect of feminization of Corporate Board on the firm risk taking (in decision making and strategic choices) must be analyzed considering the sector: according Sapienza et *al.* (2009), women working in financial industry are less risk averse than women entering other industries.

But, Nelson (2016) insists upon the biases of "*creating false beliefs about the characteristic of individuals based on their group membership"*. If we refer to the classical stereotypes, it's usually expected that women are less risk oriented. At the crossroads between biology and sociology, some authors (Arnett and Jensen, 1994) suggest that the level of risk taking might be induced by two factors: the endogenous factors and the restrictions societies and their culture impose on the individual (laws, norms, education …). Latest works seems to point out that gender differences in risk taking could be explained by both biology and social frameworks. Regarding risk

[10] According to the figures supplied by CEDEF (*Centre de Documentation Économie-Finances*) attached to the French Ministry for the Economy and Finance.

taking, it has been valued as a masculine activity along with aggressiveness and competitiveness (Granie, 2013). Studies confirm that gender difference in risk taking might be explained by the effect of conformity to the expected behavior of the male group as defined by western societies (Rowe and al. 2004). Following Sarrasin and Mayor (2010), gender is less a predictor of risk taking than the pressure to conform to masculinity traits.

So far, we agree with Nelson (2016) that risk-taking behavior differences between genders might not be that strong and stereotypes might clout results interpretation if not acknowledged. It implies a careful appreciation of methodologies and variables used in the research to better understand risk taking behavior at individual and global level as economic situations implies most of the time risky outcomes.

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Table 1 Definition of variables

Variable	Definition
Risk-taking	Standard deviation of return on assets (ROA) over a 5-year time window.
Blau's index	Calculated as $(1 - \Sigma \rho_i^2)$, where ρ_i is the percentage of board members in each category.
Firm size	Natural logarithm of total assets (in millions of Euros).
Leverage	Total debt (long term plus short term debt) over total assets.
ROA	Earnings before interest and taxes to total assets.
Firm growth	Annual grow rate of sales.
Firm age	Natural logarithm of the number of years since the inception of the firm.
Board size	Total number of directors on corporate boards.
Board independence	Percentage of unaffiliated independent director on the board (according to the Bouton's 2002 report).

Table 2 Descriptive statistics (N=478)

Variables	Mean	S.D.	Median	Min.	Max.
σ(ROA) x 100	2.912	3.282	1.681	0.060	21.730
Blau's index	0.157	0.134	0.153	0.000	0.492
Firm size	8.253	1.569	8.188	0.112	12.371
Leverage (%)	26.305	25.122	22.929	0.008	245.547
ROA (%)	4.481	7.200	4.152	-47.200	49.251
Firm's growth	8.105	31.272	6.003	-83.695	563.360
Firm's age	3.629	1.225	3.784	0.000	5.844
Board size	11.267	3.612	11.000	3.000	21.000
Board independence (%)	48.448	20.619	46.667	0.000	100.000

Table 3 Correlation matrix

	1	2	3	4	5	6	7	8	9
1. Risk	1.000								
2. Blau's index	-0.086	1.000							
3. Firm size	-0.171***	0.057	1.000						
4. Leverage	0.014	0.023	-0.007	1.000					
5. ROA	-0.058	0.083	0.060	0.229***	1.000				
6. Firm's growth	0.007	-0.061	-0.144***	-0.053	-0.069	1.000			
7. Firm's age	-0.138***	0.066	0.052	0.007	0.142***	-0.091**	1.000		
8. Board size	-0.123***	0.029	**0.521****	0.057	0.044	-0.067	0.011	1.000	
9. Board indep.	0.101	-0.059	0.210***	-0.114**	-0.178***	-0.039	-0.007	-0.049	1.000
VIFs		1.02	1.53	1.07	1.12	1.04	1.03	1.43	1.14

Asterisks indicate significance at 1% (***) and 5% (**) levels, respectively.

Table 4 Effect of board gender diversity on risk-taking

	Model 1: Pooled OLS	**Model 2**: FE	**Model 3**: System GMM
Lag risk measure	0.675***	0.085	0.437***
	[6.45]	[0.42]	[4.46]
Board gender diversity	-0.301	-0.841	-4.220
	[-0.34]	[-0.27]	[-0.98]
Firm size	-0.002	3.138**	0.667
	[-0.02]	[2.58]	[1.45]
Leverage	-0.002	-0.046	-0.091**
	[-0.56]	[-1.57]	[-1.97]
ROA	-0.005	0.038	0.002
	[-0.19]	[1.10]	[0.06]
Firm's growth	-0.006**	-0.019***	-0.013***
	[-2.09]	[-3.82]	[-3.23]
Firm's age	-0.229**	-0.278	-0.173
	[-2.30]	[-0.32]	[-1.09]
Board size	0.030	0.142	-0.176
	[0.66]	[1.13]	[-0.52]
Board independence	-0.255	-2.795	6.282*
	[-0.43]	[-1.13]	[1.78]
Intercept	1.497	-21.711**	-0.627
	[1.19]	[-1.98]	[-0.13]
Industry	No	No	No
Firm fixed-effects	No	Yes	Yes
Year dummies	Yes	Yes	Yes
Number of observations	360	360	360
R-squared	0.444	0.525	
F statistic	14.71***	3.85***	
AR(1) test (*p*-value)			-2.11**
AR(2) test (*p*-value)			-0.82
Hansen-J test of over-identification (*p*-value)			15.61

This table reports empirical results from estimating Eq. [1]. Specifically, column 2 reports the results obtained from OLS method with clustering at the firm level. Column 3 presents the results obtained from fixed-effects (within-groups estimator) method. Estimations gained form two-step system GMM approach are reported in column 4. *t*-Statistics of OLS and FE estimators are reported in brackets and based on robust standard errors corrected for potential heteroskedasticity and time-series autocorrelation within each firm. *z*-Statistics of system GMM model are reported in parentheses and based on Windmeijer-corrected standard errors. *Year dummies* are unreported.
Asterisks indicate significance at 1% (***), 5% (**) and 10% (*) levels, respectively.