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Gender diversity and innovation performance in family firms: Evidence from the Spanish manufacturing industry

Sara Fernández-López [a,1], María Jesús Rodríguez-Gulías [a,2], Nuria Calvo [b,3], David Rodeiro-Pazos [a,4,*]

[a] Department of Finance and Accounting, Universidade de Santiago de Compostela, Avda. do Burgo, s/n., 15782 Santiago de Compostela, Galicia, Spain
[b] Department of Business, Universidade da Coruña, Campus de Elviña, s/n, 15071 A Coruña, Galicia, Spain

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ABSTRACT

This paper, drawing on the upper echelon theory, examines the relationship between the existence and degree of gender diversity in top management teams (TMTs) with firm's innovation performance, using a sample of 1.808 Spanish manufacturing firms. We follow a two-step multivariate analysis distinguishing between product and process innovation and comparing family and non-family. Our findings show a positive relationship between gender diversity and process innovation, and a U-shaped relationship between the degree of gender diversity and product innovation in family firms, but not in non-family firms.

1. Introduction

Research on the relationship between the diversity in top management teams (TMTs) and organizational performance has become popular in the last ten years (Baker et al., 2020). In this field, the study of gender diversity is particularly appealing as it fuels the debate about gender equality efforts of businesses (Hoobler et al., 2018). The upper echelon theory posits that gender diversity of team members provides the TMTs with different cognitive frames (Hambrick and Mason, 1984; Hambrick, 2007; Hewlett et al., 2013) and decision-making styles (Koryak et al., 2018), which can have positive effects on firm performance (Carpenter et al., 2004). While a non-negligible number of studies has found positive effects of gender diversity on several measures of firm success, little attention has been paid to the specific impact of gender diversity on the innovative performance (Ruiz-Jiménez et al., 2016). Particularly, few studies are referred to small firms, where ownership and control frequently overlap (Shehata et al., 2017).

At the same time, research on family firm innovation has been steadily growing in recent years (Röd, 2016; Calabrò et al., 2019; Aiello et al., 2020) and scholars are increasingly paying attention to how the heterogeneity among family firms can affect innovation activities (Röd, 2019). Despite this interest, the study of gender diversity in TMTs, and particularly the effect of female leadership in the distinct environment of family firms, remains relatively underdeveloped (Chadwick and Dawson, 2018). The different characteristics

* Corresponding author.
E-mail addresses: sara.fernandez.lopez@usc.es (S. Fernández-López), mariajesus.rodriguez.gulias@usc.es (M.J. Rodríguez-Gulías), nuria.calvob@udc.es (N. Calvo), david.rodeiro@usc.es (D. Rodeiro-Pazos).
[1] http://orcid.org/0000-0003-2496-4333
[2] http://orcid.org/0000-0001-8390-474X
[3] https://orcid.org/0000-0002-5711-5015
[4] https://orcid.org/0000-0002-5272-2676

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of family businesses, as well as the generally accepted fact that they create a more favorable climate for women's inclusion in top management positions compared to non-family firms (Chadwick and Dawson, 2018; Martínez-Jiménez, 2009), offer a distinctive and valuable context for exploring the relationship between gender diversity and innovation performance.

This paper aims to investigate a research question positioned at the intersection of identified gaps in the two aforementioned streams of literature: To what extent is gender diversity in TMTs associated with a family firm's innovation performance? Drawing on the upper echelon theory, we use a sample of 1808 Spanish manufacturing firms in 2016 to analyse whether gender diversity in TMT is associated with product innovation or process innovation, as defined by the Oslo Manual (OECD, 2018), and whether this potential relationship differs between family and non-family firms. Addressing this question becomes highly relevant, as it provides new evidence on the role of female managers in the innovation performance of family firms compared to non-family firms and clarifies the extent to which the degree of gender diversity may affect this relationship.

The analysis of our research question is particularly relevant in the Spanish context, where family businesses stand out as the primary drivers of turnover and job creation. Approximately 60 % of European private sector companies and 40–50 % of jobs are attributed to family businesses (European Family Businesses, 2016), with figures of 80 % and 50 %, respectively, in the United States (PwC, 2023). In Spain, family businesses are even more prominent, accounting for 89 % of all businesses and generating 67 % of private employment (KPMG, 2021).

In addition, the latest European Innovation Scoreboard report ranked Spanish companies well below the European average in terms of innovation expenditure and the percentage of SMEs carrying out product and/or process innovations (Comisión Europea, Dirección General de Mercado Interior, Industria, Emprendimiento y Pymes, 2021). In 2020, Spanish innovative firms represented 33.4 % of all firms, in contrast to 57.1 % in EU19 countries and 52.7 % in EU27 countries (EUROSTAT, 2024).

A recent study examining 2045 companies in the Spanish manufacturing sector reveals that the "family factor" serves as a catalyst for innovation; family firms invest more in innovation than non-family firms and are also more efficient in managing the innovative process (Fundación IE, 2022). Although there is room for improvement, the proportion of women in family businesses has been growing in recent years. In Spain, women represent 32 % of board members in family firms and hold 24 % of management positions (Instituto de la Empresa Familiar, 2023). Given these distinct characteristics of the Spanish business context, there is a compelling need for analyzing the role of gender diversity in the innovation performance of family and non-family firms. Understanding this role can help to design more effective policies aimed at fostering innovation in technology-follower countries with a high proportion of family firms within the private sector, such as Spain.

Two major contributions to the literature are expected. First, the study responds to calls for further exploration of diversity that can shed light on the relationship between family firms and innovation performance (Röd, 2016; Calabrò et al., 2019). Specifically, drawing on the upper echelon theory, the advantages of gender diverse management teams in family firm environment are discussed. Second, the study builds a bridge between two strands of the literature. In so doing, it contributes to both the literature on gender diversity and innovative performance of firms, which is still rather limited (Ruiz-Jiménez et al., 2016), and the literature on family firm innovation which, despite exponential growth in the last decade, has not yet explored how gender diversity can affect innovative performance within this context (Röd, 2016; Calabrò et al., 2019). Moreover, this research adds to the strand of the literature on female leadership in family businesses, which remains underdeveloped (Campopiano et al., 2017; Nelson and Constantinidis, 2017; Chadwick and Dawson, 2018; Hernández-Lara and Gonzales-Bustos, 2020). Specifically, this investigation delves deeper into the varied effects of gender diversity degrees on innovation performance, an approach that is aligned with the hemophilic relationship approach within organizations, as proposed by Lazarsfeld and Merton (1954).

The rest of the paper is organized as follows. Section 2 presents a literature review explaining how gender diversity in TMTs can be associated with innovation performance in family and non-family firms. Section 3 details the data, variables, and models used in the empirical analysis. Section 4 describes and discusses the empirical results. Finally, Section 5 presents concluding remarks, as well as limitations, directions for future research and provides practical implications.

2. Literature review

Since Lazarsfeld and Merton (1954) introduced the concept of homophily, which describes individuals' tendency to bond with those similar to them, many researchers have studied this phenomenon across various dimensions, including race, cognitive processes, family relations, location, organizational ties, and gender. Conversely, other strands of literature have analysed the phenomenon of diversity across these same dimensions. This paper focuses on studying the role of gender diversity on innovation performance in both family and non-family firms. The literature review is divided into two subsections: first, we explain how gender diversity in TMTs influences innovation performance; second, we analyse this relationship within the context of family firms.

2.1. Gender diversity and firms' innovation performance

Most research on the diversity-innovation relationship is grounded in the upper echelon theory (Hambrick and Mason, 1984; Hewlett et al., 2013; Hambrick, 2007), which connects firm performance with the composition of power groups within organizations. According to this theory, company outcomes are closely influenced by the integration of cognitive perspectives, values, and behaviors among TMT members, as they are responsible for strategic decision-making. From this approach, heterogeneity provides TMTs with diverse knowledge and decision-making styles (Koryak et al., 2018), as well as varied values, experiences, and personalities, resulting in a complementary set of competencies that facilitate improved decision-making. Research from the upper echelon theory has thus underlined the importance of TMT diversity in organizational performance, of which innovation performance is one of the most

relevant for firm success.

Hence, the innovation capacity of firms depends on internal and external drivers that facilitate the alignment of strategy, organization, processes, learning, and networking (Ferreira et al., 2015; Tidd and Bessant, 2020). Particularly, among the internal drivers, the knowledge embedded in employees stands out as a key resource for gaining competitive advantage, especially in the small firms. This knowledge enables firms to transform individual and group-level tacit knowledge into successful products, services, or decisions through the dynamic interaction between tacit and explicit knowledge (Zack, 2002; Zahra et al., 2007; Hambrick, 2007). Thus, team diversity, particularly in TMTs, can be an advantage for a set of outcomes (Röd, 2019), enhancing cognitive capabilities to search for solutions (Beckman et al., 2014). Moreover, TMT diversity is often the result of recruiting the best employees, which allows to improve the firm's customer orientation (Hunt et al., 2015). Consequently, the literature on innovation considers the diversity of TMTs and R&D team members as potential internal drivers of innovation (Hunt et al., 2015).

More specifically, within the demographic diversity factors, the study of the effect of gender on innovation has gained popularity to promote the inclusion of women in senior management positions (Chadwick and Dawson, 2018; Bauweraerts et al., 2022). Thus, several studies of the innovation literature have recently addressed the relationship between innovation performance and the presence of women either in TMTs or R&D teams.

Regarding the TMTs' gender diversity, Miller and Triana (2009) indicate that while gender diversity is positively related to innovation, there is no clear evidence of a positive relationship with firm performance. Østergaard et al. (2011) find that companies increase their innovation capacity when their TMTs balance the participation of men and women, concluding that only certain degree of diversity enhances firm innovation. Torchia et al. (2011) report that a TMT composed of at least three women increases the firm's innovation capacity only if they are involved in strategic tasks. The research findings by Ruiz-Jiménez et al. (2016) show that the more gender-diverse TMTs are, the more capacity the company has to generate new knowledge. In a recent study, Azzam (2022) also evidences the positive relationship between the presence of female directors on the boards of UK firms and R&D intensity. However, Bednar et al. (2021) provide evidence supporting the positive effect of female owners and principal investigators on a firm's innovation performance, thereby reinforcing the influence of homophilic relationships within organizations, particularly in the case of women. Concerning the type of innovation, Galia et al. (2015) evidence the positive effect of gender-diverse TMTs on marketing innovation, and the negative one on product innovation. On the contrary, neither Carter et al. (2010) nor Parrotta et al. (2014)[5] find evidence of the effect of gender diversity on the firm probability to innovate or to implement solutions in different technological areas.

Regarding the effect of gender-diverse R&D teams on firm innovation, the literature presents mixed findings. Whereas Díaz-García et al. (2013) show a positive relationship between gender diversity in R&D teams and innovation only for radical innovations, Teruel and Segarra (2017) indicate that such positive association is higher in large firms and for non-technical innovations. Other studies evidence that functional diversity outweighs than gender diversity in explaining innovation performance, except for the specific case of service innovation, in which both aspects (functional and gender diversity) are deemed relevant (Fernández-Sastre, 2015). Lastly, Xie et al. (2020) find that gender diversity in R&D teams enhances innovation efficiency by helping firms in adapting processes to contexts of high competition, uncertainty, and complexity.

Previous evidence indicates that the relationship between gender diversity in TMTs or R&D teams and innovation performance remains inconclusive. The reasons for these mixed findings may be partially explained by the Bassett-Jones paradox; that is, although demographic diversity is a validated source of creativity and innovation, it can potentially hinder team performance if members disengage from those who are different from them (Van der Vegt and Janssen, 2003; Bassett-Jones, 2005; Van Knippenberg and Schippers, 2007).

2.2. Gender diversity and firms' innovation performance in family firms

Literature on family firm innovation has exponentially grown in recent years (Aiello et al., 2020; Calabrò et al., 2019). As the research field advances, scholars have emphasized the need of exploring the family firm's heterogeneity concerning innovation, as indicated by recent literature reviews (Röd, 2016; Calabrò et al., 2019). Although some studies have addressed the relationship between TMT diversity and innovation in family businesses, diverse TMTs are framed in terms of generational or non-family involvement (Röd, 2019). In contrast, gender diversity in TMTs remains still overlooked in the literature on family firm innovation (see Campopiano et al. (2017) or Nelson and Constantinidis (2017) for recent reviews of women's involvement in family firms).

In this regard, family firms provide a unique context for analysing the effect of gender-diverse TMTs on firm innovation. Family firms offer women advantages and opportunities to assume management and leadership positions (Martínez-Jiménez, 2009; Chadwick and Dawson, 2018). Thus, women who are part of the owners' family are often selected as TMT members on the basis of family ties (Ruigrok et al., 2007). Moreover, family firms tend to incorporate women into top management positions at a faster pace than non-family firms (Barrett and Moores, 2009). Additionally, women are generally more conservative and risk-averse than men, and research indicates that risk-averse employees find working for family firms more attractive (Block et al., 2016). Consequently, the presence of women in TMTs is more prevalent in family businesses than in non-family firms (Chadwick and Dawson, 2018), regardless of whether they belong to the family (Montemerlo et al., 2013). Moreover, from a theoretical approach, the upper echelon theory has also proven to be an appropriate framework in the study of family companies (Ensley and Pearson, 2005), although Chadwick and Dawson (2018) argue that this approach could have less explanatory potential in family firms relative to comparable non-family

[5] Parrotta et al. (2014) consider the gender diversity of the workforce.

businesses.

Based on the upper echelon theory, as well as on the empirical evidence presented in the preceding subsection, TMT gender diversity appears to be positively associated with firms' innovation performance (Bauweraerts et al., 2022). Below, we elaborate upon the relationship between gender-diverse TMTs and innovation performance in family firms by considering the idiosyncrasies of such companies.

Drawing on linkages among internal and external sources of knowledge, cognitive diversity within TMTs enhances innovation capacity (Zahra, 2012). In this respect, the presence of women in decision-making positions brings expertise and knowledge (Huse, 2007) that differ from those of their male counterparts. Even when women are part of the owners' family, their distinct knowledge and perspectives, stemming from different socialization experiences (Ruiz-Jiménez et al., 2016), contribute to the TMT's ability to integrate diverse perspectives and detect innovative opportunities (Miller and Triana, 2009; Díaz-García et al., 2013). Also, women may increase the diversity of the cognitive background of TMTs in family firms to a greater extent than in non-family firms, or to interfere in the firm's agreements for innovation (Rodríguez-Gulías et al., 2023). Thus, the literature on family firm innovation attributes a less diversified set of cognitive resources to family firms' TMTs (Sirmon and Hitt, 2003; Nieto et al., 2015; Brinkerink, 2018), as management positions are usually "reserved" to family members (Classen et al., 2012). In this line of reasoning, it is likely that female family members are in top management jobs even when their career path is not the best fit for the job. Conversely, non-family firms will seek managers with specific training suited to their roles within the TMT and, in that sense, it is more likely that their training will match that of their male counterparts, limiting the cognitive diversity and resulting in more homogeneous TMTs.

Social capital, defined as the network of relationships that can enhance a firm's performance, increases the firm's capability to combine and exploit internal and external sources of knowledge for innovation. Compared to non-family business, family firms have shown to create stronger social capital, particularly inside the company (Veider and Matzler, 2016), because their organizational structures are often characterized by fewer bureaucratic constraints, flatter hierarchies, and greater autonomy for employees at all levels (Bigliardi and Galati, 2017). Such organizational flexibility allows employees to freely interact to develop and discuss new ideas (Østergaard et al., 2011), fostering an environment conducive to knowledge exchange. In this respect, it is noteworthy that tacit knowledge embedded in employees is often a major source of innovation in small firms (Gupta et al., 2006). Several studies indicate that women's leadership styles favour this collaborative climate more effectively than their male counterparts (Greene et al., 2003; Chadwick and Dawson, 2018). Women exhibit a more inclusive management style, taking others' viewpoints (Eagly et al., 2003) and perceiving power like a way of dissemination of knowledge and information (Krishnan and Park, 2005). This collaborative and supportive leadership style contributes to create a pro-active climate for innovation (Sandberg, 2003), where individuals feel motivated to exchange knowledge and experiences, resulting in more innovative solutions. Building on these arguments can be expected that women may more comfortably apply this management style in more flexible organizations, such as family firms.

Research on family firm innovation concurs that the family's aim to preserve the firm's wealth and continuity often results in a risk-averse and less pro-active environment for innovation (Gomez-Mejía et al., 2010; Gomez-Mejía et al., 2011; De Massis et al., 2015). The conservatism and risk aversion commonly deter family businesses from engaging in innovation activities outside the firm's current domain (Cucculelli et al., 2016) or in collaboration with external players (Bigliardi and Galati, 2017). Literature on gender also agrees that women are more conservative and less risk-taking than men (Block et al., 2016). Consistent with the risk-aversion argument, gender diversity in TMTs seems to have a negative effect on family firm performance (Danes et al., 2007; Mínguez-Vera and Martin, 2011), or a less positive relationship that in non-family firms (Chadwick and Dawson, 2018). Recent studies focusing on Spanish firms in innovative sectors by Hernández-Lara and Gonzales-Bustos (2020) and Gonzales-Bustos et al. (2020) reveal a positive relationship

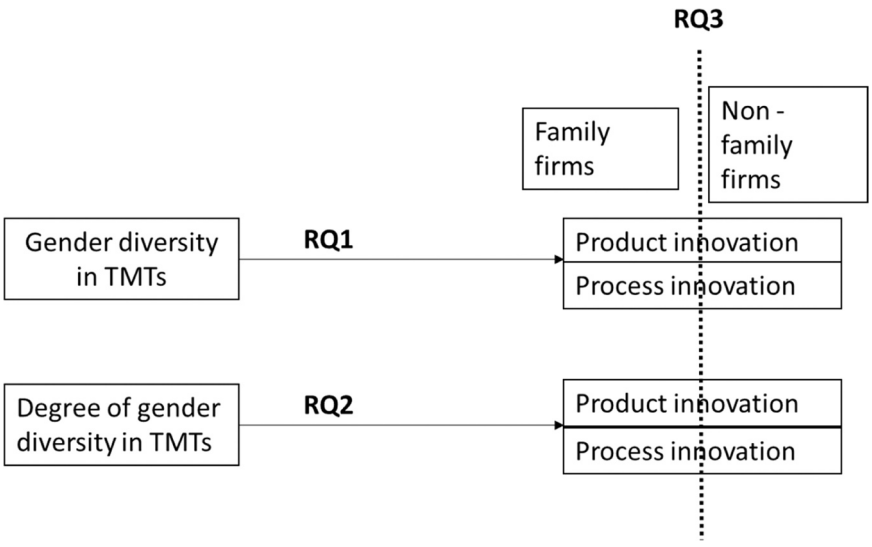

Fig. 1. Conceptual model of gender diversity in TMTs and innovation performance in family vs non-family firms.

between the presence of women on boards and R&D and patents, although this relationship is more evident in non-family firms. In contrast, Amore et al. (2014) find a positive relationship between female leadership and family business performance, especially if other women are in TMTs, and Bauweraerts et al., (2022) also evidence a positive relationship between female family directors and the R&D intensity. These mixed results may partly lie in the fact that individuals' risk aversion is less constraining in environments with conservative attitudes toward risk. As Block et al. (2016) indicate, risk-averse employees find working for family businesses more attractive. Therefore, women may feel more inclined to display risk aversion in conservative environments like family firms without their executive prestige being decimated.

After reviewing previous literature, it seems that gender diversity in TMTs generally yields benefits for firms' innovation performance. Moreover, the organizational structures of family firms might reinforce these advantages of gender diversity. While a non-negligible number of studies on family firm innovation have focused on differences between family and non-family firms (for recent reviews, see Durán et al., 2016; Röd, 2016; Bigliardi and Galati, 2017; Calabrò et al., 2019), to the best of our knowledge, no study has investigated the role of TMT gender diversity in family firms' innovation performance. Our study aims to address this gap by examining the extent to which gender diversity in TMTs is associated with family firms' innovation performance. More specifically, this overarching research question could be divided into three specific research questions (Fig. 1):

- Is gender diversity in TMTs related to firms' innovation performance in family businesses? Specifically, this study examines both product innovation and process innovation.
- Is this potential relationship affected by the degree of gender diversity in TMTs of family firms? To explore this, we consider both the percentage of women in top management positions and the square of this variable to capture potential non-linear relationships.
- Are there differences between family and non-family firms? Hence, the sample is divided into family and non-family business.

Fig. 1 shows the conceptual model of this study.

3. Methodology

The subsections of this third epigraph introduce the data and sample, the definition and measurements of the variables, and the estimation strategies and the econometric models.

3.1. Data and sample

Information was extracted from the Business Strategy Survey or Encuesta sobre Estrategias Empresariales (ESEE). The ESEE survey is possibly the most complete survey regarding data on technological activities of Spanish manufacturing companies. It collects questions related to R&D activities, patent registration, and product and process innovation. Furthermore, innovation data from the ESEE have been commonly employed in previous studies on family firms in the Spanish context (for instance: Monreal-Pérez et al., 2012; Kotlar et al., 2013; Kotlar et al., 2014; Diéguez-Soto et al., 2018; Rodríguez-Gulías et al., 2023).

The ESEE database is constructed as an unbalanced panel data, including a random sample of companies ranging from 10 to 200 employees, along with a more detailed sample of companies with over 200 employees. The 2016 edition introduced questions related to the sex of managers for the first time. This new information opens new possibilities for research that we sought to leverage in this study, given the interest of the subject. Hence, the study sample includes 1808 Spanish manufacturing firms observed in 2016, comprising 788 family firms and 1020 non-family firms. According to the ESEE's methodology, family firms are those where a family group actively participates in management and / or control.

3.2. Definition and measurements of the variables

We used two dependent variables: product innovation and process innovation. Following the Oslo Manual (OECD, 2018), product [process] innovation refers to a new or improved product or service [process] that differs from the company's previous product or service [business process] and has been introduced to the market [into use in the company]. Thus, we employed two dummy variables indicating whether a firm had introduced product innovation (INNOPROD) or process innovation (INNOPROC), respectively.

Gender diversity in TMTs was measured in two ways. Firstly, we created a dummy variable (GEN_DIVER) that takes the value 1 if the company's TMT was gender-diverse, and 0 if it comprised only men or women. Secondly, we measured the degree of gender diversity in the TMT (GEN_DIVERINT) as the percentage of women in top management positions. We also considered this intensity of gender diversity squared (GEN_DIVERINT2) to capture potential non-linear relationships between gender diversity and firm innovation.

We included four control variables. The natural logarithm of the number of employees (LNEMP) was considered as a proxy for firm size. Industry-specific characteristics were considered by one sectoral dummy that identifies the high-medium technology sectors according to the Eurostat classification[6] (HIGHTECH). Finally, the firm's R&D intensity was considered in two ways: the percentage of sales allocated to R&D expenditures (RD_SALES) and the percentage of employees working in R&D activities (RD_EMP).

[6] Eurostat uses the aggregation of the manufacturing industry according to technological intensity and based on the NACE Rev.2 at the two-digit level.

3.3. Strategy of estimation and model specification

Given that the dependent variables are dummies, we employed logistic regression models in all estimated models. Firstly, to explore the relationship between gender diversity in TMTs and the likelihood of having product or process innovation in family and non-family firms (first and third research questions), we proposed the following model with three alternative specifications:

Model a

$$\Pr(\text{INNO}=1) = F(\beta_0 + \beta_1 \textbf{GEN\_DIVER} + \beta_2 \text{LNEMP} + \beta_3 \text{HIGHTECH} + \beta_4 \text{RD\_SALES})$$

Model b

$$\Pr(\text{INNO}=1) = F(\beta_0 + \beta_1 \textbf{GEN\_DIVER} + \beta_2 \text{LNEMP} + \beta_3 \text{HIGHTECH} + \beta_5 \text{RD\_EMP})$$

Model c

$$\Pr(\text{INNO}=1) = F(\beta_0 + \beta_1 \textbf{GEN\_DIVER} + \beta_2 \text{LNEMP} + \beta_3 \text{HIGHTECH} + \beta_4 \text{RD\_SALES} + \beta_5 \text{RD\_EMP})$$

Where $F(z) = e^z/(1 + e^z)$ is the cumulative logistic distribution, INNO is the observed product (INNOPROD) or process (INNOPROC) innovation, and β_0 is the constant.

As mentioned, three alternative specifications (a, b and c) were proposed due to slight correlation between the two control variables referred to R&D intensity. Hence, RD_SALES and RD_EMP were introduced alternatively (Models a and b) and together (Model c).

Secondly, to analyse the role of the degree of gender diversity in firms' innovation performance (second and third research questions), only firms with gender-diverse TMTs were considered. In this stage, the proposed model was re-run by replacing the GEN_DIVER variable with GEN_DIVERINT and GEN_DIVERINT2 variables.

All alternative specifications were estimated using the *logit* estimator of Stata. Furthermore, the option *vce (robust)* was included to avoid some kinds of misspecification.

4. Empirical results

4.1. Univariate analysis

The descriptive statistics of the dependent and independent variables are presented in Table 1 for family and non-family firms separately.

Regarding the dependent variables (Table 1), only 16.62 % of family firms and 14.71 % of non-family firms had introduced some product innovation (INNOPROD) in 2016. The percentages are slightly higher for process innovation (INNOPROC), with 38.58 % and 38.33 % for family and non-family firms, respectively. Therefore, in both cases of product and process innovation, the figures are marginally higher for family companies.

To test the significance of these differences in innovation performance, we conducted a t-test of mean differences between family firms and non-family firms (Table 2). The results do not reveal significant differences. That is, we cannot confirm that family firms have significantly higher innovation performance than non-family firms.

Concerning the key explanatory variables (Table 1), 45.70% of family firms had a gender-diverse TMT (GEN_DIVER), compared to 40.76 % of the non-family firms. In terms of the degree of gender diversity (GEN_DIVERINT), the mean percentage of women in the management teams was 21.37 % in family firms and 17.29 % in non-family firms. These figures align with evidence from other studies, suggesting that women are generally underrepresented in leadership roles compared to men in family firms, though less so than in non-family firms (Ernst and Young, 2015; Chadwick and Dawson, 2018). At the same time, these results support our intuition that family firms serve as a good "breeding ground" for analysing the role of gender diversity in innovative performance.

Turning to the control variables, the average number of workers was near 134 and 214 in family and non-family firms, respectively. About 30 % of family firms operated in high-medium technology industries, compared to roughly 35 % of non-family firms do so. The mean percentage of R&D expenditures over sales was around 0.61 % in family companies and 0.78 % in non-family ones. The mean average percentage of employees dedicated to R&D activities was close to 2 % and lightly higher than 2 % in family and non-family business, respectively.

Finally, Table 3 shows the correlation matrix of the independent continuous variables for both subsamples. As mentioned, the two measures of R&D intensity, RD_SALES and RD_EMP, are slightly highly correlated. This correlation has been considered in the model specification.

4.2. Multivariate analysis

We conducted a two-step multivariate analysis. Initially, we estimated three econometric models to study the relationship between gender-diverse TMTs and the innovation performance of Spanish family and non-family manufacturing firms. Then, we re-estimated the models to explore the role of the degree of gender diversity (percentage of women in TMTs) in the innovation probability of family and non-family firms.

In the first step, Models a, b and c were estimated by using the dummy variable GEN_DIVERS. Results are shown in Table 4 and Table 5 for product and process innovation, respectively.

Table 1
Descriptive statistics of dependent and independent variables: family and non-family firms.

Variable	Obs	Mean	Std. Dev.	Min	Max
FAMILY FIRMS					
INNOPROD	788	0.1662	0.3725	0	1
INNOPROC	788	0.3858	0.4871	0	1
GEN_DIVER	733	0.4570	0.4985	0	1
GEN_DIVERINT	733	21.3724	27.2268	0	100
EMP[a]	788	133.59	392.38	3	8451
HIGHTECH	788	0.2995	0.4583	0	1
RD_SALES (%)	786	0.6198	1.5945	0	17.1472
RD_EMP (%)	784	1.9475	4.9829	0	48.7805
NON-FAMILY FIRMS					
INNOPROD	1020	0.1471	0.3543	0	1
INNOPROC	1020	0.3833	0.4864	0	1
GEN_DIVER	939	0.4026	0.4907	0	1
GEN_DIVERINT	939	17.2888	25.5071	0	100
EMP[a]	1020	213.58	727.46	1	11370
HIGHTECH	1020	0.3529	0.4781	0	1
RD_SALES (%)	1012	0.7847	2.8661	0	41.4461
RD_EMP (%)	1015	2.2102	7.5636	0	100

Notes:
[a] Variable is not in logs.

Table 2
Differences between family firms and non-family firms: *t*-test.

	NON-FAMILY FIRMS		FAMILY FIRMS		*t*-test	
	Obs	**Mean**	**Obs**	**Mean**	**t**	**p > 0**
INNOPROD	1020	0.1471	788	0.1662	−1.1162	0.2645
INNOPROC	1020	0.3833	788	0.3858	−0.1063	0.9154

Notes: The *t* statistic is used to test the equality of means. *p < 0.1; **p < 0.05; ***p < 0.01.

Table 3
Correlation matrix: family and non-family firms.

		(1)	(2)	(3)	(4)
		LNEMP	RD_SALES	RD_EMP	DIVER_INT
FAMILY FIRMS					
(1)	LNEMP	1			
(2)	RD_SALES	0.2585*	1		
(3)	RD_EMP	0.1686*	0.6711*	1	
(4)	DIVER_INT	−0.0654	−0.0075	−0.0053	1
NON-FAMILY FIRMS					
(1)	LNEMP	1			
(2)	RD_SALES	0.1467*	1		
(3)	RD_EMP	0.0923*	0.6142*	1	
(4)	DIVER_INT	−0.0415	−0.0119	0.0014	1

Notes: The Pearson correlation coefficients for the continuous variables considered in the empirical analysis are showed. *, **, *** denote significance at the 5 %, 1 %, and 0.1 % levels.

The estimated models (Table 4 and Table 5) show a significant positive relationship between the presence of gender-diverse TMTs and the innovation performance of family firms, but only when the outcome is measured as process innovation (INNPROC). These results suggest that gender-diverse TMTs contribute to increase the probability of developing process innovation in family firms. In contrast, for non-family firms, the estimated coefficients of gender diversity show a non-significant negative association with process innovation. Given that no previous studies have addressed this issue while considering the family firm status, the obtained results cannot be directly compared with those of previous research. Despite this, they are to some extent consistent with findings that have found a positive relationship with service innovation (Fernández–Sastre, 2015) and marketing innovation (Galia et al., 2015).

The underlying explanation for the significant association with process innovation, but not with product innovation, in family firms may be attributed to the different knowledge characteristics associated with these two types of innovation (Chang et al., 2015). Whereas product innovation is often linked with external knowledge (Gopalakrishnan and Damanpour, 1997), process innovation is more closely associated with internal and tacit knowledge (Chang et al., 2015). As mentioned, the accumulation of tacit knowledge, typically embedded in employees, serves as a key resource for gaining competitive advantage, especially in small firms (Gupta et al.,

Table 4
Estimates of TMT gender diversity on product innovation (INNOPROD): family vs. non-family firms.

	FAMILY FIRMS			NON-FAMILY FIRMS		
	Model a	**Model b**	**Model c**	**Model a**	**Model b**	**Model c**
CONS	−4.556***	−4.906***	−4.852***	−4.174***	−4.267***	−4.239***
	(0.442)	(0.462)	(0.458)	(0.345)	(0.343)	(0.351)
GEN_DIVER	0.339	0.338	0.332	0.222	0.178	0.212
	(0.227)	(0.228)	(0.228)	(0.213)	(0.211)	(0.214)
LNEMP	0.594***	0.653***	0.639***	0.453***	0.470***	0.461***
	(0.099)	(0.102)	(0.101)	(0.079)	(0.077)	(0.080)
HIGHTECH	−0.132	−0.104	−0.143	0.401*	0.504*	0.398 +
	(0.241)	(0.238)	(0.241)	(0.204)	(0.208)	(0.206)
RD_SALES	0.254**		0.066	0.149***		0.099*
	(0.081)		(0.100)	(0.039)		(0.046)
RD_EMP		0.103***	0.091**		0.051*	0.027 +
		(0.024)	(0.030)		(0.020)	(0.015)
Nº observations	732	731	731	931	934	929
Log likelihood	−288.1298	−280.2213	−279.827	−347.2585	−351.3246	−344.0688
Wald X^2	62.36***	72.95***	71.92***	76.99***	77.66***	82.75***

Notes: Robust standard errors in brackets; + , *, **, *** denote significance at the 10, 5, 1, and 0.1 % levels.

Table 5
Estimates of TMT gender diversity on process innovation (INNOPROC): family vs. non-family firms.

	FAMILY FIRMS			NON-FAMILY FIRMS		
	Model a	**Model b**	**Model c**	**Model a**	**Model b**	**Model c**
CONS	−2.552***	−2.641***	−2.657***	−2.585***	−2.598***	−2.590***
	(0.300)	(0.303)	(0.304)	(0.243)	(0.242)	(0.244)
GEN_DIVER	0.461**	0.454**	0.456**	−0.154	−0.156	−0.164
	(0.165)	(0.167)	(0.167)	(0.159)	(0.159)	(0.159)
LNEMP	0.459***	0.470***	0.474***	0.477***	0.475***	0.476***
	(0.072)	(0.073)	(0.074)	(0.058)	(0.057)	(0.058)
HIGHTECH	−0.127	−0.149	−0.141	0.373*	0.419**	0.376*
	(0.177)	(0.177)	(0.178)	(0.149)	(0.148)	(0.149)
RD_SALES	0.131 +		−0.022	0.077**		0.055 +
	(0.075)		(0.088)	(0.028)		(0.031)
RD_EMP		0.067**	0.072*		0.024*	0.012
		(0.023)	(0.029)		(0.012)	(0.011)
Nº observations	732	731	731	931	934	929
Log likelihood	−452.1259	−445.6139	−445.5645	−568.8309	−572.5409	−567.5374
Wald X^2	70.82***	80.3***	81.31***	97.59***	93.54***	96.96***

Notes: Robust standard errors in brackets; + , *, **, *** denote significance at the 10, 5, 1, and 0.1 % levels.

Table 6
Estimates of TMT gender diversity intensity on product innovation (INNOPROD): family vs. non-family firms.

	FAMILY FIRMS			NON-FAMILY FIRMS		
	Model a	**Model b**	**Model c**	**Model a**	**Model b**	**Model c**
CONS	−0.351	−0.951	−0.698	−3.794***	−3.801***	−3.756***
	(1.164)	(1.159)	(1.183)	(1.010)	(1.014)	(1.011)
DIVER_INT	−0.111**	−0.106**	−0.109**	−0.002	−0.004	−0.003
	(0.036)	(0.037)	(0.037)	(0.036)	(0.036)	(0.036)
DIVER_INT2	0.001**	0.001**	0.001**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LNEMP	0.224	0.308 +	0.266	0.431***	0.433***	0.421***
	(0.163)	(0.163)	(0.167)	(0.115)	(0.115)	(0.116)
HIGHTECH	−0.254	−0.127	−0.233	0.424	0.458	0.388
	(0.326)	(0.310)	(0.325)	(0.294)	(0.301)	(0.296)
RD_SALES	0.228*		0.126	0.086		0.055
	(0.105)		(0.120)	(0.058)		(0.062)
RD_EMP		0.081*	0.058		0.035	0.026
		(0.036)	(0.042)		(0.028)	(0.023)
Nº observations	335	334	334	374	375	372
Log likelihood	−162.8623	−161.8771	−160.862	−176.5739	−175.861	−174.5592
Wald X^2	25.57***	25.24***	25.09***	37.53***	36.55***	36.76***

Notes: Robust standard errors in brackets; + , *, **, *** denote significance at the 10, 5, 1, and 0.1 % levels.

2006; Zahra et al., 2007). Gender-diverse TMTs may leverage this strategically relevant knowledge more effectively than non-gender-diverse ones, as women directors are inclined to hire more women in R&D teams and contribute more to knowledge exchange than men (Madison et al., 2022).

In the second step, we re-estimated the proposed models to explore the role of the degree of gender diversity (DIVER_INT and DIVER_INT2) in the innovation probability of family and non-family companies, considering only firms with gender-diverse TMTs. Table 6 displays the estimated results for product innovation (INNOPROD) and Table 7 exhibits the process innovation (INNOPROC) ones.

The results (Table 6 and Table 7) reveal a significant U-shaped relationship between the degree of gender diversity and the probability of innovation in family firms, but only when innovation performance is measured as product innovation (INNPROD). The estimated coefficients suggest that initially, the probability of having product innovation decreases as the intensity of gender diversity in TMTs increases, but after reaching a given percentage of women in the TMT, product innovation is positively correlated with the intensity of gender diversity. This finding is partly consistent with those by Torchia et al. (2011), who warned about the need for a minimum number of women to have a more heterogeneous TMT and generate innovative solutions. Also, Ruíz-Jiménez et al. (2016) highlighted that a greater representation of women in management positions can enhance the firm's capability to combine knowledge, as women perceive power in terms of disseminating information and knowledge (Krishnan and Park, 2005). Considering the concept of homophilic relationship proposed by Lazarsfeld and Merton (1954), these results evidence the positive relationship between a high percentage of women in the TMT and product innovation. Furthermore, these findings could also be compared with those by Østergaard et al. (2001), who concluded that there is a significant and positive effect of gender diversity on firm innovation, but only when the 60–70 % of the team members are of same gender. In their study, the authors do not distinguish the gender of the predominant group in each case.

Table 8 summarizes the main findings for the variables of interest. Taking together, the results indicate that gender diversity shows a significant relationship with innovation performance in family firms, but not in non-family firms. Then, there is weak evidence to support that family firms create a more conducive environment for reinforcing the innovation advantages of gender diversity compared to non-family businesses, resulting in higher innovation performance. More in detail, gender-diverse TMTs are positively related to process innovation in family firms (first and third research questions). Moreover, when the percentage of women in TMTs is considered, a U-shaped relationship between gender diversity and product innovation is observed (second and third research questions). This finding speaks in favor of achieving a critical mass of women in the TMT to leverage the advantages of gender diversity in terms of innovation performance.

Finally, concerning control variables, firm size (LNEM) and R&D intensity (RD_SALES and RD_EMP) generally show a positive association with both measures of innovation performance in both subsamples. However, operating in high-medium technology sectors (HIGHTECH) only presents a positive relationship with innovation performance for non-family companies.

5. Discussion

This study contributes to the literature of gender diversity from the innovation perspective, adding new evidence to the recent debate about the role of group diversity in firms' innovation performance (Østergaard et al., 2011; Torchia et al., 2011; Parrotta et al., 2014; Ruiz-Jiménez et al., 2016; Koryak et al., 2018; Hernández-Lara and Gonzales-Bustos, 2020; Azzam, 2022; Bauweraerts et al., 2022). Based on the arguments that positively relate TMT gender diversity and firm innovation, we discuss about how the distinct context of family businesses may shape this relationship. More specifically, we implicitly argue that the internal working environment

Table 7
Estimates of TMT gender diversity intensity on process innovation (INNOPROC): family vs. non-family firms.

	FAMILY FIRMS			NON-FAMILY FIRMS		
	Model a	**Model b**	**Model c**	**Model a**	**Model b**	**Model c**
CONS	−2.101*	−2.351*	−2.414*	−1.706*	−1.905*	−1.727*
	(0.996)	(1.021)	(1.012)	(0.820)	(0.823)	(0.826)
DIVER_INT	−0.016	−0.011	−0.011	−0.048	−0.043	−0.047
	(0.036)	(0.036)	(0.036)	(0.031)	(0.031)	(0.031)
DIVER_INT2	0.000	0.000	0.000	0.001*	0.001 +	0.001 +
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LNEMP	0.488***	0.514***	0.526***	0.376***	0.392***	0.369***
	(0.124)	(0.127)	(0.128)	(0.093)	(0.092)	(0.094)
HIGHTECH	−0.133	−0.159	−0.136	0.222	0.322	0.216
	(0.247)	(0.242)	(0.248)	(0.237)	(0.229)	(0.237)
RD_SALES	0.031		−0.035	0.121 +		0.095
	(0.081)		(0.099)	(0.072)		(0.068)
RD_EMP		0.025	0.032		0.034 +	0.019
		(0.021)	(0.029)		(0.021)	(0.016)
Nº observations	335	334	334	374	375	372
Log likelihood	−221.2894	−219.4724	−219.3834	−235.0655	−236.6934	−233.5059
Wald X^2	19.6***	21.94***	22.7***	36.19***	35.95***	34.87***

Notes: Robust standard errors in brackets; + , *, **, *** denote significance at the 10, 5, 1, and 0.1 % levels.

Table 8
Summary of findings by family firm status.

	FAMILY FIRMS (RQ3)		NON-FAMILY FIRMS (RQ3)	
	PRODUCT INNOVATION	PROCESS INNOVATION	PRODUCT INNOVATION	PROCESS INNOVATION
Gender diversity in TMT (RQ1)	()	+	()	(-)
Degree of gender diversity (RQ2)	U	()	()	()

Notes: + / - / () denotes positive/negative/not significant relationship.

of family businesses fosters a setting more conducive for exploiting the advantages of TMT gender diversity in terms of innovation performance than in non-family firms. In so doing, we compare the relationship between TMT gender diversity and innovation performance in both types of companies. We also distinguish between product and process innovations, considering that each type of innovation requires different innovative competencies from the firm.

Consistent with prior research (Barrett and Moores, 2009; Chadwick and Dawson, 2018), our findings confirm that gender-diverse TMTs are more likely in family firms than non-family firms. In the Spanish manufacturing industry, the percentage of firms with gender-diverse TMTs was lower than 50 % regardless their family firm status. Family and non-family firms were not highly innovative, although family firms introduced more product and process innovations into the market in 2016.

Regarding the first and third research questions, we find that the presence of men and women in TMTs is positively related to innovation in family firms, but only when innovation performance is measured as process innovation. We provide a plausible explanation for this result, which aligns with the idiosyncrasies of family firms. Family firms offer a context more prone to reduce entry barriers for women of the owners' family to access top management positions (Barrett and Moores, 2009). In addition, their flexible organizational structure facilitates the flow of new ideas and knowledge exchange within the company (Veider and Matzler, 2016; Bigliardi and Galati, 2017). This favorable context can explain the better performance in process innovation compared to product innovation. Thus, the former relies more on internal and tacit knowledge, and the collaborative management styles of women may foster a pro-active climate for a greater knowledge exchange related with how to do things.

The findings regarding gender diversity intensity (second and third research questions) contribute to the ongoing debate about the role of gender minorities in decision groups (Krishnan and Park, 2005; Østergaard et al., 2011; Ruiz-Jiménez et al., 2016; Bauweraerts et al., 2022) and the presence of homophilic relationships within organizations (Lazarsfeld and Merton, 1954; Bednar et al., 2021). Our analysis reveals a significant U-shaped relationship between the degree of gender diversity and product innovation in family firms, indicating that product innovation initially decreases with an increasing number of women in the TMT but then increases after reaching a certain participation of women in the board team. This U-shaped relationship underlines the need of more in-depth research into how gender diversity is measured, and particularly to consider the percentage of women in TMTs. Traditionally, women have been a minority in leadership teams (Mackey et al., 2017), a trend reflected in the descriptive statistics of Spanish manufacturing firms, regardless of their family firm status. This lack of critical mass of female leaders could make women reluctant to share their distinctive knowledge and expertise or to apply leadership styles conducive to a more flexible climate for idea exchange. However, as the proportion of women in top management positions increases, there is a tendency to form friendships with similar individuals Lazarsfeld and Merton, 1954), leading to increased involvement in decision-making processes that require investment, such as product innovation. In this sense, our findings can be compared to some extent with those by Amore et al. (2014), which referred to the financial performance of family firms.

Our analysis does not uncover any significant relationship between TMT gender diversity and innovation performance in non-family firms, differing from the studies of Hernández-Lara and Gonzales-Bustos (2020) and Gonzales-Bustos et al. (2020). Our findings support the notion that family firms foster a climate where the innovation advantages of gender diversity can be reinforced compared to non-family businesses. They also contribute to the debate opened by the Bassett-Jones paradox; although the participation of men and women in TMTs enriches the firm's innovation perspective, we should also consider the costs associated with the coordination and the use of power mechanisms to include the perspectives of a minority into group decisions.

6. Conclusion

Family firms have their own idiosyncrasies, particularly at the management level. The involvement of family members may deter certain firm's strategies due to risk-averse behaviors rooted in their emotional involvement in preserving the firm's wealth. Belonging to the owners family provides women with better access to top management positions compared to other firms and is favorable for attracting other women to these organizations.

This study contributes to filling the research gap in analyzing the role of gender diversity in firm innovation. Previous literature shows mixed findings, and researchers have conditioned the positive relationship between gender diversity in TMTs and innovation performance to firm size, the type, and the scope of innovations. In this regard, our findings evidence the positive relationship between TMT gender diversity and process innovation, but also the positive association of the of low gender diversity and product innovation (U-shaped relationship), which is contrary to having a balance between men and women, in family firms. These results suggest that process innovation improves with different managers' perspectives, different leadership styles, and even different competencies, and mixing men and women in TMT can be a good way to find the different approaches that serve to increase the innovation capacity of

traditionally conservative family firms. However, product innovation requires other organizational configurations, where gender diversity could be even considered a limitation.

This study evidences the complexity of configuring human resources to increase innovation capacity, highlights the differences between product and process innovation, and adds new insights about the effects of involving female leaders on innovation performance, an unresolved matter in the organizational culture of family firms.

6.1. Limitations and future research

While this study offers valuable insights into the role of gender diversity in innovation of family firms, we must point that it has been necessary to limit the study to 2016 because the data on the sex of managers were only available for that year. This absence of previous data has not allowed us to analyse the role of gender diversity maturity in firm innovation. We were also unable to analyse whether the women in TMTs belonged to the family of the firm's owners, which was a limitation to identify entry barriers for non-family women and evaluate the risk-aversion of family vs non-family women in TMTs, compared to men. Future studies could extend this research to a wider range of time and investigate whether the role of gender diversity in innovation performance is consistent through time. Furthermore, future waves of the ESEE survey could allow us to analyse whether improving gender equality, as one of the Sustainable Development Goals (SDGs), has any effect on the innovation performance of family and non-family firms. Scholars could also analyse the effect of diversity between family vs non-family members in TMTs of family firms from a gender perspective, following the line initiated by Binacci et al. (2016), who found a U-shaped relationship between non-family managers team diversity and family firm performance, and Jain et al. (2021), who recently investigated the effect of gender-diverse TMTs on compensation policies of the firm.

The analysis of gender perspective is obviously partial without considering the functional perspective as well. The innovation capacity of firms also depends on the different bases of knowledge and roles of responsibility within the TMTs. Although there is a bunch of studies that analyse the functional diversity and intergenerational perspectives on innovation capacity of firms (Kraiczy et al., 2014; De Clercq and Belausteguigoitia, 2015; Fernández-Sastre, 2015; Arzubiaga et al., 2018), the effect of mixing the gender and functional perspectives in the study of diversity applied to family firms remains unexplored and is an attractive scope for future research.

6.2. Practical implications

The findings of this study could serve academics and practitioners of family firms to take advantage of the pro-innovation conditions of family firms to compete in dynamic markets. Particularly, if we can learn from family businesses with gender-diverse TMTs how to create a climate that favors process innovation, we could apply these lessons in improving innovation performance in both family and non-family firms. The advantages of the organizational conditions typical of family firms allows them to better exploit the differential perspectives of men and women, resulting in higher innovation performance. Firms should invest in leadership development programs that promote gender diversity and inclusive leadership styles, fostering a culture that values diverse perspectives crucial for innovation. Then, it should be also possible for family and non-family firms to use diversity as a resource to enrich their innovation performance.

CRediT authorship contribution statement

Nuria Calvo: Validation, Investigation, Writing – review & editing, Supervision, Formal analysis, Writing – original draft, Methodology, Conceptualization. **David Rodeiro-Pazos:** Writing – review & editing, Investigation, Conceptualization, Writing – original draft, Formal analysis, Project administration, Data curation. **Sara Fernández-López:** Supervision, Formal analysis, Writing – review & editing, Methodology, Conceptualization, Writing – original draft, Investigation. **Rodríguez-Gulías María-Jesús:** Writing – review & editing, Investigation, Conceptualization, Writing – original draft, Formal analysis, Validation, Data curation.

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